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FINAL ENGINEERING EVALUATION/ COST ANALYSIS SITE 28 NSWC INDIAN HEAD, MD
9/1/2006
CH2MHILL

Final

**Engineering Evaluation/Cost Analysis
Site 28**

**Naval Support Facility, Indian Head
Indian Head, Maryland**

Contract Task Order 111

September 2006

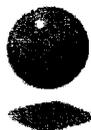
Prepared for

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Prepared by



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Executive Summary

This document presents an Engineering Evaluation and Cost Analysis (EE/CA) for a non-time-critical removal action for Site 28 at the Naval Support Facility, Indian Head (NSF-IH), in Indian Head, Maryland. The purpose of this document is to present the remedial action alternatives to reduce risks to human health and ecological receptors associated with site soil to acceptable levels through excavation and removal and/or treatment of affected soil at Site 28.

This EE/CA will be completed as a non-time-critical removal action as required by Section 300.415(b)(4)(i) of the National Oil and Hazardous Substance Pollution Contingency Plan (NCP; 40 CFR Part 300). Submittal of this document fulfills the requirements for non-time-critical actions defined by the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and the Superfund Amendments and Reauthorization Act of 1986 (SARA). This EE/CA has been prepared in general accordance with the United States Environmental Protection Agency's (USEPA) guidance document *Superfund, Guidance on Conducting Non-Time-Critical Removal Actions under CERCLA*, PB93-963402, August 1993.

NSF-IH is a Navy facility located in northwestern Charles County, Maryland, approximately 25 miles southwest of Washington, DC. Site 28 is in the northeast corner of the facility, on the shore of Mattawoman Creek. The site encompasses observation Well 14 and the former locations of the zinc recovery furnace and a shoreline burning cage. Because of past activities at the site, there are both potential human health and ecological risks associated with constituents in the soil.

To address the risks posed by the soil, alternatives designed to break the soil exposure pathways through soil removal and/or treatment were analyzed. The three alternatives considered for Site 28 are:

- Alternative 1: No Action
- Alternative 2: Soil Removal for Human Health and Ecological Risks
- Alternative 3: Soil Removal for Human Health Risks and *In Situ* Treatment for Ecological Risks

Alternative 1 serves as a baseline for the evaluation and is not considered a viable option for the site.

Through analyzing and comparing the benefits of Alternatives 2 and 3, it has been determined that Alternative 2, Soil Removal for Human Health and Ecological Risks, is the recommended alternative. This alternative is protective of both human health and the environment because the impacted soil will be removed from the site and disposed off site.

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Acronyms and Abbreviations

ac	acres
ARAR	Applicable or Relevant and Appropriate Requirements
BERA	baseline ecological risk assessment
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	Code of Federal Regulations
CLEAN	Comprehensive Long-Term Environmental Action Navy
COC	chemical of concern
CTO	Contract Task Order
EE/CA	Engineering Evaluation/Cost Analysis
EOD	explosive ordnance disposal
ERA	Ecological Risk Assessment
ft	feet
ft ²	square feet
gpm	gallons per minute
IAS	Initial Assessment Study
ICs	institutional controls
IHIRT	Indian Head Installation Restoration Team
in.	inches
LTM	long-term monitoring
LUCs	land-use controls
µg/L	micrograms per liter
MDE	Maryland Department of the Environment
msl	mean sea level
NAVFAC	Naval Facilities Engineering Command
Navy	United States Department of the Navy
NCP	National Oil and Hazardous Substance Pollution Contingency Plan
NEESA	Naval Energy and Environmental Support Activity
NOS	Naval Ordnance Station
NPL	National Priorities List
NSF-IH	Naval Support Facility, Indian Head
OSHA	Occupational Safety and Health Administration
ppm	parts per million
PRG	Preliminary Remediation Goal
RAO	Removal Action Objective
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation

SARA	Superfund Amendments and Reauthorization Act of 1986
SERA	screening-level ecological risk assessment
SPAWARS	Space and Naval Warfare Systems Command
SVOC	semivolatile organic compound
TBC	to-be-considered
TIE	Toxicity Identification Evaluations
UCL	upper confidence limit
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UXO	unexploded ordnance
yd ³	cubic yards

SECTION 1

Introduction

This report presents an Engineering Evaluation and Cost Analysis (EE/CA) for a non-time-critical removal action for soil at Site 28 at Naval Support Facility, Indian Head (NSF-IH). NSF-IH is a facility of the Naval Support Activity South Potomac in the Naval District Washington Region. It is located in northwestern Charles County, Maryland, approximately 25 miles southwest of Washington, DC. Figure 1-1 shows the location of NSF-IH.

This EE/CA was prepared by CH2M HILL under the Naval Facilities Engineering Command (NAVFAC), Atlantic Division, Comprehensive Long-Term Environmental Action Navy (CLEAN) II Contract No. N62470-95-D-6007, Contract Task Order (CTO) 111.

1.1 Purpose and Objective

This EE/CA provides the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) documentation to support a non-time-critical removal action at Site 28. The purpose of this EE/CA is to present the Navy's intent to remove and dispose and/or treat the contaminated soil at Site 28. This action should remove the potential source for contaminants in the soil, groundwater, and sediment at and adjacent to the site. This EE/CA presents three removal alternatives.

Although risks from groundwater to human receptors are estimated to be potentially unacceptable, groundwater is not addressed in this EE/CA. As described in the Final Remedial Investigation Report, Site 28 (CH2M HILL, 2005a), the shallow groundwater at Site 28 is not recommended for advancement in the CERCLA process. Given the proximity of Site 28 to Mattawoman Creek, low hydraulic conductivity, and the very thin saturated thickness, shallow groundwater in the vicinity of Site 28 would not be considered a potable resource. One could not build a legal well in this unit, given Maryland well construction regulations, which require a minimum of 20 feet of isolation casing from ground surface. This unit is also not capable of meeting sustained yield requirements of Maryland well construction regulations (COMAR 26.04.04.07) because well casing greater than 200 feet would likely be required.¹

1.2 Regulatory Framework

This document is issued by the Navy, a Federal agency authorized for remediation of Site 28, with regulatory oversight from the U.S. Environmental Protection Agency (USEPA)

¹ Maryland water well construction regulations require a minimum of 20 feet of vertical separation between the ground surface and the top of the screen (COMAR 26.04.04.07.D.3.c; Excerpt 2). In addition, a private potable water supply well must be capable of a sustained yield of at least 1 gallon per minute (gpm) and be able to produce 500 gallons in a 2-hour period at least once per 24-hour period (COMAR 26.04.04.07.p; Excerpt 3). Aquifers not capable of sustained 4 gpm (500 gallons/120 minutes) production must make up the difference in casing storage, which translates to very long well screens.

and the Maryland Department of the Environment (MDE), under Section 104 of CERCLA and the Superfund Amendments and Reauthorization Act of 1986 (SARA).

Section 104 allows an authorized agency to remove, or arrange for removal, 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." A non-time-critical removal action is being considered for Site 28.

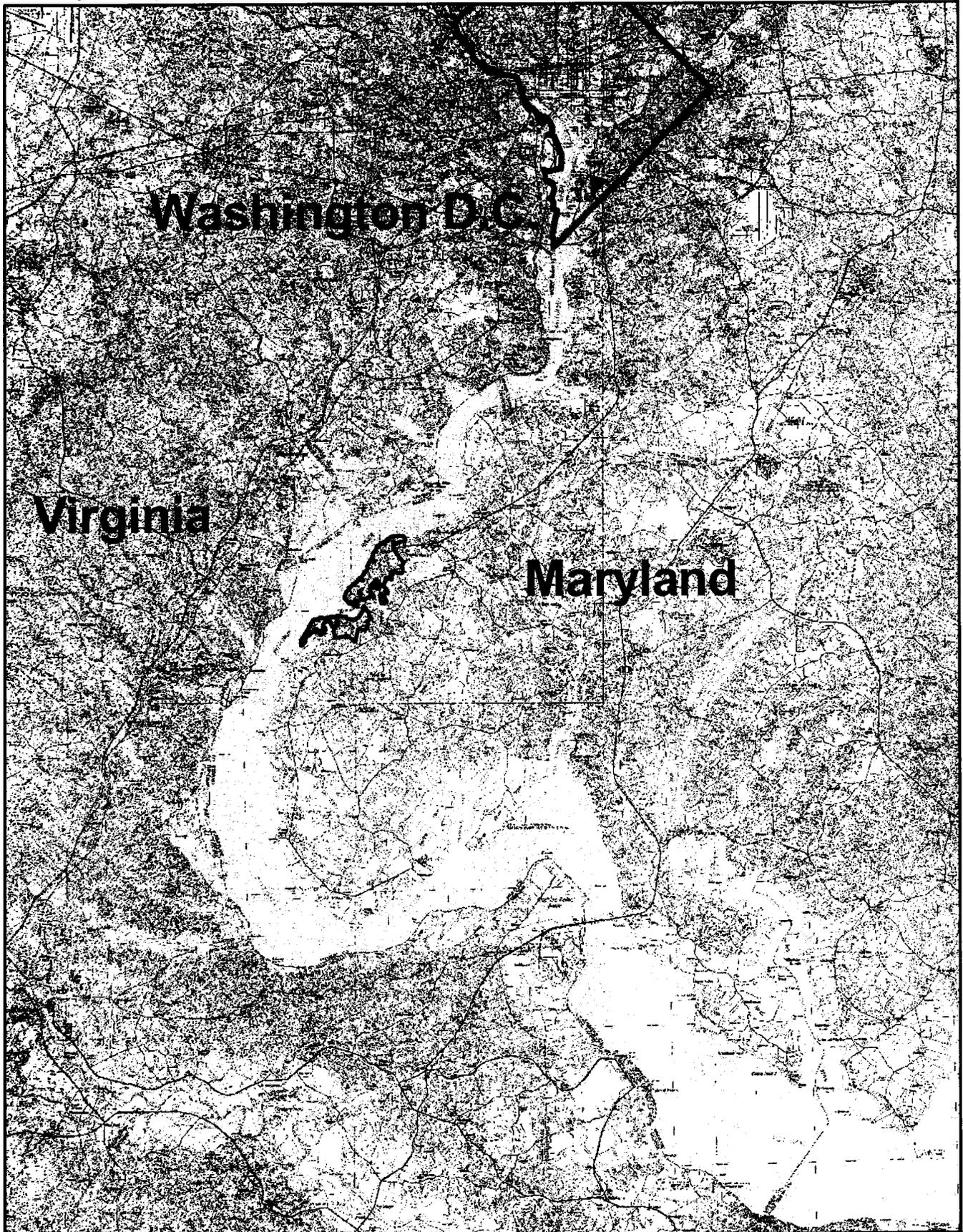
Title 40 CFR Section 300.415 requires the lead agency to conduct an EE/CA when a non-time-critical removal action is planned for a site. The goals of an EE/CA are to identify the objectives of the removal action and to analyze the effectiveness, implementability, and cost of various alternatives that may satisfy these objectives. An EE/CA documents the removal action alternatives and selection process. Where the extent of the contamination is well defined and limited in extent, non-time-critical removal actions also allow for the expedited cleanup of sites in comparison to the remedial action process under CERCLA. This EE/CA has been prepared in general accordance with USEPA's guidance document *Superfund, Guidance on Conducting Non-Time-Critical Removal Actions under CERCLA*, PB93-963402, January 1993.

Community involvement requirements for non-time-critical removals include 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. Significant public comments will receive written responses. The selected alternative will be documented in an Action Memorandum. Both the responses and the Action Memorandum will be included in the Administrative Record.

1.3 Organization of the EE/CA

This EE/CA includes the following sections:

- Section 1 – Introduction
- Section 2 – Site Characterization
- Section 3 – Identification of the Removal Action Objectives
- Section 4 – Identification and Analysis of Removal Action Alternatives
- Section 5 – Comparative Analysis of the Removal Action Alternatives
- Section 6 – Recommended Removal Action Alternative
- Section 7 – References



LEGEND

-  Facility Boundary
-  District of Columbia
-  Water Bodies



0 20000 40000 Feet



Figure 1-1
Facility Location Map
NSF-IH Site 28 EE/CA
Indian Head, Maryland

Site Characterization

This section presents information that forms the basis for the site characterization. This information includes site history and characteristics, previous investigations, previous remedial or removal actions, nature and extent of impact, and human health and ecological risks at Site 28.

2.1 Site 28 History and Characteristics

2.1.1 Site History

Site 28, also referred to variously as the "Original NOS [Naval Ordnance Station] Burning Ground," the "Slavins Dock Area," and the "Wildlife Area," is located on the main installation of NSF-IH (Figure 2-1). The site encompasses observation Well 14 and the former locations of the zinc recovery furnace and a shoreline burning cage (Figure 2-2). For the remedial investigation, the site was subdivided into two zones: A and B. Zone A comprises the area between the north and south fence lines, the area outside of the fence line to the north, and shoreline to the east. The former zinc recovery furnace and the former burning cage are in Zone A. The former burning cage, used to burn scraps such as wooden crates, was just south of observation well number 14. Zone B is reported as the "Original Burning Ground" in the IAS and as the "Shoreline Burning Cage" by Dolph (2001). This area, outside the NSF-IH fence line but within Navy property, is south of Zone A. This area extends approximately 600 feet south from the southern Zone A fence line.

During World War I, the Navy initiated a metal-recycling program, which was vital during World War II and continues to present day. In 1928, the zinc recovery furnace, designated Building 415, was erected. The last station map on which the building appears is dated October 31, 1952, indicating that the building was demolished in the early 1950s (Dolph, 2001).

Well 14 was installed in 1918 to a depth of 430 feet (ft) below ground surface (bgs) using cable drilling (Public Works of the Navy, date unknown). Initially this was used as a potable well, but it became an observation well in 1988 and remains so today.

A small burning cage to the south of Well 14 was used to burn debris (e.g., wooden crates) (Dolph, 2001). The exact location of the former burning cage is unknown. The burning ground is shown outside of the existing perimeter fence on at least one historical map; however, burned debris, glass, and slag-like materials were observed inside the fence in an area adjacent to the mouth of Swale 4 (Figure 2-2).

2.1.2 Site Topography

The topography of Site 28 is characterized by a relatively steep slope from the southeast to just before the shoreline with Mattawoman Creek. The slope near the shoreline is moderately sloped to relatively flat. A dirt road, underlain by a former railroad track, lies just west of the site. The elevation ranges from 47 ft above mean sea level (msl) from the

west along the dirt road to sea level at the shoreline with Mattawoman Creek (Figure 2-2). There are four swales (Swales 1 to 4) on Site 28 that are moderately to deeply incised (Figure 2-2).

2.1.3 Site Geology

The northeast section of Site 28 does not contain any vegetation and has been extremely eroded. The shallow subsurface geology in this area is characterized by moist light gray, highly plastic silty clay. The southern section of the site is characterized by fine-grained sand and silty sand with occasional trace clay. The soil on either side of the dirt road (old railroad tracks) contains fill and consists of fine to coarse sand and gravel. The entire site is underlain by dense, gray, highly plastic clay.

The depth to the clay ranges from 4 to 26 ft bgs, depending on surface elevation. This unit is likely part of the Quaternary deposit. Figure 2-3 shows the locations of soil borings used to obtain geologic data and the location of two geologic cross-sections (A-A' and B-B'). Figure 2-4 presents cross-section A-A', oriented approximately northwest-southeast through the site. Figure 2-5 shows cross-section B-B', oriented approximately west-east through the site. The sample locations beginning with IS28MM are "mixed media" sample locations from which soil and in situ groundwater samples were collected.

2.1.4 Site Hydrogeology

Groundwater at Site 28 discharges to Mattawoman Creek, a tidal tributary of the Potomac River east of the site. Typically, when a hydrostratigraphic unit discharges to a tidal water body, its water table or potentiometric surface fluctuates in a harmonic motion. The fluctuation is a somewhat delayed and dampened reflection of the tidal fluctuation. The amplitude (or height) of the fluctuation generally decreases with increasing distance from the shoreline. The time lag between high tide and high water level in the hydrostratigraphic unit also generally increases with increasing distance from the shore. Typically, these influences take the form of a pressure-front propagation, rather than large-scale penetration of surface water into groundwater bodies (CH2M HILL, 2005a).

The water table was encountered at the site at depths ranging from approximately 0.85 ft bgs (at IS28MW03) to approximately 12.72 ft bgs (at IS28MW01) when measured on September 10, 2003. The groundwater is relatively shallow (i.e., lies relatively close to the ground surface), and the flow is southeast toward Mattawoman Creek. The hydraulic gradient of the groundwater at the site is approximately 0.1 (CH2M HILL, 2005a).

Four swales at Site 28 discharge to Mattawoman Creek. Swale 4 flows perennially and is unaffected by drought conditions or seasonal fluctuations, suggesting an anthropogenic source, according to anecdotal evidence provided by NSF-IH. The remaining three swales (i.e., Swales 1 to 3) appear to be erosion channels for surface runoff caused by the lack of vegetation at the site; therefore, these erosion channels only exhibit flow when there are precipitation events that create runoff.

2.2 Previous Investigations

In 1983, Naval Energy and Environmental Support Activity (NEESA) conducted an Initial Assessment Study (IAS) to evaluate sites at NSF-IH and to determine if a potential threat to

human health or the environment existed. The findings for Site 28 are provided in the IAS report, in which the 1.8-acre site was referred to as the “original NOS burning ground.” File searches did not provide information about the types of materials that were burned. NEESA concluded on the basis of materials manufactured when the site was in operation, circa 1890 to 1942, that smokeless powder may have been burned at the site. Various contaminated wastes were also burned openly. During the IAS site reconnaissance, no signs of burned materials were observed. NEESA concluded that there was not enough information to characterize the potential hazard of the site. The site was not recommended for a Navy Assessment and Control of Installation Pollutants Confirmation Study (Fred C. Hart Associates, 1983).

Several soil sampling events were conducted following the IAS. In August 1993, a soil sample from Site 28, referred to at that time as the “Slavins Dock area,” was collected about 20 ft southwest of “Well #14” and analyzed for soil texture, pH, and fertility. The pH for the sandy loam soil was 6.7. The soil test results indicated that copper, magnesium, sulphate, and zinc were present in amounts of 25, 30, 22.7, and 14,700 pounds per acre, respectively. For zinc, this translates into 7,350 parts per million (ppm).

In May 2000, the analytical results of total lead and total zinc in a soil sample (soil sample 1) collected from Site 28 near “Wildlife Area Well #14” indicated concentration levels of 9.37 and 515 ppm, respectively. In July 2000, a soil sample (IR2855-000712) was collected and analyzed for various metals. The analysis detected cadmium (1.2 ppm), lead (3.8 ppm), and selenium (1.8 ppm) in the sample.

2.2.1 Sediment Toxicity Identification Evaluation Demonstration

In October 2000, a sediment sample was collected in Mattawoman Creek just off the shoreline of Site 28 for a Toxicity Identification Evaluation (TIE) associated with Site 42. The sediment sample had a measured pore water concentration of zinc of 25,000 micrograms per liter ($\mu\text{g/L}$) (SAIC, 2001).

2.2.2 Mattawoman Creek Study

TetraTech NUS’s study of Mattawoman Creek included use of the Rapid Sediment Screening technology developed by Space and Naval Warfare Systems Command (SPAWARS) (Tetra Tech NUS, 2004). A review of the data collected for the Mattawoman Creek study indicated that additional site-specific data are required to evaluate the effect of Site 28 on the environment.

2.2.3 Site Remedial Investigation

A Remedial Investigation (RI) field investigation was conducted at Site 28 between May and August 2003 (CH2M HILL, 2005a). For the investigation, Site 28 was divided into Zones A and B. The former zinc recovery furnace and the former burning cage are in Zone A. Zone B is reported as the “Original Burning Ground” in the IAS and as the “Shoreline Burning Cage” by Dolph (2001). Most of the area inside the fence line is forested and sloped. Figure 2-3 shows Zones A and B defined for the Site 28 investigation.

The work in Zone A consisted of sampling surface soil, subsurface soil, groundwater (direct push and monitoring well), sediment, and surface water. The work in Zone B consisted of sampling surface and subsurface soil. Several semivolatile organic compounds (SVOCs)

and numerous organics and inorganics were detected throughout the Site 28 media at varying concentrations. A detailed summary of the detected constituents is provided in Section 4 of the RI report (CH2M HILL, 2005a).

An additional 29 sediment samples were collected from 15 locations in Mattawoman Creek adjacent to Site 28 for the Ecological Risk Assessment (ERA) (sampling locations IS28SD01 through IS28SD15 in Figure 2-3). Sediment samples were collected from two depth intervals (0-6 and 6-12 inches [in.]) by using a gravity sampler to collect sediment cores at each station. The surface sediment samples (up to 6 in. deep) were collected to support the ERA. The subsurface sediment samples (6-12 in.) were collected to aid in determining the nature and extent and potential offsite migration of chemicals into Mattawoman Creek.

An ecological inventory of the site was taken during the May sampling event. This is discussed in Section 7.3.4 of the RI report (CH2M HILL, 2005a).

Human Health Risk Assessment Summary

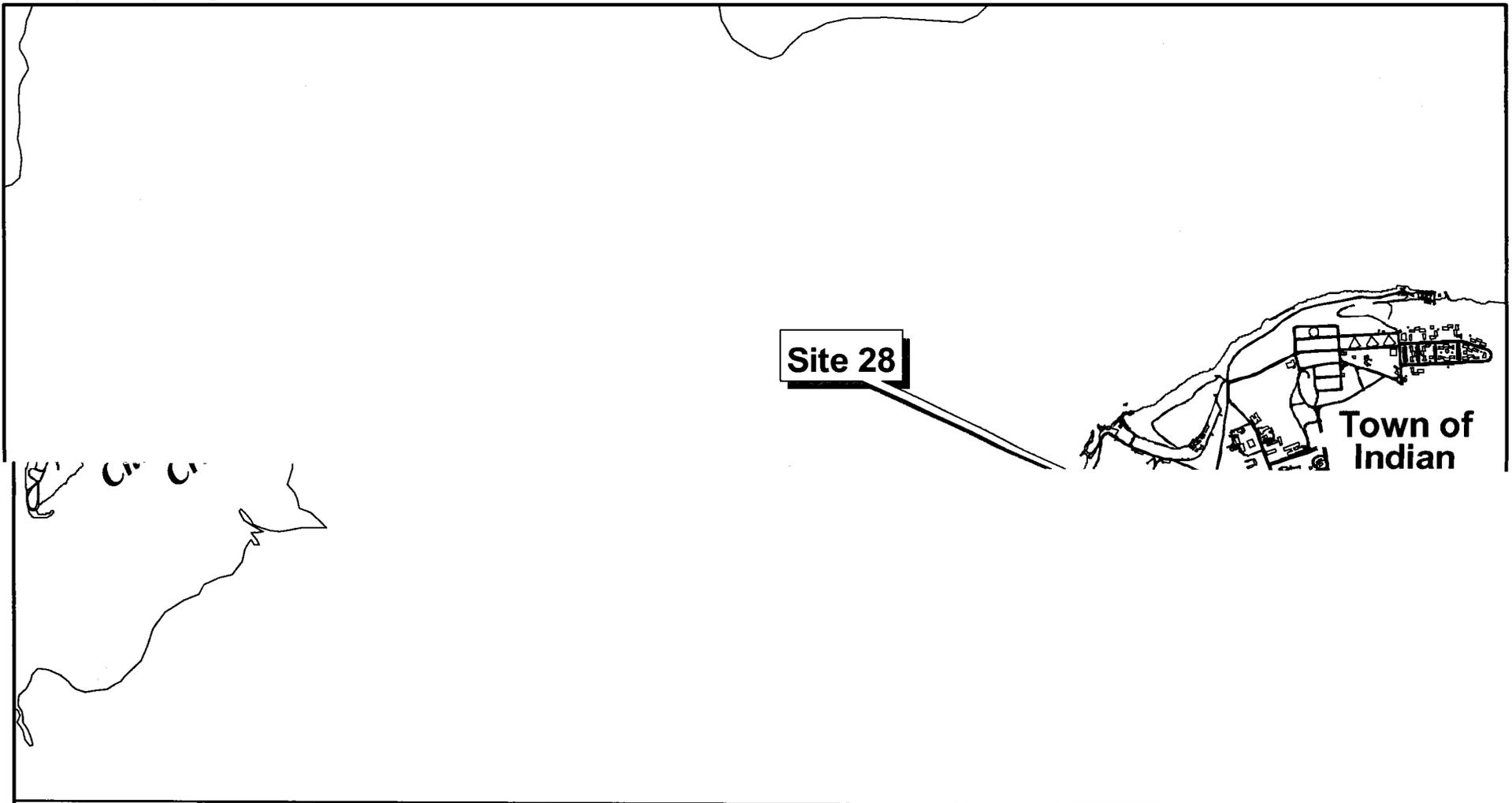
The human health risk assessment determined that potentially unacceptable risk was present for future adults, children, lifetime residents, and construction workers exposed to soil and groundwater at Site 28. Risks to commercial and industrial workers from soil were not quantitatively evaluated in the risk assessment. However, based on the calculated risk to an adult resident exposed to soil (i.e., a noncarcinogenic hazard that only marginally exceeded the USEPA target hazard level), which is the most directly analogous receptor to a commercial worker, the potential risk to this receptor is likely acceptable. The analysis of the elevated lead concentrations in the Swale 3 area concluded that exposure to surface and subsurface soil in this area would potentially be a concern for fetuses of expectant construction workers, utility workers (if they are exposed at the upper end of the estimated range of parameter values), and adult trespassers (if they are exposed at the upper end of the estimated range of parameter values), and for future child residents.

Ecological Risk Evaluation Summary

The screening-level ecological risk assessment (SERA) determined that potentially unacceptable risk was present in the soil and sediment at Site 28.

Based on the results of the SERA, antimony, cadmium, copper, lead, mercury, nickel, silver, and zinc were identified as potential risk-driving chemicals of concern (COCs) in surface soil for soil invertebrates and plants. Of these metals, cadmium, lead, mercury, and zinc were also identified as COCs for upper-trophic-level receptors. Although not identified as COCs for soil invertebrates or plants, arsenic and selenium were identified as COCs for upper-trophic-level receptors.

A baseline ecological risk assessment (BERA) is currently underway to address potential ecological risks at Site 28.



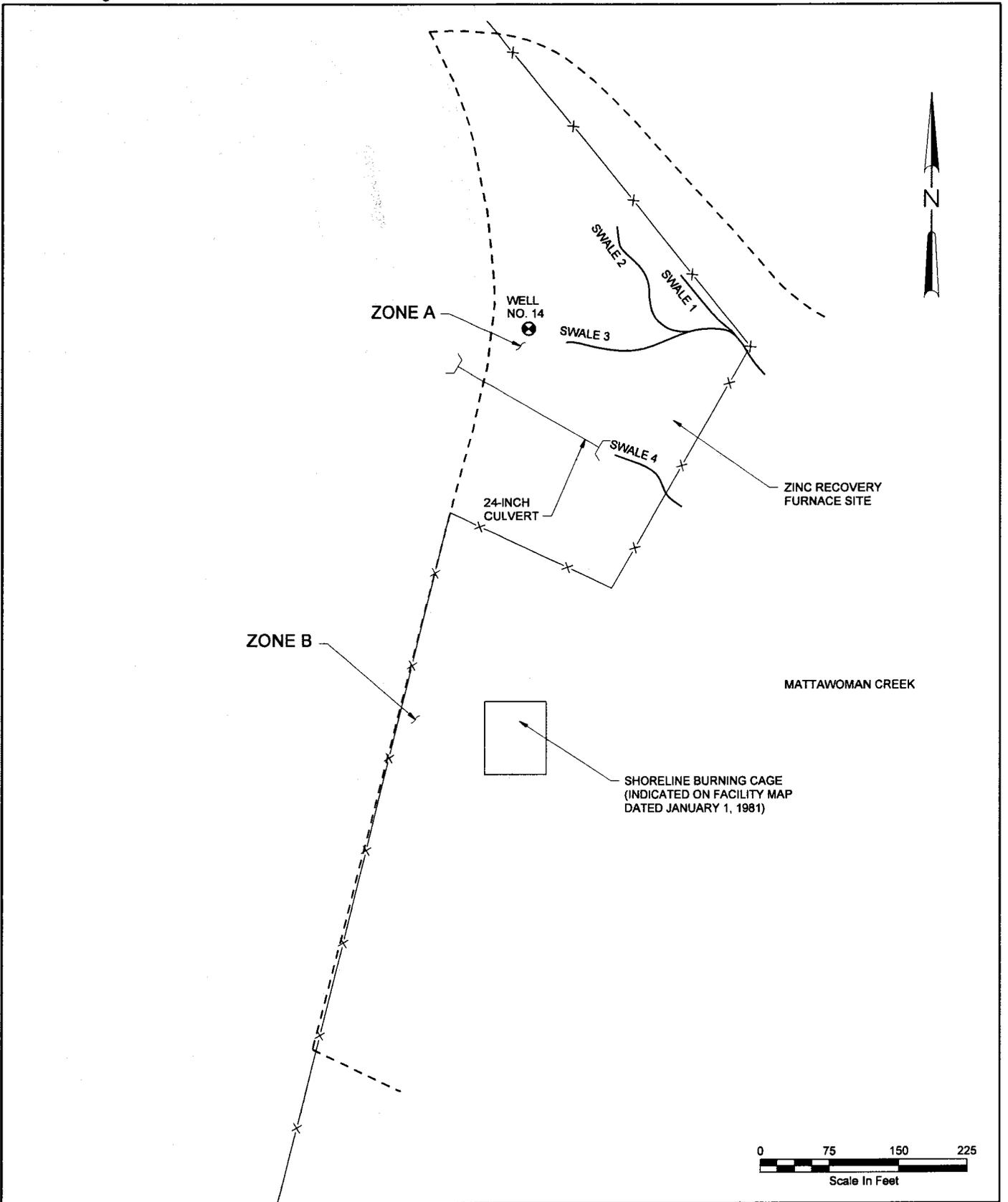
LEGEND

-  IR Site Boundary
-  Perennial Swale
-  Intermittent Swale
-  Railroads
-  Buildings
-  Asphalt Road
-  Dirt Road
-  Gravel Road



0 2500 5000 Feet

Figure 2-1
Location of Site 28
NSF-IH Site 28 EE/CA
Indian Head, Maryland

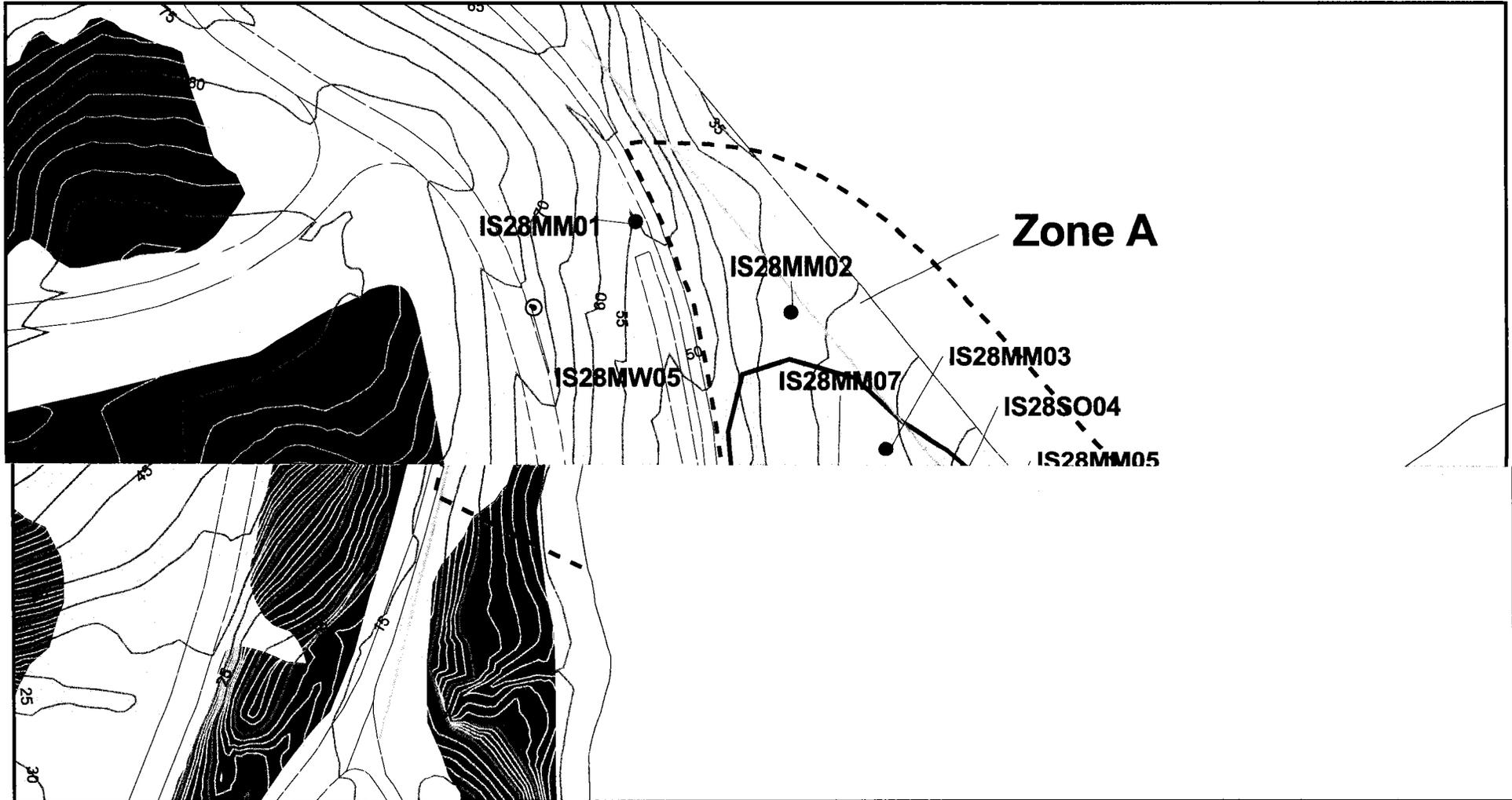


LEGEND

- X—X- FENCE LINE
- - - - - APPROXIMATE SITE BOUNDARY FOR RI

Figure 2-2
Site 28 Layout
NSF-IH Site 28 EE/CA
Indian Head, Maryland

NOTE: SWALE LOCATIONS ARE APPROXIMATE.



LEGEND

- Sample locations are labeled with the Station ID, as described in Section 3.2.1
- Onshore Sample Location (GPS)
 - ⊙ Monitoring Well Location (Surveyed)
 - ◆ Mattawoman Creek Sediment Sample Location (GPS)
 - - - Zone Boundary
 - - - Fence Line
 - ▭ IR Sites
 - ▭ Buildings
 - ∧ Five foot Contours
 - ∧ One Foot Contours
 - ∧ Railroads
 - ▭ Roads

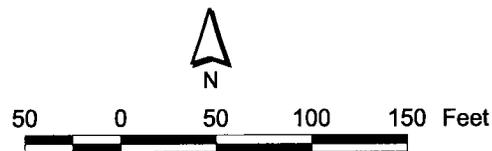


Figure 2-3
Location of Site 28 Zones and Cross Sections
NSF-IH Site 28, EE/CA
Indian Head, Maryland

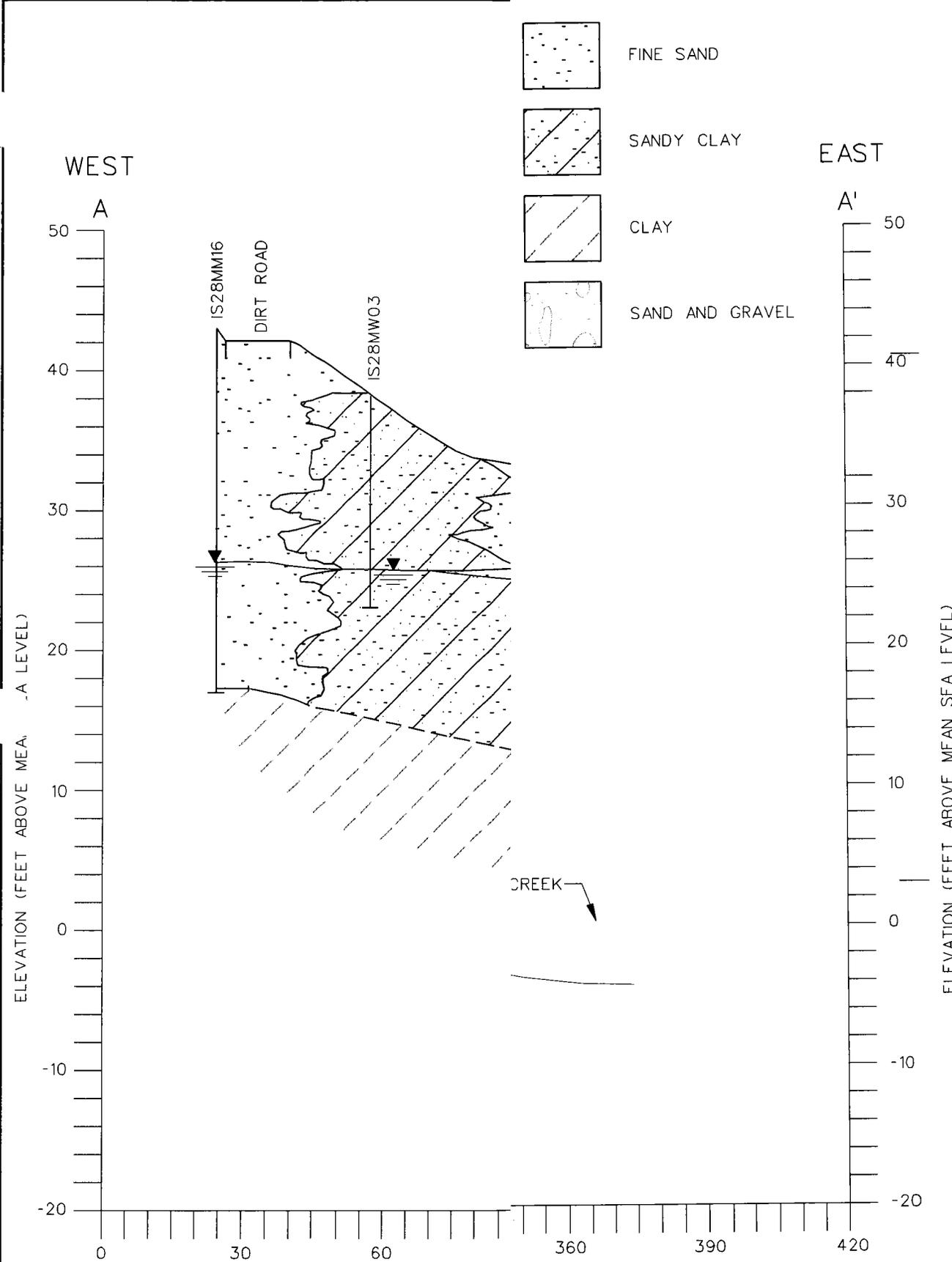
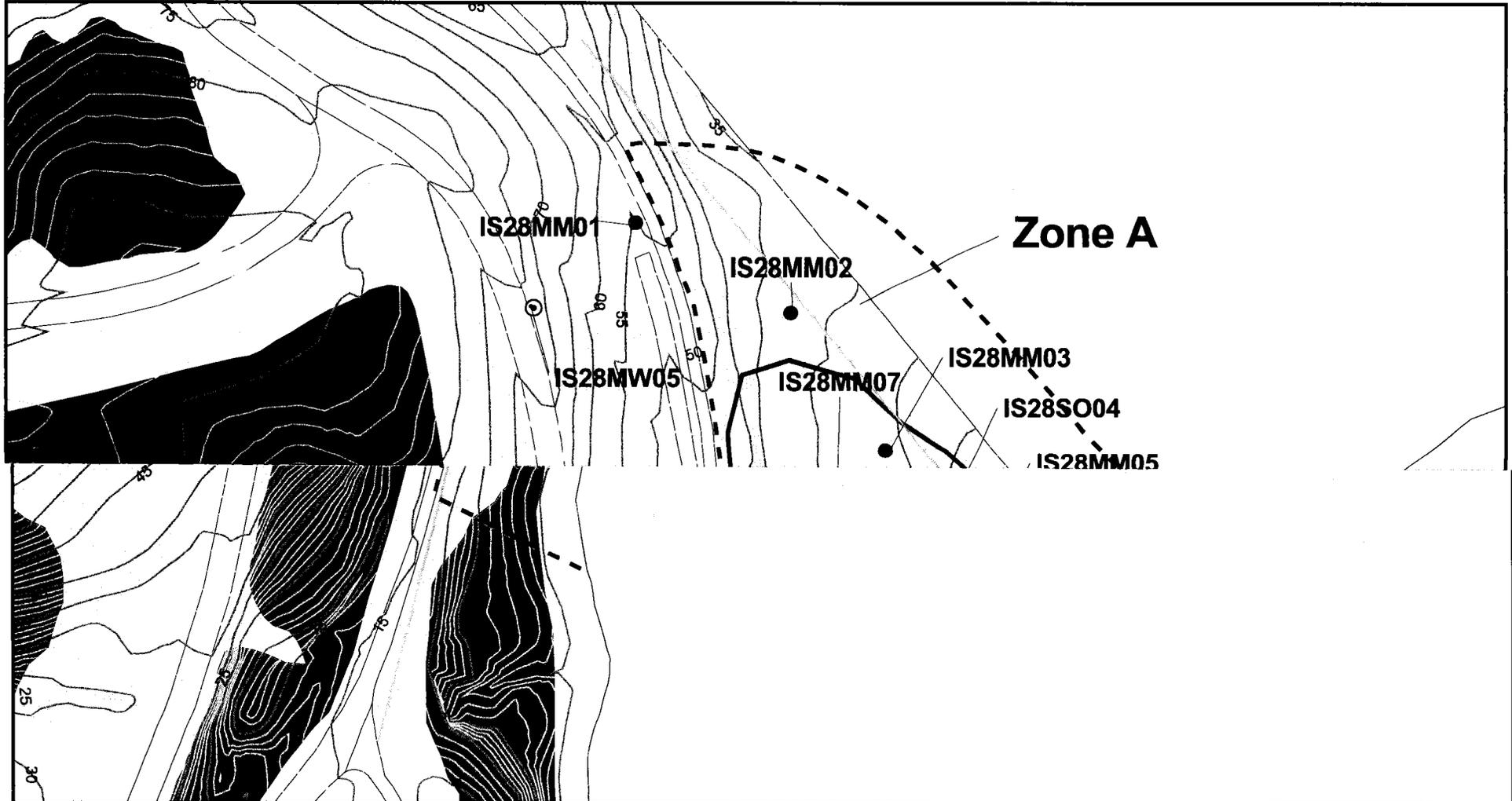


Figure 2--
Geologic Cross Section A--
NSF-IH Site 28 EE/C
Indian Head, Maryland



LEGEND

- Sample locations are labeled with the Station ID, as described in Section 3.2.1
- Onshore Sample Location (GPS) ⊙ Monitoring Well Location (Surveyed)
- ◆ Mattawoman Creek Sediment Sample Location (GPS)
- - - Zone Boundary
- - - Fence Line
- ▭ IR Sites
- ∧ Five foot Contours
- One Foot Contours
- ▨ Buildings
- ∨ Railroads
- Roads

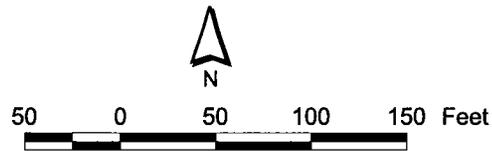


Figure 2-3
 Location of Site 28 Zones and Cross Sections
 NSF-IH Site 28, EE/CA
 Indian Head, Maryland

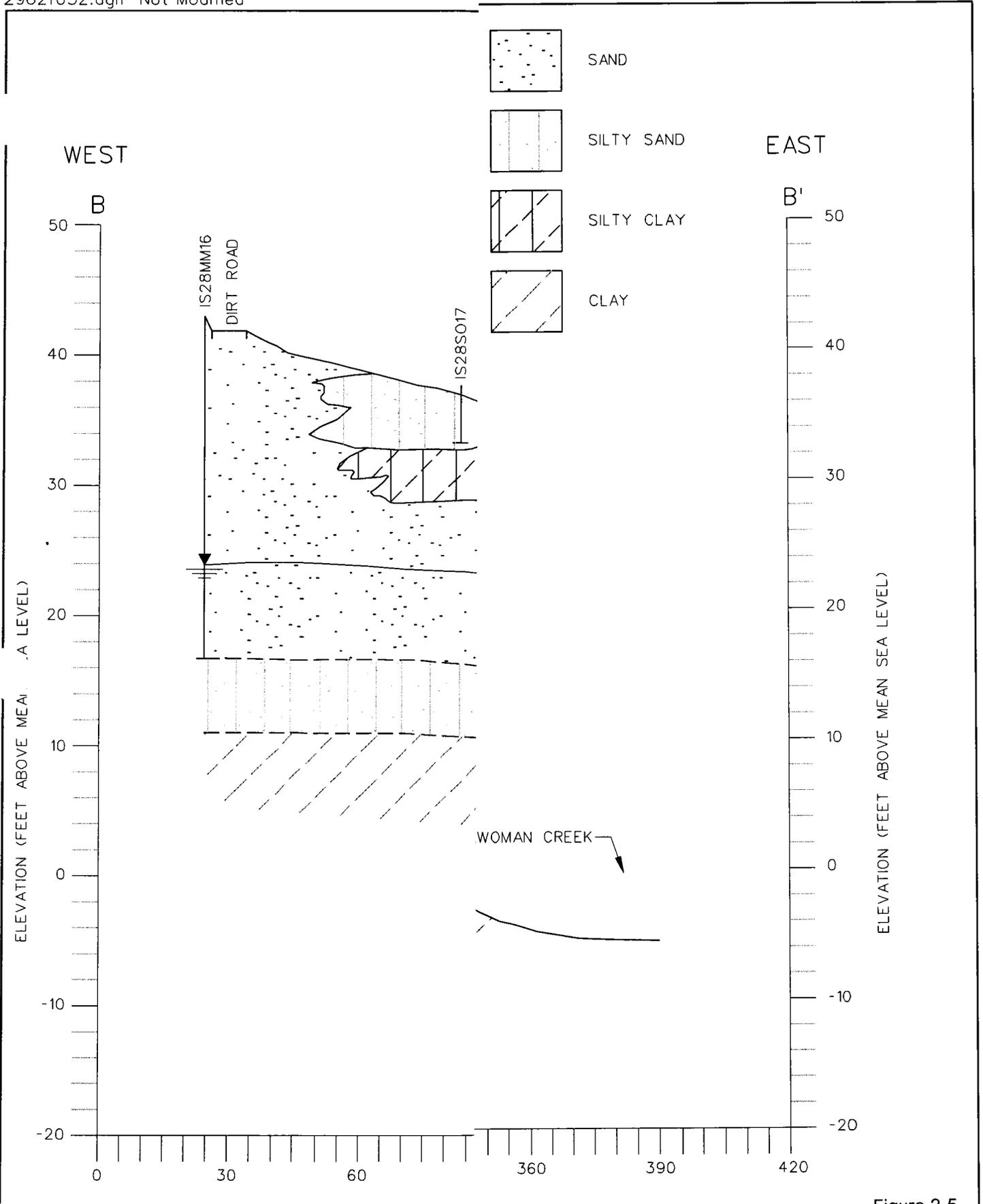


Figure 2-5
Geologic Cross Section B-B'
NSF-IH Site 28 EE/CA
Indian Head, Maryland

Identification of the Removal Action Objectives

To select an appropriate removal action for Site 28, the site removal action objectives (RAOs) need to be developed. This section presents information that forms the basis for the site RAOs. This information includes statutory limits on removal actions, the RAOs and scope, applicable or relevant and appropriate requirements (ARARs), and a discussion of the selection of cleanup criteria.

3.1 Statutory Limits on Removal Actions

The NCP (40 CFR Part 300.415) dictates statutory limits of \$2 million and 12 months per site on USEPA-fund-financed removal actions, with statutory exemptions for emergencies and actions consistent with later removal action to be taken. This removal action will not be USEPA-fund-financed. The Navy/Marine Corps Installation Restoration Manual does not limit the cost or duration of the removal action; however, cost effectiveness is a recommended criterion for evaluation of removal action alternatives. No other statutory limits exist for the proposed non-time-critical removal action.

3.2 Removal Action Objectives and Scope

The RAOs for Site 28 are to:

- Reduce potential risks to human health and ecological receptors associated with site soil contaminants to acceptable levels, represented by the agreed upon preliminary remediation goals (PRGs).
- Restore the site to existing, but improved, conditions (e.g., grading and vegetation).

3.3 Applicable or Relevant and Appropriate Requirements

ARARs are distinguished by USEPA as being either applicable to a situation or relevant and appropriate to a situation. The distinctions are critical to understanding the constraints imposed on remedial alternatives by environmental regulations. ARARs can include any promulgated standard, requirement, criterion, or limitation under a state environmental or facility-siting law that is more stringent than the associated federal standard, requirement, criterion, or limitation. The definitions of ARARs below are from USEPA guidance (USEPA, 1988). Both the applicable requirements and the relevant and appropriate requirements pertain to a site, to the extent practicable.

Applicable requirements are standards, standards of control, and other substantive environmental protection requirements, criteria, or limits promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, or other circumstance, as defined in the NCP, 40 CFR 300.5. For a requirement to be applicable, the remedial action or the circumstances at the site must satisfy all the jurisdictional prerequisites of that requirement. Only those state standards identified by a

state in a timely manner and that are more stringent than federal requirements may be considered as applicable requirements.

Relevant and appropriate requirements are standards, standards of control, and other substantive environmental protection requirements, criteria, or limits promulgated under federal or state law that, although not applicable to a hazardous substance, a pollutant, a contaminant, a remedial action, or other circumstances at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site so that their use is well suited to the particular site. Relevant and appropriate requirements also are defined in the NCP (40 CFR 300.5). For example, although Resource Conservation and Recovery Act (RCRA) regulations are not applicable to closing in-place hazardous waste that was disposed of before 1980, RCRA regulations for landfill closure with hazardous substances in-place may be deemed relevant and appropriate. Only those state standards identified by a state in a timely manner and that are more stringent than federal requirements may be considered as relevant and appropriate requirements.

Only promulgated Federal and State of Maryland laws and regulations can be considered as ARARs. In addition to ARARs, proposed rules, guidance documents, directives, and similar documents that might affect a CERCLA remedial action are "to-be-considered" (TBC) documents. If the ARARs do not address a particular situation, remedial actions should be based on the TBC criteria or guidelines.

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

- *Chemical-specific* ARARs are health or risk management-based numbers or methodologies that result in the establishment of numerical values for a given media that would meet the NCP "threshold criterion" of overall protection of human health and the environment. These requirements generally set protective cleanup concentrations for the COCs in the designated media, or set safe concentrations of discharge for remedial activity. Chemical-specific ARARs may be concentration-based cleanup goals or may provide the basis for calculating such levels. In cases where no chemical-specific ARAR exists, chemical advisories may be used to develop removal objectives.
- *Location-specific* ARARs restrict activities based on the geographic location of the site or characteristics of the surrounding environments. These ARARs are intended to limit activities within designated areas. Location-specific ARARs may include restrictions on actions within wetlands or floodplains, near locations of known endangered species, or on protected waterways. Federal and State of Maryland location-specific ARARs are summarized in Appendix A.
- *Action-specific* ARARs are requirements that define acceptable procedures related specifically to the type of activity being performed. These ARARs control or restrict hazardous substance- or pollutant-related activities. These controls are considered when specific removal activities are planned for a site. Federal action-specific and State of Maryland action-specific ARARs that may affect the development and conceptual arrangement of removal action alternatives are summarized in Appendix A.

3.4 Selection of Site Cleanup Criteria

Areas were identified by the human health risk analysis in the RI report (CH2M HILL, 2005a) as having discrete, elevated lead concentrations. The current average site-wide lead concentration is below the USEPA residential child soil screening value of 400 milligrams per kilogram (mg/kg) (OSWER Directive 9355.4-12, issued on July 14, 1994). The proposed soil removal for human health-associated risk is to remove soil with lead concentrations greater than 1,000 mg/kg, as agreed to by the Indian Head Installation Restoration Team (IHIRT), to further reduce the average site-wide lead concentration.

A BERA is currently underway to address potential ecological risks at Site 28; however, to derive PRGs for the direct contact COCs, the maximum concentrations of each metal in the soil samples submitted for toxicity testing for the Site 47 BERA (CH2M HILL, 2005b) were selected to represent the action levels (Table 3-1). No adverse effects (survival or growth) were observed in any of the bioassay samples from Site 47 (28-day tests with the earthworm *Eisenia foetida*). The rationale for using the Site 47 values is presented in the technical memorandum titled "Development of PRGs, Distribution of COCs, and Evaluation of Soil Characteristics - Site 28, NDWIH," presented in Appendix B.

Table 3-1
Ecological Risk Action Levels and PRGs
NSF-IH Site 28 EE/CA
Indian Head, Maryland

COC	Action Level (mg/kg)	PRG (mg/kg)
Antimony	1.1	0.4
Cadmium	1.4	0.8
Copper	40.6	10
Lead	583	30
Mercury	3	0.1
Nickel	16.8	7.1
Silver	425	0.9
Zinc	219	121

COC - chemical of concern

PRG - preliminary remediation goal

mg/kg - milligrams per kilogram

Identification and Analysis of Removal Action Alternatives

Based on the analysis of the nature and extent of contamination and on the cleanup objectives developed in the previous section, three removal action alternatives were developed. The following are the remedial action alternatives and the rationale for their use. The remedial alternatives considered for detailed evaluation at Site 28 are:

- Alternative 1: No Action
- Alternative 2: Soil Removal for Human Health and Ecological Risks
- Alternative 3: Soil Removal for Human Health Risks and *In situ* Treatment for Ecological Risks

Each alternative was evaluated using the effectiveness, implementability, and cost criteria set forth in the NCP and the USEPA guidance for conducting EE/CAs (USEPA, 1993). The effectiveness of each alternative is evaluated in accordance with the following criteria:

- Overall protection of human health and the environment
- Compliance with ARARs
- Long-term effectiveness
- Reduction of toxicity, mobility, or volume through treatment
- Short-term effectiveness

Implementability addresses the technical and administrative feasibility of implementing the alternative and is evaluated in accordance with the following criteria:

- Technical feasibility
- Administrative feasibility
- Availability of services and materials
- State acceptance
- Community acceptance

State and community acceptance will be addressed following regulatory agency and public review of this EE/CA.

Additionally, a cost estimate was prepared for each alternative to help in the selection of a removal action. Each estimate contains the capital cost, consisting of direct and indirect costs, and annual post-removal site control costs.

4.1 Alternative 1—No Action

4.1.1 Summary

This section provides an analysis of the effectiveness, implementability, and costs associated with a no-action alternative. Although a no-action scenario is not required, it is presented in this report to serve as a baseline for comparison of the other alternatives.

4.1.2 Effectiveness

Protection of Human Health and the Environment

Because no action is taken, the contaminated soil would remain on site as a continuing source of potential exposure to human and ecological receptors. Therefore, this alternative is not protective of human health and the environment.

Compliance with ARARS

This alternative will comply with the location- and action-specific ARARs identified in Appendix A.

Long-Term Effectiveness and Permanence

The no-action alternative would not be an effective or permanent solution. All contaminated soil would remain onsite as a continuing source of potentially unacceptable risk to human and ecological receptors.

Reduction of Toxicity, Mobility, and Volume through Treatment

Because no action is taken, material is neither destroyed nor treated. This alternative does not provide for any reduction in toxicity, mobility, or volume, and does not satisfy the statutory preference for treatment.

Short-Term Effectiveness

There are no short-term effects or risk to the community, workers, or the environment. Because no action is taken or implemented, there would be no workers to expose and no remedial activities to disrupt the environment for biota. However, leaving the contaminated soil on site allows for continued degradation of the environment and continued potential exposure to human and ecological receptors.

4.1.3 Implementability

Technical Feasibility

This alternative does not include treatment or monitoring; therefore, there would not be any technical difficulties to overcome.

Administrative Feasibility

This alternative does not include treatment or action of any kind; therefore, coordination of activities with regulatory or other agencies would not be required.

Availability of Services and Materials

This criterion is not applicable; no services or materials are needed for this alternative.

4.1.4 Cost

All costs are based on assumptions presented in this EE/CA. The net present worth of Alternative 1, No Action, is \$0.

4.2 Alternative 2—Soil Removal for Human Health and Ecological Risks

4.2.1 Summary

This section provides an analysis of the effectiveness, implementability, and costs associated with a soil removal alternative for human health and ecological risks. This alternative includes site preparation, soil and sediment removal associated with potential human health and ecological risks, confirmatory sample collection and analysis, site restoration, and surface water sample collection and analysis. Additionally, land-use controls (LUCs) will be implemented to prevent the use of shallow groundwater. This alternative will adhere to COMAR 26.24.01, regarding remediation activities in tidal wetlands, and COMAR 26.17.01, regarding erosion and sediment control measures. Figure 4-1 shows the proposed extent of the excavation area considered for this alternative.

Site Preparation

Site preparation will consist of clearing trees, brush, and remaining concrete foundation associated with the former building to provide unobstructed access to the site for all excavation and site restoration-related equipment. All vegetation will be chipped and spread in adjoining areas. Well 14 is still used as an observation well; thus, the cost for well abandonment is not considered in the cost estimate.

Soil Removal

Under this alternative, the soil that presents a potential threat to both human health and the environment will be removed. The soil that currently represents a potential threat to human health (lead concentration is greater than 1,000 mg/kg) is shown in blue in Figure 4-1. It covers an area of approximately 0.51 acres (ac). For cost estimating purposes, it is assumed that the depth of excavation will average 2 feet bgs. This assumption is based on the depth-to-water measurements from the soil and groundwater sampling activities during the RI. The water table elevations are shown in Figures 4-2 and 4-3. Additionally, because the site is on a slope, the depth for excavation in the upper part of the slope is assumed to extend to about 5 feet bgs and in the lower part to about 1 foot bgs.

Similarly, the soil that currently represents a potential threat to ecological receptors is shown in yellow in Figure 4-1. Except for a small area outside of the human health risk area, most of the ecological risk area falls within the human health risk area footprint for excavation. It is assumed that the excavation in the ecological risk area will average 1 ft bgs. Because of current site conditions, it is assumed that only half of the area representing the ecological risk will need to be excavated. Furthermore, if a minimum of 1 ft of fill is required

to achieve the desired final grading of the site, the soil will not be excavated because the exposure pathway will be broken.

Based on both the human health and ecological risk areas, the area of the excavation is estimated to be 0.99 ac and the total excavated volume is estimated to be 2,419 cubic yards (yd³). In general, the excavation depths would depend on the depth at which water is encountered. The goal would be to stop excavating if water is encountered before the assumed depth. Figure 4-4 provides the excavation and confirmatory sampling flowchart for decision-making.

The excavated soil will be mechanically screened and inspected by an explosive ordnance disposal (EOD) technician to ensure that no unexploded ordnance (UXO) leaves the site. It is not anticipated that UXO will be found at the site; however, this measure is included as a precaution. Following the screening, the soil will be stockpiled and hauled to an approved off-site landfill for disposal.

Additional excavation or grading may be required for the flat area created for the former building's foundation to achieve the desired final grade.

Confirmatory Sample Collection and Analysis

Following the excavation, samples will be collected from the bottom of the excavation in the areas that currently present a risk to human health; however, samples will not be collected in locations where the excavation extends to the groundwater table. Samples will be collected from the lateral extent of the excavation in the areas that currently present a risk to ecological receptors. The samples from the human health risk area will be analyzed for lead, and the samples from the ecological risk area will be analyzed for the constituents listed in Table 3-1. The success of the soil removal action will be based primarily on the post-removal mean concentration (95 percent upper confidence limit [UCL] of the mean) for the site, rather than on COC concentrations at individual sampling locations (i.e., if a few exceedances of the action levels are found, this would not necessarily trigger the need for further excavation). However, if exceedances appear clustered in one area, additional excavation will be completed. Figure 4-4 presents a flow chart showing the approach for applying action levels in the confirmatory sampling.

Site Restoration

After the cleanup goals have been achieved, the site will be backfilled with approved backfill material and seeded with native grasses and wetland plants. The backfilling will be conducted such that the site will have a slope similar to the undisturbed surrounding area (approximately 6 ft horizontal run to 1 foot vertical rise [6H:1V]) as shown in Figures 4-2 and 4-3. This will include grading the flat area created for the former building's foundation. The backfill material will be analyzed prior to placement to ensure that the concentrations of the COCs are consistent with background concentrations measured for NSF-IH and to ensure it is structurally suitable for the final slope of the site. For the cost estimate, it is assumed that an average of 2 feet will need to be placed in the location of the excavation to achieve the desired grade. Swale 4 will be maintained as a feature of the site.

After the final grade has been completed, the site will be re-vegetated. Native wetland plants will be planted at the bottom of the slope in the tidal fringe. The remainder of the site

will be restored using a native grass mix. Straw mulch will be placed over the entire area to minimize erosion of the grass seeds until they germinate.

Surface Water Sample Collection and Analysis

Following the site restoration, surface water samples will be collected and analyzed to determine if risks to ecological receptors associated with the site still exist. Because the number of samples and sampling parameters will be determined at a later date, the cost of the sampling is not included in the cost estimate for this alternative.

Groundwater LUCs

To prevent future use of the shallow groundwater, LUCs will be implemented that prohibit the use of groundwater at the site as a potable water supply.

4.2.2 Effectiveness

Protection of Human Health and the Environment

Alternative 2 satisfies this criterion because the soil that may represent a potential risk to human and ecological receptors will be removed from the site.

Compliance With ARARS

This alternative will comply with the location- and action-specific ARARs identified in Appendix A.

Long-Term Effectiveness and Permanence

Because the contaminated soil will be permanently removed from the site, Alternative 2 affords excellent compliance with the long-term effectiveness and permanence criterion.

Reduction of Toxicity, Mobility, and Volume through Treatment

Reduction of toxicity, mobility, and volume of the contaminants in soil will be achieved through this alternative, but not through treatment. Rather, the contaminated soil will be sent off site to an approved landfill for disposal.

Short-Term Effectiveness

Short-term impacts to the remediation workers resulting from the implementation of this alternative will be minimized through the implementation of good health and safety practices. Occupational Safety and Health Administration (OSHA)-trained personnel will be required for all the site-related activities. Furthermore, erosion control measures will be used to minimize the discharge of sediment from Site 28 to Mattawoman Creek during excavation.

4.2.3 Implementability

Technical Feasibility

Excavation and landfill disposal is technically feasible because the technology has become a standard practice.

Administrative Feasibility

Excavation and landfill disposal is administratively feasible because the technology has become a standard practice. Similarly, instituting the groundwater LUCs will be easy because current Maryland regulations prevent the use of shallow groundwater for potable water.

Availability of Services and Materials

The services and materials required for this alternative are readily available.

4.2.4 Cost

All costs are based on assumptions presented in this EE/CA. The net present worth of Alternative 2, Soil Removal for Human Health and Ecological Risks, is approximately \$982,000. The detailed cost breakdown for this alternative is presented in Table C-1 in Appendix C. Assumptions used for this cost estimate are:

- The results obtained from post-excavation samples will not trigger the need for further excavation;
- Only 2 samples will be collected to determine the acceptability of clean imported fill;
- Water from decontamination activities will be disposed of as a non-hazardous liquid;
- Excavated soil will be disposed of as a non-hazardous waste to a subtitle D facility;
- Excavation work will be completed within 15 working days;
- No obstructions or UXO will be encountered during excavation;
- No further monitoring or maintenance will be required after the remedial action is implemented for Alternative 2.

The information provided in the cost estimate is based on the best available information regarding the anticipated scope of the remedial alternatives. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternatives. This is an order-of-magnitude cost estimate that is expected to be within -30 to +50 percent of the actual project costs.

4.3 Alternative 3—Soil Removal for Human Health Risks and In Situ Treatment for Ecological Risks

4.3.1 Summary

This section provides an analysis of the effectiveness, implementability, and costs associated with soil removal for human health and *in situ* treatment for ecological risks. This alternative includes site preparation, removal of soil associated with potential human health risks, addition of phosphatic reagent amendment to soil and sediment associated with ecological risks, confirmatory sample collection and analysis, site restoration, long-term monitoring (LTM) with institutional controls (ICs), and surface water sample collection and analysis. Additionally, LUCs will be implemented to prevent the use of shallow groundwater. This alternative will adhere to COMAR 26.24.01, regarding remediation activities in tidal wetlands, and COMAR 26.17.01, regarding erosion and sediment control measures. Figure 4-1 shows the extent of the proposed areas for excavation and application of soil amendment considered for this alternative.

Site Preparation

Site preparation will consist of clearing trees, brush, and remaining concrete foundation associated with the former building to provide unobstructed access to the site for all excavation and site-restoration-related equipment. All vegetation will be chipped and spread in adjoining areas. Well 14 is still in use as an observation well; thus, the cost for well abandonment is not considered in the cost estimate.

Soil Removal

Under this alternative, the soil that presents a potential threat to human health will be removed. The soil that currently represents a potential threat to human health (lead concentration is greater than 1,000 mg/kg) is shown in blue in Figure 4-1. It covers an area of approximately 0.51 ac. For cost-estimating purposes, it is assumed that the depth of excavation will average 2 feet bgs. This assumption is based on the depth to water measurements from the soil and groundwater sampling activities during the RI. The water table elevations are shown in Figures 4-2 and 4-3. Additionally, because the site is on a slope, the depth for excavation in the upper part of the slope is assumed to extend to about 5 feet bgs and in the lower part to about 1 foot bgs. In general, the excavation depth would depend on the depth at which water is encountered. The goal would be to stop excavating if water is encountered before the assumed depth. Figure 4-4 provides the excavation and confirmatory sampling flowchart for decision-making. The total excavated volume is estimated to be 1,642 yd³.

The excavated soil will be mechanically screened and inspected by an EOD technician to ensure that no UXO leaves the site. It is not anticipated that UXO will be found at the site; however, this is included as a precautionary measure. The excavated soil will be stockpiled and hauled to an approved, offsite landfill for disposal.

Additional excavation or grading may be required for the flat area created for the former building's foundation to achieve the desired final grade.

Confirmatory Sample Collection and Analysis

Following the excavation, samples will be collected from the bottom of the excavation and analyzed for lead. The success of the soil removal action will be based primarily on the post-removal mean concentration (95 percent UCL of the mean) for the site, rather than on COC concentrations at individual sampling locations (i.e., if a few exceedances of the action levels are found, this would not necessarily trigger the need for further excavation). However, if exceedances appear clustered in one area, additional excavation will be completed. Figure 4-4 presents a flow chart showing the approach for determining the extent of the excavation.

Soil Amendment

The soil that currently represents a potential threat to ecological receptors is shown in yellow in Figure 4-1. To treat the COCs for ecological risks, a phosphatic reagent will be added to the soil. This will be accomplished by tilling the soil to a depth of 1 ft, adding an appropriate amount of the phosphatic reagent, and tilling the soil/reagent to homogenize the soil/reagent mixture. If a minimum of 1 ft of fill material is required to achieve the desired final grading of the site, the soil will not be amended because the exposure pathway will be broken. Because of the current site conditions, it is assumed that only half of the area

representing the ecological risk will need to be amended. The area for the soil amendment is estimated to be 0.48 ac, and the loading rate for the soil amendment is assumed to be 3 percent by weight (36 tons). This amendment technology has been evaluated in soil for COCs similar to those identified for Site 28, including lead, cadmium, and zinc (Wright et al., 2004; Chen et al., 1997).

Site Restoration

After the cleanup goals have been achieved for the human health risk, the excavated area will be backfilled with approved clean backfill material and seeded with native grasses. The backfill material will be analyzed prior to placement to ensure that the concentrations of the COCs are consistent with background concentrations measured for NSF-IH and to ensure it is structurally suitable for the final slope of the site. The backfilled area and areas where the soil amendment have been added will be regraded to achieve a final grade of the site similar to the existing grade of approximately 6H:1V as shown in Figures 4-2 and 4-3. Swale 4 will be maintained as a feature of the site during the restoration process.

Following regrading, the site will be revegetated. Native wetland plants will be planted at the bottom of the slope in the tidal fringe. The remainder of the site will be restored using a native grass mix. Straw mulch will be placed over the entire area to minimize erosion of the grass seeds until they germinate.

Long-Term Monitoring with Institutional Controls

To evaluate the performance of the phosphatic reagent amendment in soil, soil LTM of COCs will be conducted at the site to monitor the concentrations of the COCs. The monitoring will occur until the site can be closed with no further action or until the treatment has been deemed successful (i.e., constituent concentrations are below the PRGs). The site will be subject to LTM and 5-year reviews until the risk at the site is no longer present.

In addition, ICs will be in place to minimize or prevent humans from being on site during the treatment process for ecological receptors. Because of the location of the site and the desired use of the site, the ICs will consist of signs indicating that the site is undergoing environmental restoration. Periodic inspections of the site will be required to guarantee that the ICs are effective in preventing land access and use.

In the event the treatment is insufficient to close out the site, it may be necessary to perform more work at the site to break the exposure pathway to ecological receptors. This would entail either removing and backfilling or placing at least 1 ft of soil over the impacted area. The cost for this additional work is not included in the cost estimate.

Surface Water Sample Collection and Analysis

Following the site restoration, surface water samples will be collected and analyzed to determine if risks to ecological receptors associated with the site still exist. Though mentioned in this document, the number of samples and analytical parameters will be determined at a later date. Thus, the cost of this sampling effort is not included in the cost estimate for this alternative.

Groundwater LUCs

To prevent future use of the shallow groundwater, LUCs will be implemented that prohibit the use of groundwater at the site as a potable water supply.

4.3.2 Effectiveness

Protection of Human Health and the Environment

Alternative 3 satisfies this criterion because the soil that represents potential risk to human receptors will be removed from the site and the soil that represents a potential risk to ecological receptors will be treated to acceptable levels.

Compliance With ARARS

This alternative will comply with the location- and action-specific ARARs identified in Appendix A.

Long-Term Effectiveness and Permanence

Alternative 3 will comply with the long-term effectiveness and permanence criterion because some of the soil will be removed for human health risks and some will be treated *in situ* for ecological risks. To evaluate the performance of the soil amendment, LTM of the soil will be performed.

Although this alternative is expected to attain a high degree of success, the use of the amendment will not necessarily provide the level of treatment required to close out the site. Therefore, a contingency plan of additional removal and backfilling or of adding additional soil to the site will have to be in place.

Reduction of Toxicity, Mobility and Volume through Treatment

Reduction of toxicity, mobility, and volume of the contaminants in the soil will be achieved through this alternative. Although there will not be a reduction of toxicity or mobility of constituents contributing to the human health risks, the volume will be reduced because the contaminated soil will be placed in a landfill. However, the soil amendment will reduce the toxicity and mobility of the constituents contributing to the ecological risks through treatment.

Short-Term Effectiveness

Short-term impacts to the remediation workers resulting from the implementation of this alternative will be minimized through the implementation of good health and safety practices. OSHA-trained personnel will be required for all the site-related activities. Furthermore, erosion control measures will be used to minimize the discharge of sediment from Site 28 to Mattawoman Creek during the excavation and soil amendment activities.

4.3.3 Implementability

Technical Feasibility

Excavation and landfill disposal is technically feasible because the technology has become a standard practice. The soil amendment process is technically feasible because both the equipment and the phosphatic reagent required are readily available.

Administrative Feasibility

Excavation and landfill disposal is administratively feasible because the technology has become a standard practice. The soil amendment process is administratively feasible because both the equipment and the phosphatic reagent required are readily available and will not present a hazard or disruption to NSF-IH personnel or operations. Similarly, instituting the LUCs and ICs for the duration of the treatment will not be a significant burden.

Availability of Services and Materials

The services and materials required for this alternative are readily available.

4.3.4 Cost

All costs are based on assumptions presented in this EE/CA. The net present worth of Alternative 3, Soil Removal for Human Health Risks and *In Situ* Treatment for Ecological Risks, is approximately \$924,000. The detailed cost breakdown for this alternative is presented in Tables C-2 and C-3 in Appendix C. Assumptions used for this cost estimate are:

- The results obtained from post-excavation samples will not trigger the need for further excavation;
- Only two samples will be collected to determine the acceptability of clean imported fill;
- Water from decontamination activities will be disposed of as a non-hazardous liquid;
- Excavated soil will be disposed of as a non-hazardous waste to a Subtitle D facility;
- Excavation work can be completed within 5 working days;
- Soil amendment activities will be completed within 15 working days;
- No obstructions or UXO will be encountered during excavation.

The information provided in the cost estimate is based on the best available information regarding the anticipated scope of the remedial alternatives. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternatives. This is an order-of-magnitude cost estimate that is expected to be within -30 to +50 percent of the actual project costs.



LEGEND

- Limits of excavation (Alt 2) or soil amendment (Alt 3) based on potential ecological risk
- Limits of excavation (Alt 2 and Alt 3) based on potential human health risk
- ▨ Limits of sediment/soil excavation (Alt 2) or soil amendment (Alt 3) based on potential ecological risk (BERA results)
- IR Site
- Buildings
- Roads
- ≡ Railroads
- ∇ Five foot Contours
- ∇ One Foot Contours
- ⋈ Zone Boundary
- Fence Line

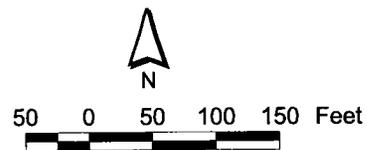
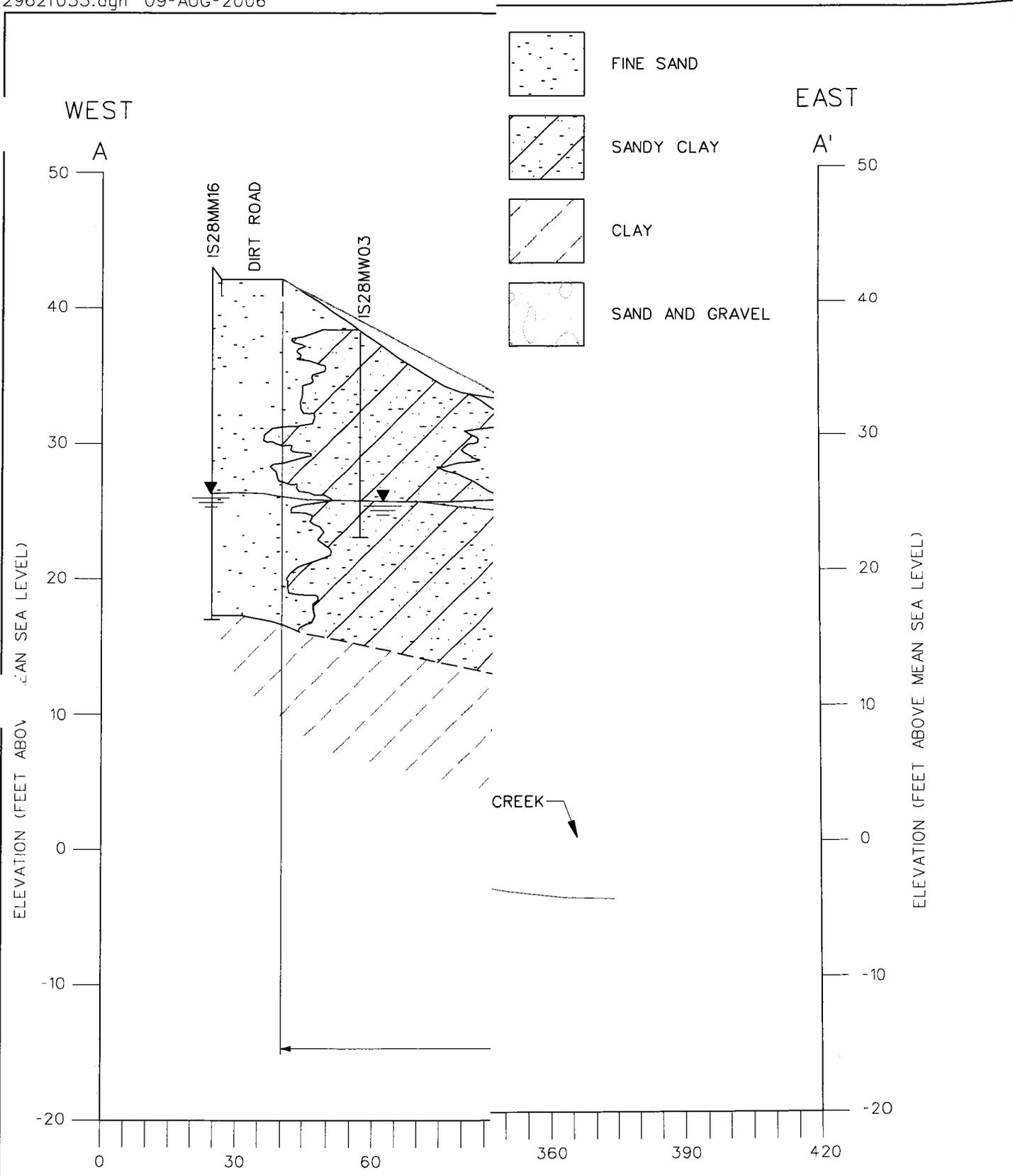
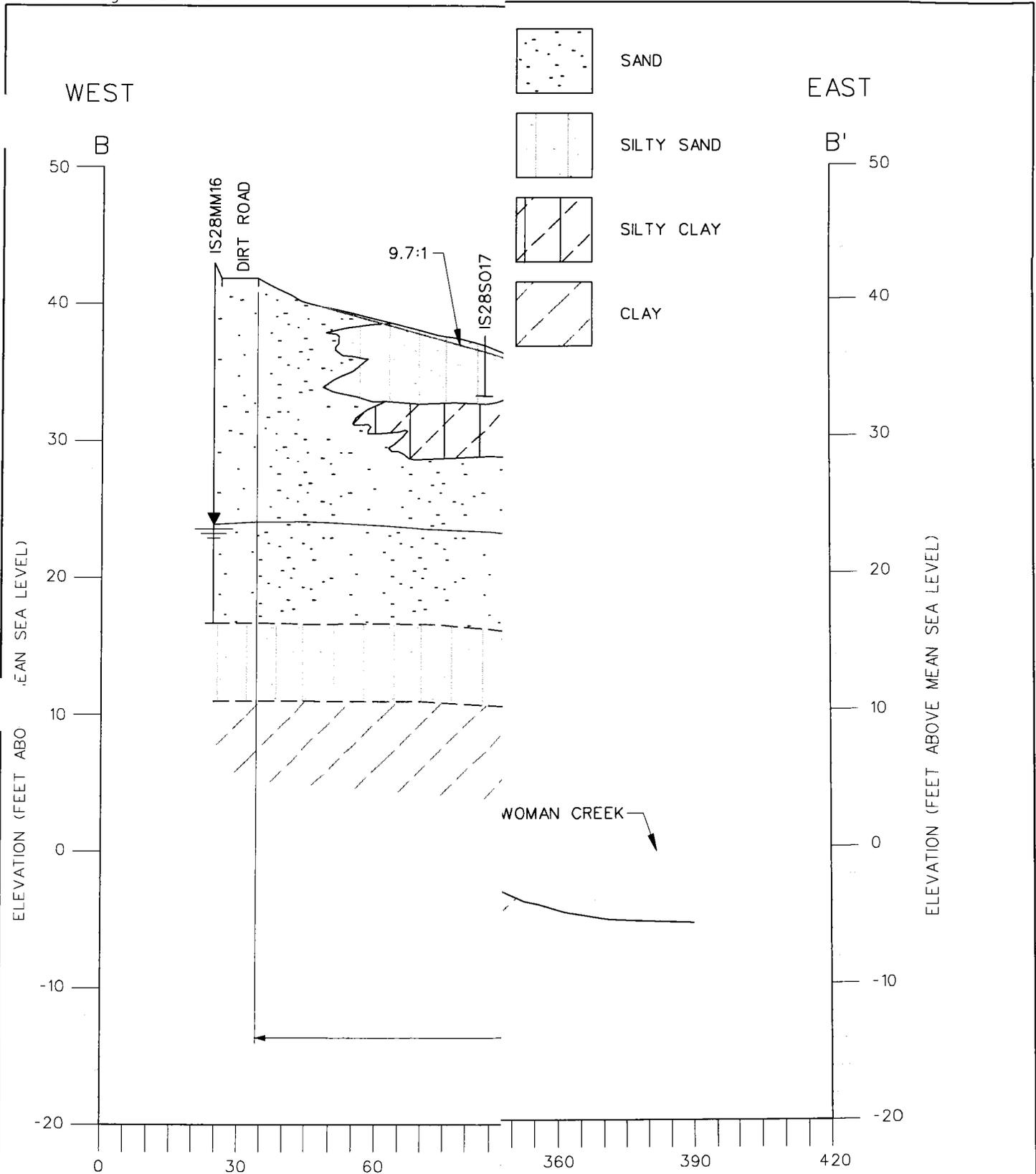


Figure 4-1
Limits of Excavation and/or Soil Amendment
for Alternative 2 and Alternative 3
NSF-IH Site 28 EE/CA
Indian Head, Maryland



NOTES:
 ALTERNATIVE 2: SOIL REMOVAL FOR HUMAN HEALTH AND
 ALTERNATIVE 3: SOIL REMOVAL FOR HUMAN HEALTH RISK
 TREATMENT FOR ECOLOGICAL RISKS
 REFER TO FIGURE 2-3 FOR GEOLOGIC CROSS SECTION I

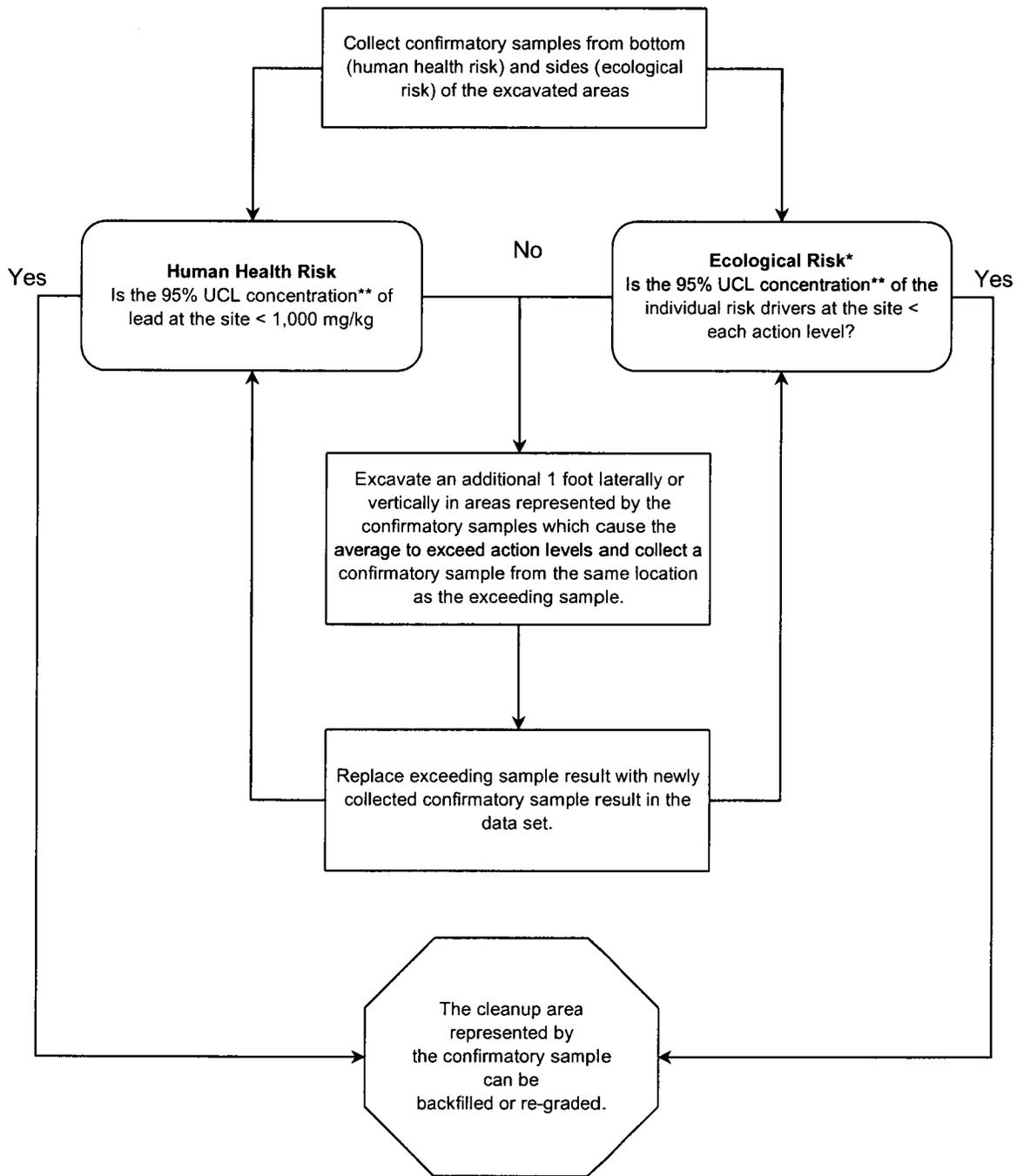
Figure 4-2
 LIMITS OF EXCAVATION
 AND/OR SOIL AMENDMENT FOR
 ALTERNATIVE 2 AND ALTERNATIVE 3,
 GEOLOGIC CROSS SECTION A-A'
 NSF-IH SITE 28 EE/CA
 INDIAN HEAD, MARYLAND



NOTES:

ALTERNATIVE 2: SOIL REMOVAL FOR HUMAN HEALTH AND
 ALTERNATIVE 3: SOIL REMOVAL FOR HUMAN HEALTH RISK:
 TREATMENT FOR ECOLOGICAL RISKS
 REFER TO FIGURE 2-3 FOR GEOLOGIC CROSS SECTION L'

Figure 4-3
 LIMITS OF EXCAVATION
 AND/OR SOIL AMENDMENT FOR
 ALTERNATIVE 2 AND ALTERNATIVE 3
 GEOLOGIC CROSS SECTION B-B'
 NSF-IH SITE 28 EE/CA
 INDIAN HEAD, MARYLAND



*The Ecological Risk Sampling applies only to Alternative 2

**The confirmation samples will be compared to the 95% UCL of the arithmetic mean concentration of each constituent

Figure 4-4
Excavation Decision Flow Chart
NSF-IH Site 28 EE/CA
Indian Head, Maryland

excavated soil. Although Alternative 2 is the most costly, an added cost benefit may be achieved in the event that Alternative 3 requires additional work to meet PRGs.

TABLE 5-1
Relative Ranking of Alternatives
NSF-IH Site 28 EE/CA, Indian Head, Maryland

CERCLA Criterion	Alternative		
	1 No Action	2 Soil Removal for Human Health and Ecological Risks	3 Soil Removal for Human Health Risks and in-Situ Treatment for Ecological Risks
Protection of human health and the environment	no	yes	yes
Compliance with ARARs	no	yes	yes
Long-term effectiveness	low	high	moderate-high
Reduction of toxicity, mobility, and volume through treatment	low	low	moderate
Short-term effectiveness	low	high	high
Technical feasibility	high	high	high
Administrative feasibility	high	high	high
Availability of services and materials	NA	high	high
Estimated costs	\$0	\$982,000	\$924,000
Relative total ranking	low	high	moderate-high

Recommended Removal Action Alternative

The EE/CA was performed in accordance with current USEPA and Navy guidance documents for a non-time-critical removal action under CERCLA. Three alternatives were analyzed based on evaluation of the effectiveness, implementability, and cost of each alternative. The effectiveness evaluation included reviewing the protectiveness of the alternative and its ability to meet the RAOs. Implementability included looking at the technical feasibility, availability, and administrative feasibility of the alternative. The evaluation of cost included a review of capital cost, operating cost, and present-worth cost.

Alternative 2, Soil Removal for Human Health and Ecological Risks, is the recommended alternative. Alternative 2 is recommended because it will achieve the RAOs for Site 28 with the greatest certainty of success. Furthermore, it complies with the ARARs; it is simple to implement; and it has a higher degree of certainty when considering the overall effectiveness and permanence of the remedial actions.

Alternative 2 provides the Navy with a solution that is potentially unhindered by future land use restrictions at Site 28. Alternative 2 will reduce ecological COC concentrations at the site to a level that will eliminate the potential future concern or pathway for contaminant transport to ecological receptors. Implementation of Alternative 2 is technically feasible and is a more permanent remedy than the other alternatives. Although implementation of Alternative 2 is the most costly alternative, Alternative 2 satisfies all the RAOs with the greatest potential effectiveness. The cost for implementation of Alternative 2 is estimated to have a present worth of \$982,000.

SECTION 7

References

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Appendix A
Federal and State of Maryland Location-Specific
and Action-Specific Applicable or Relevant and
Appropriate Requirements and To-Be-
Considered Requirements

TABLE A-1

Potential Federal Action-Specific ARARs
 NSF-IH Site 28 EE/CA
 Indian Head, Maryland

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comments
Federal Action-Specific ARARs					
Handling and Disposal of Certain Hazardous Wastes					
Remediation, release, and disposal polychlorinated biphenyls (PCBs)	Requirements governing the remediation, release, and disposal of PCBs must be met.	Remediation, release, and disposal of PCBs.	40 CFR 761	Not Applicable	PCBs are not contaminants of concern at Site 28.
Resource Conservation and Recovery Act (RCRA) 42 USC 6901 et seq.*					
Onsite waste generation	Waste generator shall determine if that waste is hazardous waste.	Generate hazardous waste.	40 CFR 262.10 (a), 262.11	Potentially applicable	Applicable for any operation where waste is generated. Portions of the extracted soil or sediment may be characteristic RCRA hazardous waste.
Hazardous waste accumulation	Generator may accumulate waste onsite for 90 days or less or must comply with requirements for operating a storage facility.	Accumulate hazardous waste.	40 CFR 262.34	Potentially applicable	If waste is generated at Site 28 (e.g., extracted soil or sediment), and is determined to be hazardous, any storage of the hazardous waste will not exceed 90 days. Accumulation of hazardous wastes onsite for longer than 90 days would be subject to the substantive RCRA requirements for storage facilities.
Recordkeeping	Generator must keep records.	Generate hazardous waste.	40 CFR 262.40	Not an ARAR	Administrative requirements are not ARARs for onsite CERCLA actions.
Container storage	Containers of RCRA hazardous waste must be: - Maintained in good condition. - Compatible with hazardous waste to be stored. - Closed during storage except to add or remove waste.	Storage of RCRA hazardous waste not meeting small quantity generator criteria held for a temporary period greater than 90 days before treatment, disposal or storage elsewhere, in a container.	40 CFR 264.171, 172, 173	Potentially applicable	Container storage requirements are applicable only if hazardous wastes are generated during interim remedial activities and are stored onsite for greater than 90 days. If waste is generated at Site 28 (e.g., extracted soil or sediment), and is determined to be hazardous, any storage of the hazardous waste will not exceed 90 days.
	Inspect container storage areas weekly for deterioration.	Storage of RCRA hazardous waste not meeting small quantity generator criteria held for a temporary period greater than 90 days before treatment, disposal or storage elsewhere, in a container.	40 CFR 264.174	Potentially applicable	
Container storage	Place containers on a sloped, crack-free base, and protect from contact with accumulated liquid. Provide containment system with a capacity of 10 percent of the volume of containers of free liquids. Remove spilled or leaked waste in a timely manner to prevent overflow of the containment system.	Storage of RCRA hazardous waste not meeting small quantity generator criteria held for a temporary period greater than 90 days before treatment, disposal or storage elsewhere, in a container.	40 CFR 264.175(a) and (b)	Potentially applicable	Container storage requirements are applicable only if hazardous wastes are generated during interim remedial activities and are stored onsite for greater than 90 days. If waste is generated at Site 28 (e.g., extracted soil or sediment), and is determined to be hazardous, any storage of the hazardous waste will not exceed 90 days.
	Keep incompatible materials		40 CFR 264.177	Potentially	

TABLE A-1 Potential Federal Action-Specific ARARs NSF-IH Site 28 EE/CA Indian Head, Maryland					
Action	Requirement	Prerequisite	Citation	ARAR Determination	Comments
	separate. Separate incompatible materials stored near each other by a dike or other barrier.			applicable	
	At closure, remove all hazardous waste and residues from the containment system, and decontaminate or remove all containers, liners.		40 CFR 264.178	Potentially applicable	
	Keep containers of ignitable or reactive waste at least 50 feet from the facility property line.		40 CFR 264.176	Not applicable	
Excavation	Movement of excavated materials to new location and placement in or on land will trigger land disposal restrictions for the excavated waste or closure requirements for the unit in which the waste is being placed.	Materials containing RCRA hazardous wastes subject to land disposal restrictions are placed in another unit.	40 CFR 268.40	Potentially applicable	Applicable to disposal of soil containing land disposal-restricted RCRA hazardous waste. The wastes generated from the interim remedial activities at Site 28 may be RCRA hazardous wastes.
Waste pile	Use single liner and leachate collection system. Waste put into waste pile subject to land disposal restriction regulations.	RCRA hazardous waste, non-containerized accumulation of solid, nonflammable hazardous waste that is used for treatment or storage.	40 CFR 264.251 (except 251(j), 251(e)(11))	Relevant and appropriate	Wastes will not be managed in waste piles as part of the interim remedial activities at Site 28. These wastes may be RCRA hazardous wastes, but will be placed in lined rollofs.
Closure with no postclosure care	General performance standard requires elimination of need for further maintenance and control; elimination of postclosure escape of hazardous waste, hazardous constituents, leachate, contaminated run-off, or hazardous waste decomposition products.	Land based unit containing hazardous waste. RCRA hazardous waste placed at site, or placed in another unit. Cleanup to health-based standards that will not require long-term management. Not applicable to material treated, stored, or disposed only before the effective date of the requirements, or if treated in-situ, or consolidated within area of contamination.	40 CFR 264.111	Potentially applicable or relevant and appropriate	This requirement may apply to active (in-situ) management of wastes if wastes at Site 28 are determined to be RCRA hazardous wastes. May be relevant to active management of wastes which are sufficiently similar to hazardous wastes. An <i>in-situ</i> remedial action (i.e., application of a soil amendment) is one of the alternatives presented in the EE/CA for Site 28.
Clean closure	Removal or decontamination of all waste residues, contaminated containment system components, contaminated subsoils, and structures and equipment contaminated with waste and leachate, and management of them as hazardous waste.	Surface impoundment, container or tank liners and hazardous waste residues, or contaminated soil (including soil from dredging or soil disturbed in the course of drilling or excavation) returned to land.	40 CFR 264.111 and 264.228 (a, b, e through k, m, o, p, q).	Potentially applicable	May be applicable if the excavated soil and/or sediment at Site 28 is determined to be a RCRA hazardous waste.
RCRA corrective	An area at a RCRA facility may be	RCRA corrective action	40 CFR 264.552	Not applicable	Not an ARAR. No actions that would

TABLE A-1

Potential Federal Action-Specific ARARs

NSF-IH Site 28 EE/CA

Indian Head, Maryland

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comments
action	designated as a corrective action management unit (CAMU). Placement of remediation wastes into or within a CAMU does not constitute land disposal of hazardous wastes nor creation of a unit subject to minimum technology requirements.	management unit.			require designation of a CAMU are planned.
Placement of waste in land disposal unit	Attain land disposal treatment standards before putting waste into landfill in order to comply with land disposal restrictions.	Placement of RCRA hazardous waste in a landfill, surface impoundment, waste pile, injection well, land treatment facility, salt dome formation, or underground mine or cave.	40 CFR 268.40	Potentially applicable	This requirement may apply if active disposal of RCRA restricted hazardous waste occurs as part of the interim remedial activities at Site 28.
Use of equipment that contacts hazardous waste with organic concentrations greater than 10 percent by weight	Air emission standards for process vents or equipment leaks.	Equipment that contains or contacts hazardous waste with organic concentrations of at least 10 percent by weight or process vents associated with specified operations the manage hazardous wastes with organic concentrations of at least 10 percent by weight.	40 CFR 264.1030 through 1034 (excluding 1030(c), 1033(j), 1034(c)(2), 1034 (d)(2)); 40 CFR 264.1050 through 1063 (excluding 1015(c), 1050(d), 1057(g)(2), 1061(d), 1063(d)(3))	Not applicable	Organic contaminants of concern are not present at suitably high levels at Site 28.
Discharge to groundwater from regulated unit	Groundwater Protection Standards: Owners/operators of RCRA treatment, storage, or disposal facilities must comply with conditions in this section that area designed to ensure that hazardous constituents entering the groundwater from a regulated unit do not exceed the concentration limits for contaminants of concern set forth under Section 264.94 in the uppermost aquifer underlying the waste management area beyond the point of compliance.	Uppermost aquifer underlying a waste management unit beyond the point of compliance; RCRA hazardous waste, treatment, storage, or disposal.	40 CFR 264.94(a)(1), (a)(3), (c), (d), and (e).	Not an ARAR	Site 28 is not a RCRA treatment, storage, or disposal facility.
Clean Water Act (CWA), 33 USC 1251 et seq.					
Discharge to POTW	Pretreatment standards. Control the introduction of pollutants into POTWs so as to: prevent interference with the operation of a POTW; prevent		40 CFR 403	Not an ARAR	Discharge to a POTW is not planned as part of the interim remedial activities at Site 28.

TABLE A-1

Potential Federal Action-Specific ARARs

NSF-IH Site 28 EE/CA

Indian Head, Maryland

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comments
	pass through of pollutants through a treatment works; and improve opportunities to recycle and reclaim municipal and industrial wastewater and sludges.				
Discharge of treatment system effluent	Best available technology. Use of Best Available Technology (BAT) economically achievable is required to control toxic and nonconventional pollutants. Use of best conventional pollutant control technology (BCT) is required to control conventional pollutants.	Point source discharge to waters of United States.	40 CFR 122.44(a)	Not an ARAR	Treatment system effluent is not planned as part of the interim remedial activities at Site 28.
Discharge of treatment system effluent (continued)	Best Management Practices. Develop and implement a Best Management Practice program to prevent the release of toxic constituents to surface waters.		40 CFR 125.100	Not an ARAR	Treatment system effluent is not planned as part of the interim remedial activities at Site 28.
	Monitoring Requirements. Discharge must be monitored to assure compliance. Comply with additional substantive requirements such as; mitigate any adverse effects of any discharge, and proper operation and maintenance of treatment systems.		40 CFR 122.41 (i), (j)	Not an ARAR	Treatment system effluent is not planned as part of the interim remedial activities at Site 28.
Clean Air Act (CAA) 40 USC 7401 et seq.					
Operations generating pollution	Establishes requirements for the control of pollution from Federal facilities.	Operations generating pollution.	Section 118 of the CAA.	Not an ARAR	Interim remedial activities at Site 28 will not be generating these air emissions.
Discharge of Volatile Organic Compounds (VOCs) to air.	A prediction of total emissions of VOCs must be made to demonstrate that emissions do not exceed 450 lb/hr, 3,000 lb/day, 10 gal/day, or allowable emission levels from similar sources using Reasonably Available Control Technology (RACT).	Emissions of VOCs	40 CFR 52	Not an ARAR	Interim remedial activities at Site 28 will not be generating these air emissions.
Operations generating odors into the environment	Systems must be designed to provide an odor-free operation.	Operations generating odors into the environment.	Section 101 of the CAA, 40 CFR 52	Not an ARAR	Interim remedial activities at Site 28 will not be generating these air emissions.
Discharge to air	An Air Pollution Emission Notice (APEN) must be filed with the State of Virginia to include an estimation of emission rates for each pollutant expected.	Major sources of air pollutants	40 USC Section 7140; portions of 40 CFR 52.220	Not an ARAR	Interim remedial activities at Site 28 will not be generating these air emissions.
Discharge to air	Provisions of State Implementation Plan (SIP) approved by EPA under Section 110 of CAA.	Major sources of air pollutants	40 USC Section 7140; portions of 40 CFR 52.220	Not an ARAR	Interim remedial activities at Site 28 will not be generating these air emissions.
NAAQS Attainment areas	New major stationary sources shall apply best available control technology for each pollutant, subject	Major stationary sources as identified in 40 CFR 52.21(b)(1)(i)(a) that	40 CFR 52.21(j) (CAA)	Not an ARAR	Interim remedial activities at Site 28 will not be generating these air emissions.

TABLE A-1					
Potential Federal Action-Specific ARARs					
NSF-IH Site 28 EE/CA					
Indian Head, Maryland					
Action	Requirement	Prerequisite	Citation	ARAR Determination	Comments
	to regulation under the Act, that the source would have potential to emit in significant amounts.	emits, or has the potential to emit, 100 tons per year or more of any regulated pollutant; any other stationary source that emits, or has the potential to emit, 250 tons per year or more of any regulated pollutant.			
NAAQS non-Attainment areas	Source must obtain emission offsets in Air Quality Control Region of greater than one-to-one	Any stationary facility or source of air pollutants that directly emits, or has the potential to emit, 100 tons per year or more of any air pollutant (including any major emitting facility or source of fugitive emissions of any such pollutants).	CAA Part D, Section 173(1)	Not an ARAR	Interim remedial activities at Site 28 will not be generating these air emissions.
	Source subject to "lowest achievable emission rate (LAER)" as defined in 40 CFR 51.18(j)(xiii). All major stationary sources owned or operated by any person in the State are in compliance, or on a schedule for compliance, with all applicable emission standards.		CAA Part D, Section 173(2) CAA Part D, Section 173(3)		
Air Quality					
Emissions of mercury, vinyl chloride, and benzene	Requirements to verify that emissions of mercury, vinyl chloride, and benzene do not exceed levels expected from sources that are in compliance with hazardous air pollution regulation.	Emissions of mercury, vinyl chloride, and benzene from sources in compliance with hazardous air pollution regulation.	40 CFR 61	Not an ARAR	Interim remedial activities at Site 28 will not be generating these air emissions.
U.S. Department of Transportation, 49 USC 1802, et seq.					
Hazardous Materials Transportation	No person shall represent that a container or package is safe unless it meets the requirements of 49 USC 1802, et seq. or represent that a hazardous material is present in a package or motor vehicle if it is not.	Interstate carriers transporting hazardous waste and substances by motor vehicle. Transportation of hazardous material under contract with any department of the executive branch of the Federal Government.	49 CFR 171.2(f)	Potentially applicable	To be determined (i.e., if the excavated soil or sediment is determined to be hazardous). Substantive portions of these requirements would be ARARs for transport of hazardous materials onsite. Offsite transport of hazardous materials must comply with both substantive and administrative requirements.
	No person shall unlawfully alter or deface labels, placards, or descriptions, packages, containers, or motor vehicles used for transportation of hazardous materials.		49 CFR 171.2(g)	Potentially applicable	
Hazardous	Each person who offers hazardous	Person who offers	49 CFR 172.300	Potentially	To be determined (i.e., if the excavated soil or

TABLE A-1
 Potential Federal Action-Specific ARARs
 NSF-IH Site 28 EE/CA
 Indian Head, Maryland

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comments
Materials Marking, Labeling, and Placarding	material for transportation or each carrier that transports it shall mark each package, container, and vehicle in the manner required.	hazardous material for transportation; carries hazardous material; or packages, labels, or placards hazardous material.		applicable	sediment is determined to be hazardous). Substantive portions of these requirements would be ARARs for transport of hazardous materials onsite. Offsite transport of hazardous materials must comply with both substantive and administrative requirements.
	Each person offering non-bulk hazardous materials for transportation shall mark the proper shipping name and identification number (technical name) and consignee's name and address.		49 CFR 172.301	Potentially applicable	
	Hazardous materials for transportation in bulk packages must be labeled with proper identification (ID) number, specified in 49 CFR 172.101 table, with required size of print. Packages must remain marked until cleaned or refilled with material requiring other marking.		49 CFR 172.302	Potentially applicable	
Hazardous Materials Marking, Labeling, and Placarding (continued)	No package marked with a proper shipping name or ID number may be offered for transport or transported unless the package contains the identified hazardous material or its residue.		49 CFR 172.303	Potentially applicable	To be determined (i.e., if the excavated soil or sediment is determined to be hazardous). Substantive portions of these requirements would be ARARs for transport of hazardous materials onsite. Offsite transport of hazardous materials must comply with both substantive and administrative requirements.
	The marking must be durable, in English, in contrasting colors, unobscured, and away from other markings.		49 CFR 172.304	Potentially applicable	
	Labeling of hazardous material packages shall be as specified in the list.	Person who offers hazardous material for transportation; carries hazardous material; or packages, labels, or placards hazardous material.	49 CFR 172.400	Potentially applicable	
	Non-bulk combination packages containing liquid hazardous materials must be packed with closures upward, and marked with arrows pointing upward.		49 CFR 172.312	Potentially applicable	
	Each bulk packaging or transport vehicle containing any quantity of hazardous material must be placarded on each side and each end with the type of placards listed in Tables 1 and 2 of 49 CFR 172.504.		49 CFR 172.504	Potentially applicable	

TABLE A-1

Potential Federal Action-Specific ARARs
 NSF-IH Site 28 EE/CA
 Indian Head, Maryland

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comments
Criteria for Classification of Solid Waste Disposal Facilities and Practices, 40 CFR Part 257*					
Solid Waste Disposal	A facility or practice shall not contaminate an underground drinking water source beyond the solid waste boundary or a court- or State-established alternative.	Solid waste disposal facility and practices except agricultural wastes, overburden resulting from mining operations, land application of domestic sewage, location and operations of septic tanks, solid or dissolved materials in irrigation return flows, industrial discharges that are point sources subject to permits under CWA, source special nuclear or by-product material as defined by the Atomic Energy Act, hazardous waste disposal facilities that are subject to regulation under RCRA subtitle C, disposal of solid waste by underground injection, and municipal solid waste landfill units.	40 CFR 257.3-4 and Appendix I	Potentially applicable	The interim remedial action may include the disposal of wastes in a solid waste disposal facility. Substantive requirements would be applicable to an onsite disposal facility for non-hazardous wastes.
	A facility shall not cause a discharge of pollutants into waters of the U.S. that is in violation of the <u>substantive</u> requirements of the NPDES under CWA Section 402, as amended.		40 CFR 257.3-3(a)	Potentially applicable	See above comment.
	A facility shall not cause discharge of dredged material or fill material to waters of the U.S. that is in violation of the <u>substantive</u> requirements of CWA Section 404.		40 CFR 257.3-3	Not an ARAR	The interim remedial action at Site 28 will not include the disposal of dredge or fill material into the river.
	A facility or practice shall not cause nonpoint source pollution of waters of the U.S. that violates applicable legal <u>substantive</u> requirements implementing an areawide or Statewide water quality management plan approved by the Administrator under CWA Section 208, as amended.		40 CFR 257.3-3(a)	Potentially applicable	The interim remedial action may include the disposal of wastes in a solid waste disposal facility. Substantive requirements would be applicable to an onsite disposal facility for non-hazardous wastes.
Solid Waste Disposal (continued)	The facility or practice shall not engage in open burning of residential, commercial, institutional, or industrial solid waste.	Not applicable to infrequent burning of agricultural wastes in the field, silvicultural wastes	40 CFR 257.3-7(a)	Not an ARAR	No open burning is planned as part of the interim remedial action at Site 28.

TABLE A-1

Potential Federal Action-Specific ARARs
 NSF-IH Site 28 EE/CA
 Indian Head, Maryland

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comments
		for forest management purposes, land clearing debris from emergency cleanup operations, and ordnance.			
	The facility shall not violate applicable requirements developed under a State Implementation Plan (SIP) approved or promulgated by the Administrator pursuant to CAA Section 110, as amended.		40 CFR 257.3-7(b)	Not an ARAR	No solid waste management units that would impact the SIP are planned.
Occupational Safety and Health Administration (OSHA)					
Hazardous waste work	Requirements for hazardous waste workers such as training, personal protective equipment (PPE), and clothing must be met.	Hazardous waste work.	29 CFR 1904, 29 CFR 1910, 29 CFR 1926	Potentially Applicable	The interim remedial action at Site 28 may involve hazardous waste workers, therefore the requirements of OSHA must be met.

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 EPA considers the entire statutes or policies as potential ARARs; only substantive requirements of the specific citations are considered potential ARARs. Specific potential ARARs are addressed in the table below each general heading.

ACLS - Alternate concentration limits.
 APEN - Air Pollution Emission Notice.
 ARAR - Applicable or relevant and appropriate requirement.
 BACT - Best available control technology
 BDAT - Best demonstrated available technologies.
 CAA - Clean Air Act.
 CAMU - Correction action management unit.
 RCRA - Resource Conservation and Recovery Act.
 CFR - Code for Federal Regulations.
 CWA - Clean Water Act
 DOT - U.S. Department of Transportation.
 EPA - U.S. Environmental Protection Agency.
 LAER - Lowest achievable emission rate.
 MCLs - Maximum contaminant levels.
 MCLGs - Maximum contaminant level goals.
 NAAQS - National Ambient Air Quality Standards (primary and secondary).
 NESHAP - National emission standards for hazardous air pollutants.
 NCP - National Contingency Plan.
 NPDES - National Pollutant discharge elimination system.

OSHA - Occupational Safety and Health Administration
 PCBs - Polychlorinated Biphenyls
 POTW - Publicly owned treatment works.
 ppm - Parts per million.
 ppmw - Parts per million by weight.
 RA - Relevant and appropriate.
 RACT - Reasonably Available Control Technology.
 CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act.
 SDWA - Safe Drinking Water Act.
 SIP - State Implementation Plan
 SMCLs - Secondary maximum contaminant levels.
 TBC - To be considered.
 TSCA - Toxic Substances Control Act
 UIC - Underground injection control.
 USC - United States Code.
 USDW - Underground source of drinking water.
 VOCs - Volatile Organic Compounds.

TABLE A-2

Potential State Action-Specific ARARs

NSF-IH Site 28 EE/CA

Indian Head, Maryland

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comments
State Action-Specific ARARs					
Transportation, Disposal of Hazardous Waste					
Storage, treatment or disposal, and transportation of hazardous waste	Regulations and procedures for the identifications, listing, transportation, hazardous wastes must be met.	Handling of hazardous wastes.	COMAR 26.13.02, COMAR 26.13.04, Annotated Code of Maryland Title 7	Potentially Applicable	Any hazardous waste generated during interim remedial actions at Site 28 will be disposed of according to regulations. Any residues or by-products from potential in situ treatment that are hazardous will be disposed of properly
Construction, Alteration, and Extension of Sanitary Landfills					
Altering, extending or constructing sanitary landfills, determination of permit requirements	Regulation and permitting for the material alteration of proposed and former sanitary landfills.	transport of hazardous substances.	COMAR 26.04.07.04	Potentially Applicable	The interim remedial actions at Site 28 may be subject to the substantive portions of this regulation.
Disposal of Controlled Hazardous Substances-Radioactive Hazardous Substances					
Handling of radioactive hazardous substances	of level radioactive waste) in an appropriate manner.	transport of hazardous substances.	COMAR 26.15.02	Not an ARAR	Radioactive hazardous substances will not be disposed of or transported as part of the interim remedial actions at Site 28.
Stormwater Management					
Design and construction	Regulations require the design and construction of a system necessary to control stormwater.	Design and construction	COMAR 26.09.02 COMAR 26.09.02.01 COMAR 26.09.02.03(A&B) COMAR 26.09.02.05(A) COMAR 26.09.02.06 COMAR 26.09.02.08 COMAR 26.09.02.10	Applicable	The interim remedial action will incorporate measures to control and manage stormwater (i.e., erosion control measures will be implemented).
Erosion and Sediment Control					
Land clearing, grading, and earth disturbances	and erosion land disturbances. are also established.	grading, disturbances	COMAR 26.09.01 COMAR 26.09.01.04 COMAR 26.09.01.05 COMAR 26.09.01.06 COMAR 26.09.01.07 COMAR 26.09.01.11	Applicable	The interim remedial action will incorporate the standards required for clearing, grading, and other earth disturbances, including compliance with County and Municipal erosion and sediment control ordinances, and the Department's erosion and sedimentation control regulations.

TABLE A-2

Potential State Action-Specific ARARs

NSF-IH Site 28 EE/CA

Indian Head, Maryland

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comments
Oil Pollution and Tank Management					
Disposal of oil or other matter containing oil	containing oil discharged, deposited into, waters of waters within the and all ponds, and public other than those of sanitary sewer).	other oil.	COMAR 26.10.01.02, Annotated Code of Maryland Title 5	Not Applicable	Oil products are not anticipated to be present at Site 28.
Air Quality					
Ambient Air Quality Control	necessary to and property of people of the State.	affect standards.	Annotated Code of Maryland Title 2	Applicable	These regulations are applicable at NSF-IH in connection with activities that move debris, soil, etc.
Air emissions	Ambient Air Quality Standards and Guidelines.	affect standards.	COMAR 26.11.03	Not an ARAR	Interim remedial actions at Site 28 will not be generating these air emissions.
Visible air emissions	Provides Emission Standards for Visible Air Emissions.	visible air emissions.	COMAR 26.11.06.02	Applicable	These regulations are applicable at Site 28 in connection with activities that remove/transport/survey debris and/or excavated materials; disturb the soil during excavation; disturb soil or other exposed surfaces during construction.
Particulate air emissions	Provides General Emission Standards, particulates.	result in the emission of particulates.	COMAR 26.11.06.03	Applicable	These regulations are applicable at Site 28 in connection with activities that remove/transport/survey debris and/or excavated materials; disturb the soil during excavation; disturb soil or other exposed surfaces during construction.
Emissions of Volatile Organic Compounds (VOCs) into the ambient air	for VOCs.	result in the into the discharged pressure pounds absolute.	COMAR 26.11.06.06	Not an ARAR	Interim remedial actions at Site 28 will not be generating these air emissions.
Nuisance Control	Prohibits nuisance or air pollution.	nuisance or air pollution.	COMAR 26.11.06.08	Potentially Applicable	May be applicable for interim remedial actions at Site 28; measures will be implemented

TABLE A-2

Potential State Action-Specific ARARs
 NSF-IH Site 28 EE/CA
 Indian Head, Maryland

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comments
					to mitigate impacts if needed.
Odor Control	May not cause or permit the discharge or a is created.	odors, pollution.	COMAR 26.11.06.09	Not Applicable	Will not be applicable for interim remedial actions at Site 28.
Emissions of Toxic Air Pollutants (TAPs) into the ambient air	emission standards from construction activities, treatment technologies, and vents.		COMAR 26.11.15 COMAR 26.11.15.04 COMAR 26.11.15.05 COMAR 26.11.15.06 COMAR 26.11.15.07 COMAR 26.11.15.08 COMAR 26.11.15.11 COMAR 26.11.15.12 COMAR 26.11.15.13 COMAR 26.11.15.19.02(G)	Not an ARAR	Interim remedial actions at Site 28 will not be generating these air emissions.
Occupational, Industrial, and Residential Hazards					
Action that will generate noise	Limits set on the levels of noise must be met; these limits are protective of the health, welfare, and property of The construction during the day and /b dBA during night.	generate noise.	COMAR 26.02.03.02A (2) and B(2), COMAR 26.02.03.02.03A, Annotated Code of Maryland Title 3	Applicable	During the site work, the maximum allowable noise levels will not be exceeded at Site 28 boundaries.
ARAR - Applicable or relevant and appropriate requirement. TAP - Toxic Air Pollutant. USTs - Underground Storage Tanks. VOCs - Volatile Organic Compounds.					

TABLE A-3 Potential Federal Location-Specific ARARs NSF-IH Site 28 EE/CA Indian Head, Maryland					
Location	Requirement	Prerequisite	Citation	Applicability Determination	Comments
Federal Location-Specific ARARs					
National Archaeological and Historical Preservation Act					
Within area where action may cause irreparable harm, loss, or destruction of significant artifacts.	Construction on previously undisturbed land would require an archaeological survey of the area.	Alteration of terrain that threatens significant scientific, prehistoric, historic, or archaeological data.	Substantive requirements of 36 CFR 65; 16 USC 469	Not applicable	None of the remedial actions being considered for Site 28 include the disturbance of previously undisturbed land.
Federal National Historic Preservation Act, Section 106					
Historic project owned or controlled by federal agency.	Action to preserve historic properties; planning of action to minimize harm to properties listed on or eligible for listing on the National Register of Historic Places.	Property included in or eligible for the National Register of Historic Places.	Substantive Requirements of 36 CFR 800; 16 USC 470	To be considered	An archaeological study/investigation has not been performed at Site 28. If during remedial activities potential artifacts are found, appropriate actions will be taken to preserve these objects and the site. No historic buildings are located at NSF-IH.
Historic Sites, Buildings, and Antiquities Act					
Historic sites	Avoid undesirable impacts on landmarks.	Areas designated as historic sites.	16 USC 461-467; 40 CFR 6.301 (a)	Not applicable	There are no historical structures located on Site 28.
Endangered Species Act of 1973					
Critical habitat upon which endangered species or threatened species depend.	Action to conserve endangered species or threatened species, including consultation with the Department of the Interior. Reasonable mitigation and enhancement measures must be taken, including live propagation, transplantation, and habitat acquisition and improvement.	Determination of effect upon endangered or threatened species or its habitat by conducting biological assessments.	16 USC 1531; 16 USC 1536(a); 50 CFR 81, 225, 402	Not applicable	There are no endangered or rare plant and animal species located at NSF-IH. These regulations are applicable only if the situation changes.
Migratory Bird Treaty Act of 1972					
Migratory bird area	Protects almost all species of native birds in the U.S. from unregulated "take" which can include poisoning at hazardous waste sites.	Presence of migratory birds.	16 USC Section 703	Relevant and Appropriate	Migratory birds are encountered at NSF-IH. These requirements are applicable to any response actions that could result in unregulated "taking" of native birds.
Marine Mammal Protection Act					
Marine mammal area	Protects any marine mammal in the U.S. except as provided by international treaties from unregulated "take."	Presence of marine mammals.	16 USC 1372(2)	Not applicable	Marine mammals will not be encountered along the any waterways at NSF-IH. These requirements would be applicable to response actions that could fatally impact marine mammals.
Wilderness Act					
Wilderness area	Area must be administered in such a manner as will leave it unimpaired as wilderness and preserve its wilderness character.	Federally-owned area designated as wilderness area.	16 USC 1131 et seq.; 50 CFR 35.1 et seq.	Not applicable	No sites at NSF-IH are located in a federally owned wilderness area.
National Wildlife Refuge System					
Wildlife refuge	Only actions allowed under the provisions of 16 USC Section 688 dd(c) may be undertaken in areas that are part of the National Wildlife Refuge System.	Area designated as part of National Wildlife Refuge System.	16 USC 688; 50 CFR 27	Not applicable	Site 28 is not located in or adjacent to an area designated as part of the National Wildlife Refuge System.
Fish and Wildlife Coordination Act, Fish and Wildlife Improvement Act of 1978, Fish and Wildlife Conservation Act of 1980					
Area affecting stream or other water body	Provides protection for actions that would affect streams, wetlands, other water bodies or protected habitats. Any action	Diversion, channeling or other activity that modifies a stream or other water body and affects fish	16 USC 661; 16 USC 662; 16 USC 742a;	Applicable	Response actions at Site 28 will incorporate protection against any area water body, wetlands, or protected habitats.

TABLE A-3

Potential Federal Location-Specific ARARs

NSF-IH Site 28 EE/CA

Indian Head, Maryland

Location	Requirement	Prerequisite	Citation	Applicability Determination	Comments
	taken should protect fish or wildlife.	or wildlife.	16 USC 2901; 50 CFR 83		
Procedures for Implementing the Requirements of the Council on Environmental Quality on the National Environmental Policy Act and Executive Order 11990: Protection of Wetlands					
Wetland	Action to minimize the destruction, loss, or degradation of wetlands. Wetlands of primary ecological significance must not be altered so that ecological systems in the wetlands are unreasonably disturbed.	Wetlands 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	This regulation may be an ARAR for activities occurring in areas that meet the definition of a wetland. Due to the proximity of Mattawoman Creek to Site 28 and the presence of plant life associated with a nontidal wetlands, remedial activities would minimize the destruction, loss, or degradation of the wetlands.
Clean Water Act, Section 404					
Wetland	The degradation Section requires degradation or destruction of wetlands and other aquatic sites be avoided to the extent possible. Dredged or fill material must not be discharged to navigable waters if the activity: contributes to the violation of Maryland water quality standards; CWA Sec. 307; jeopardizes endangered or threatened species; or violates requirements of the Title III of the Marine Protection, Research, and Sanctuaries Act of 1972.	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	This regulation may be an ARAR for activities occurring in areas that meet the definition of a wetland. Due to the proximity of Mattawoman Creek to Site 28 and the presence of plant life associated with a nontidal wetlands, remedial activities would minimize the destruction, loss, or degradation of the wetlands.
Surface Water	Ambient Water Quality Criteria established to protect aquatic life and human consumers of water or aquatic life.	Activities that affect or may affect the surface water onsite	40 CFR 129	Relevant and appropriate	These regulations would be considered during the remedial action plan for Site 28 due to the presence of surface water. All actions will comply with the relevant aspects of this regulation.
Wild and Scenic Rivers Act					
Within area affecting national wild, scenic, or recreational rivers.	Avoid taking or assisting in action that will have direct adverse effect on national, wild, or scenic recreational rivers.	Activities that affect or may affect any of the rivers specified in Section 1276(a).	16 USC 1271 et seq. and Section 7(a); 36 CFR 297; 40 CFR 6.302 (e)	Applicable	There are no national wild, scenic, or recreational rivers located on the NSF-IH facility.
Coastal Zone Management Act					
Within coastal zone	Regulates activities affecting the coastal zone including lands thereunder and adjacent shoreline. The coastal zone is rich in a variety of natural, commercial, recreational, ecological, industrial, and esthetic resources of immediate and potential value to the present and future well-being of the Nation. Must conduct activities in a manner consistent with the approved State management programs.	Activities affecting the coastal zone including lands thereunder and adjacent shoreland.	Section 307(c) of 16 USC 1456(c); 16 USC 1451 et seq.; 15 CFR 930; 15 CFR 923.45	Not applicable	This regulation is not a ARAR for sites at NSF-IH
Coastal Barrier Resources Act, Section 3504					
Within designated coastal barrier	Prohibits any new federal expenditure within the Coastal Barrier Resource System. A coastal barrier is defined as habitats providing habitats for migratory birds and other wildlife, habitats which are essential spawning, nursery, nesting, and feeding areas for commercially and recreationally important species of finfish and shellfish, as well as other aquatic organisms	Activity within the Coastal Barrier Resource System.	16 USC 3504	Not applicable	NSF-IH is not located within a coastal barrier resource system.

TABLE A-3 Potential Federal Location-Specific ARARs NSF-IH Site 28 EE/CA Indian Head, Maryland					
Location	Requirement	Prerequisite	Citation	Applicability Determination	Comments
	such as sea turtles; contain resources of extraordinary scenic, scientific, recreational, natural, historic, archeological, cultural, and economic importance; serve as natural storm protective buffers and are generally unsuitable for development.				
Navigation and Navigable Waters					
Navigable waters	Establishes regulations pertaining to activities that affect the navigation of the waters of the United States.	Activities affecting navigable waters.	33 CFR 320-329	Potentially Applicable	There are rivers classified as navigable at NSF-IH. Measures will be taken to ensure that there is no impact to Mattawoman Creek.
Magnuson Fishery Conservation and Management Act					
Managed Fisheries	Provides for conservation and management of specified fisheries within specified fishery conservation zones (in federal waters).	Presence of managed fisheries in federal waters.	16 USC 1801, et seq.	Not applicable	There are no rivers classified as fisheries at NSF-IH.
Hazardous Waste Control Act (HWCA)					
Within 61 meters (200 feet) of a fault displaced in Holocene time	New treatment, storage or disposal of hazardous waste prohibited.	Resource Conservation and Recovery Act (RCRA) hazardous waste; treatment, storage, or disposal of hazardous waste.	40 CFR 264.18 (a)	Not applicable	No sites at NSF-IH are located near a fault displaced in Holocene time.
Within 100-year floodplain	Facility must be designed, constructed, operated, and maintained to avoid washout.	RCRA hazardous waste; treatment, storage, or disposal of hazardous waste.	40 CFR 264.18 (b)	Applicable	The NSF-IH is on a 100-year flood zone; therefore the requirements of this regulation are applicable. Measures will be taken to comply with applicable regulations.
Within salt dome formation, underground mine, or cave	Placement of non-containerized or bulk liquid hazardous waste prohibited.	RCRA hazardous waste; placement.	40 CFR 264.18 (c)	Not applicable	Placement of hazardous material into any salt dome formation, underground mine, or cave, will not occur during any response action at NSF-IH.
Executive Order 11988, Protection of Floodplains					
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 6, Appendix A; excluding Sections 6(a)(2), 6(a)(4), 6(a)(6); 40 CFR 6.302	Applicable	The NSF-IH is on a 100-year flood zone; therefore the requirements of this regulation are applicable. Measures will be taken to comply with applicable regulations.
Rivers and Harbors Act of 1972					
Navigable waters	Permits are required for structures or work affecting navigable waters.	Activities affecting navigable waters.	33 USC 403	Potentially Applicable	There are rivers classified as navigable at NSF-IH. Measures will be taken to ensure that there is no impact to Mattawoman Creek.
ARARs - Applicable or relevant and appropriate requirements. RCRA - Resource Conservation and Recovery Act. CFR - Code of Federal Regulations. CWA- Clean Water Act. DON - Department of Navy. EO - Executive Order.		FR - Federal Register. HWCA - Hazardous Waste Control Act. NAS - Naval Air Station. USC - United States Code. TBC - To Be Considered.			

TABLE A-4 Potential State Location-Specific ARARs NSF-IH Site 28 EE/CA Indian Head, Maryland					
Location	Requirement	Prerequisite	Citation	Applicability Determination	Comments
State Location-Specific ARARs					
Threatened and Endangered Species					
Critical habitat upon which endangered species or threatened species depend.	Requires action to conserve endangered or threatened fish species and the critical habitats they depend on. May not reduce the likelihood of either the survival or recovery of a listed species in the wild by reducing the reproduction, numbers or distribution of a listed species or otherwise adversely affect the species.	Determination of effect upon endangered or threatened species or its habitat.	COMAR 08.03.08	Relevant and Appropriate	There are no endangered or rare plant and animal species located at NSF-IH. However, 3 species of plant are on the Maryland State watchlist: Honeyvine, Lancaster's sedge, and Stellate sedge are present at NSF-IH though these do not meet the criteria of the Endangered Species Act. Appropriate measures will be taken to try to preserve these species.
Threatened and Endangered Fish Species					
Critical habitat upon which endangered or threatened fish species depend.	Requires action to conserve endangered or threatened fish species and the critical habitats they depend on.	Determination of effect upon endangered or threatened fish species or its habitat.	COMAR 08.02.12	Not applicable	There are no endangered or threatened fish species at NSF-IH.
Fish and Fisheries					
Fisheries, locations where species of fish exist	Requirements to conserve species of fish for human enjoyment, for scientific purposes and to ensure their perpetuation as viable components of their ecosystems.	Determination of effect upon fish species or its habitat.	Annotated Code of Maryland, <i>Natural Resource Article</i> , Title 4 - Fish and Fisheries	Not applicable	There are no fish species at NSF-IH.
Wildlife					
Areas inhabited by wildlife	Requirements to conserve species of wildlife for human enjoyment, for scientific purposes and to ensure their perpetuation as viable components of their ecosystems.	Determination of effect upon wildlife species or its habitat.	Annotated Code of Maryland, <i>Natural Resource Article</i> , Title 10 - Wildlife	Applicable	Wildlife species are present on the NSF-IH site. If response actions may affect these species, the requirements of this title are applicable.
Chesapeake Bay Critical Protection Law					
Area 1,000 feet landward from tidal waters of the Chesapeake Bay and its tributaries and land under these waters	Minimize impacts of the Bay water quality and to conserve plant, fish, and wildlife habitat.	Activities that will occur in the area 1,000 feet landward from tidal waters of the Chesapeake Bay and its tributaries and land under these waters.	Annotated Code of Maryland, <i>Natural Resource Article</i> , Title 8 - Waters, Subtitle 18 - Chesapeake Bay Area Critical Protection Program	Not applicable	NSF-IH does not meet the necessary geographic requirements.
Nontidal Wetlands Protection Act, Maryland Nontidal Wetlands Regulations					
Wetland	Provides regulations for activities on or near nontidal wetlands (an area that is inundated or saturated by surface water or ground water at a frequency and duration sufficient to support, and that under normal circumstances does support, a prevalence of vegetation typically adapted for life in saturated soil conditions). Must obtain a permit from the State in order to conduct certain regulated activities in a nontidal wetland, or within a buffer or an expanded buffer.	Activities that will occur on or near nontidal wetlands.	COMAR 26.23; Annotated Code of Maryland, <i>Environmental Article</i> , Title 5 - Water Resources	Relevant and Appropriate	This regulation may be an ARAR for activities occurring in areas that meet the definition of a wetland. Due to the proximity of Mattawoman Creek to Site 28 and the presence of plant life associated with a nontidal wetland, remedial activities would minimize the destruction, loss, or degradation of the wetlands.
Maryland Wetland Law, Wetlands/Tidal Wetlands Regulations					
Tidal Wetland	Tidal wetlands are State and private tidal wetlands, marshes, submerged aquatic vegetation, lands, and open water affected by the daily and periodic rise and fall of the tide within the Chesapeake Bay and its tributaries, the coastal bays adjacent to Maryland's coastal barrier islands, and the Atlantic Ocean to a distance of 3	Activities that will alter tidal wetlands.	COMAR 26.24; Annotated Code of Maryland, <i>Environmental Article</i> , Title 5 - Water Resources; Annotated Code of Maryland,	Applicable	Wetlands (tidal and nontidal) are present at Site 28. The requirements of this title are applicable for any response actions that may affect the integrity of these wetlands.

TABLE A-4 Potential State Location-Specific ARARs NSF-IH Site 28 EE/CA Indian Head, Maryland					
Location	Requirement	Prerequisite	Citation	Applicability Determination	Comments
	miles offshore of the low water mark. Provides that activities such as dredging, filling, removing, constructing, reconstruction, or activities otherwise altering tidal wetlands must be permitted by the State.		<i>Environmental Article</i> , Title 16 - Wetlands and Riparian Rights		
Wetlands and Riparian Rights					
Wetlands	Requirements to preserve wetlands and prevent their destruction requires a license for dredging or filling of wetlands.	Activities that can affect the integrity of wetlands, such as dredging or filling.	Annotated Code of Maryland, <i>Environmental Article</i> , Title 16 - Wetlands and Riparian Rights	Relevant and Appropriate	This regulation may be an ARAR for activities occurring in areas that meet the definition of a wetland at Site 28.
Construction on Nontidal Waters and Floodplains					
Nontidal waters and floodplains	Protect and maintain nontidal waterways and/or state of Maryland floodplains must follow these regulations	Activities that affect nontidal waterways and floodplains	COMAR 08.05.03	Applicable	Any remedial actions involving alteration to Mattawoman Creek or floodplains (including temporary construction) are subject to these requirements. Appropriate actions will be taken to comply.
Maryland Water Pollution Control Regulations					
Surface waters of the State	Protect and maintain the quality of surface water in the State of Maryland. Criteria and standards for discharges limitations and policy for anti-degradation of the State's limitations and policy for anti-degradation of the State's surface water.	Activities that will pollute the surface waters of the state.	COMAR 26.08, Chapters 01-07	Applicable	This regulation is applicable for remedial actions that may affect surface water quality in the State of Maryland. Actions will be taken to mitigate the effect of the remedial action upon surface waters at NSF-IH (i.e. erosion control measures).
Water Management					
Water resources of the State	Provides for the conservation and protection of the water resources of the State by requiring that any land-clearing, grading, or other earth disturbances require an erosion and sediment control plan. Also provides that stormwater must be managed to prevent off-site sedimentation and maintain current site conditions.	Activities that affect the water resources of the State.	COMAR 26.17.01 COMAR 26.17.02. Annotated Code of Maryland, <i>Environment Article</i> , Title 4 - Water Management	Applicable	The design for the remedial actions will incorporate the requirements of this regulation.
ARARs - Applicable or relevant and appropriate requirements. RCRA - Resource Conservation and Recovery Act. CFR - Code of Federal Regulations. CWA - Clean Water Act. DON - Department of Navy. EO - Executive Order.		FR - Federal Register. HWCA - Hazardous Waste Control Act. NAS - Naval Air Station. USC - United States Code. TBC - To Be Considered.			

Appendix B
Development of PRGs

Development of PRGs, Distribution of COCs, and Evaluation of Soil Characteristics - Site 28, NSF-IH

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COPIES: Margaret Kasim/WDC
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DATE: June 22, 2005

This memorandum describes the development of action levels and preliminary remedial goals (PRGs), the spatial distribution of ecological chemicals of concern (COCs), and the soil characteristics at Site 28, NDWIH. This information was prepared in support of the engineering evaluation and cost analysis (EE/CA) for Site 28. Human health and ecological risks associated with elevated metal concentrations in the soil at Site 28 have been identified. A soil removal action is planned to mitigate human health risk from lead in surface and subsurface soil and to mitigate ecological risk from various inorganic COCs in the surface soil.

A soil removal action was proposed for areas identified by the human health risk analysis as discrete elevated lead locations. The current average site-wide lead concentration is below the USEPA residential child soil screening value of 400 milligrams per kilogram (mg/kg) (OSWER Directive 9355.4-12, issued on July 14, 1994). However, additional risk assessment was performed in response to EPA's comment on the Draft Final RI Report. The proposed soil removal for human health-associated risk would be to remove soil with lead concentrations greater than 1,000 mg/kg, excavating to a depth of 1 to 5 feet below ground surface or to the water table, whichever is encountered first.

The proposed removal area was expanded to include areas of the site that pose potential risks to ecological receptors based on PRGs developed from the soil bioassay work at Site 47 (Figure 1). The expanded soil removal would allow surface soil and the swales to be removed from consideration in the baseline ecological risk assessment (BERA) for the site, which would subsequently focus on the groundwater-to-surface water pathway and sediments in Mattawoman Creek. This approach was presented to the Indian Head Installation Restoration Team (IHIRT) at the March 30, 2005 Partnering Meeting. The consensus of the team was to proceed with this approach pending EPA consultation with the Region 3 Biological Technical Assistance Group (BTAG) to confirm the acceptability of the approach. EPA and BTAG agreed with the approach, but requested that an analysis showing that Site 47 soil is comparable to Site 28 soils and the distribution of COCs above the action levels be presented in the EE/CA so that potential hotspots could be evaluated.

Derivation of PRGs

Antimony, cadmium, copper, lead, mercury, nickel, silver, and zinc were identified as potential risk-driving COCs in surface soil for soil invertebrates and plants. Of these metals,

cadmium, lead, mercury, and zinc were also identified as COCs for upper trophic-level receptors. Although not identified as COCs for soil invertebrates or plants, arsenic and selenium were identified as COCs for upper trophic level receptors.

To derive action levels for the direct contact COCs, the maximum concentration of each metal in the soil samples submitted for toxicity testing for the Site 47 BERA (CH2M HILL, 2005) were selected to represent the action levels (Table 1). No adverse effects (survival or growth) were observed in any of the bioassay samples from Site 47 (28-day tests with the earthworm *Eisenia foetida*).

TABLE 1.
Ecological Action Levels Proposed for Site 28 Surface Soil

COC	Action Levels (mg/kg)
Antimony	1.1
Cadmium	1.4
Copper	40.6
Lead	583
Mercury	3.0
Nickel	16.8
Silver	425
Zinc	219

Spatial Distribution of COCs

The concentrations of COCs in most of the samples within the proposed soil removal area, which comprises most of Zone A (Figure 1), exceed the Action Levels for at least one or more of the COCs (Table 2). Only a few of the samples outside of the proposed removal area contain COC concentrations higher than the Action Levels (Figure 2 and Table 3). The post-removal COCs concentrations, or PRGs (assuming backfill with soil containing the metals at background concentrations), are all below the proposed Action Levels (Table 4).

TABLE 4.
Average pre- and post-removal COC concentrations in Surface Soil at Site 28

COC	Action Level (mg/kg)	Pre-removal Concentration (mg/kg)	PRG (mg/kg)
Antimony	1.1	1.7	0.4
Cadmium	1.4	15.7	0.8
Copper	40.6	119	10
Lead	583	794	30
Mercury	3.0	0.6	0.1
Nickel	16.8	10.6	7.1
Silver	425	1.7	0.9

TABLE 4.
Average pre- and post-removal COC concentrations in Surface Soil at Site 28

COC	Action Level (mg/kg)	Pre-removal Concentration (mg/kg)	PRG (mg/kg)
Zinc	219	9,594	121

The post-removal average COCs concentrations, or PRGs, would no longer pose a risk to upper trophic level receptors. Tables 5 and 6 show the pre- and post-removal risk estimates for the most at risk (based on SERA results) mammalian and avian receptors, respectively. The post-removal concentrations of all the COCs, with the exception of arsenic, would result in a no observed adverse effect level (NOAEL) based hazard quotient (HQ) for all receptors of less than one. The NOAEL-based HQ for short-tailed shrew exposure to arsenic would be 4.5. However, the lowest observed adverse effect level (LOAEL) based HQ for short-tailed shrew would be less than one (Table 5).

TABLE 5.
Hazard Quotients for Most Sensitive Mammal Species Evaluated (Short-tailed Shrew)

COC	NOAEL Hazard Quotient		LOAEL Hazard Quotient	
	Pre-removal	Post-removal	Pre-removal	Post-removal
Arsenic	12	4.5	2	0.90
Cadmium	11	0.4	2	0.04
Lead	4	0.1	0.4	0.01
Mercury	2	0.02	0.4	0.06
Selenium	1.4	0.3	0.8	0.15
Zinc	17	0.2	8	0.08

TABLE 6.
Hazard Quotients for Most Sensitive Avian Species Evaluated (Eastern Screech Owl)

COC	NOAEL Hazard Quotient		LOAEL Hazard Quotient	
	Pre-removal	Post-removal	Pre-removal	Post-removal
Arsenic	0.4	0.2	0.1	0.05
Cadmium	4	0.2	0.3	0.01
Lead	4	0.1	0.8	0.03
Mercury	0.1	<0.01	0.02	<0.01
Selenium	0.3	0.1	0.3	0.02
Zinc	103	1.0	11	0.11

Comparison of Soil Characteristics between Sites 28 and 47

The soil characteristics for Site 47 and Site 28 are shown in Tables 7 and 8, respectively. The grain size distribution of the soils at the two sites is similar, with the soil at both sites characterized by mostly fine sand, silt, and clay, although the soil at Site 28 contains about 10 percent more silt and clay than does the soil at Site 47. The soil at Site 28 also generally contains more total organic carbon (TOC) and is more neutral in pH than is the soil at Site 47. The lower pH and TOC content of the soils at Site 47 would suggest increased bioavailability of metals. Since no adverse effects were found at the proposed PRG concentrations (based on bioassay results from Site 47), the bioavailability of metals in soil at Site 28 should be similar or lower than in the soil at Site 47. Therefore, the use of the Site 47 bioassay results to guide the soil removal at Site 28 should be adequately protective of the soil invertebrate community.

TABLE 7.
Grain Size, TOC, and pH data for Site 47 Surface Soil Samples

Sample	% Silt and Clay	% Fine Sand	% Medium Sand	% Coarse Sand	% Gravel	TOC (mg/kg)	pH
IS47SATX08	35	23	42	<1	0	17,000	4.6
IS47SDTX01	72	15	10	1.5	1.5	43,000	5.7
IS47SDTX02	34	26	37	1	2	2,300	5.9
IS47SDTX04	38	23	36	1	2	17,000	4.4
IS47SSTX02	27	25	45	2	1	7,300	5.9
IS47SSTX04	12	27	47	4	10	3,900	7.1
IS47SSTX06	17	32	47	2	2	13,000	5.7
IS47SSTX10	1	18	33	41	7	13,000	6.1
IS47SSTX12	19	35	42	3	1	6,500	4.9
IS47SSTX14	80	14	5	1	0	25,000	6.1
Average	34	24	34	6	3	14,800	5.6

TABLE 8.
Grain Size, TOC, and pH data for Site 28 Surface Soil Samples (Zone A)

Sample	% Silt and Clay	% Fine Sand	% Medium Sand	% Coarse Sand	% Gravel	TOC (mg/kg)	pH
IS28SS01-0001*	29	30	13	14	14	32,000	5.9
IS28SS02-0001	59	29	4	3	5	9,600	6.7
IS28SS03-0001	59	25	9	7	0	34,000	7.8
IS28SS05-0001	48	38	8	6	0	2,800	10
IS28SS06-0001	51	29	7	10	3	13,000	7.5
IS28SS07-0001	74	19	5	2	0	17,000	6.9
IS28SS08-0001	36	32	14	11	7	22,000	7.1
IS28SS09-0001	28	17	21	17	17	5,800	7.6
IS28SS10-0001	52	23	19	6	0	62,000	7.5
IS28SS11-0001	27	32	16	23	2	15,000	7.2
IS28SS13-0001	52	25	15	6	2	69,000	7.8
IS28SS14-0001	23	36	13	15	13	16,000	7.4
IS28SS15-0001	43	33	11	13	0	26,000	6.5
IS28SS16-0001*	35	29	13	14	9	28,000	6.6
IS28SS17-0001	40	16	8	10	26	17,000	7.4
IS28SS18-0001	30	34	16	20	0	19,000	6.4
IS28SS19-0001	34	20	12	19	15	72,000	7.4
IS28SS22-0001	68	26	3	3	0	7,200	5.9
IS28SS23-0001	54	27	9	10	0	39,000	6.9
IS28SS24-0001	42	27	9	19	3	29,000	5.5
IS28SS27-0001	35	50	6	5	4	17,000	5
IS28SS42-0001	33	26	13	19	9	49,000	6.8
Average	43	28	11	11	6	27,336	7.0

Station ID	Action	IS28MM02		IS28MM03		MM42		IS28SO04				IS28SO08	
Sample Date	Level	05/12/03		05/12/03		4/03		05/20/03		05/20/03		05/13/03	
Inorganics (mg/kg)													
Antimony	1.1	0.56	B	0.37	B	2.00	J	5.30	B	3.90	J	0.86	J
Arsenic	328	117		40		35	L	377	L	213	L	99	L
Cadmium	1.4	1.00	K	1.30	K	45.00		1.20	K	0.96	J	80.00	
Copper	40.6	5.30	K	28.00		370.00		14.10		13.70		460.00	
Lead	583	31.2		41.4		2800.0		160.0	K	115.0	K	3540.0	J
Mercury	3	0.080	B	0.060	B	1.100		0.090	B	0.090	B	0.310	
Nickel	16.8	7.70	K	8.00	J	39.40		4.80	J	2.90	J	14.80	K
Selenium	1.8	0.46	B	0.73	B	0.33	J	0.61	B	0.44	U	0.44	U
Silver	425	0.70	B	4.70	B	0.94	J	1.11	U	1.00	U	1.70	J
Zinc	219	193		506		20,900		358		319		71,900	L
Shaded cells exceed Action Level.													

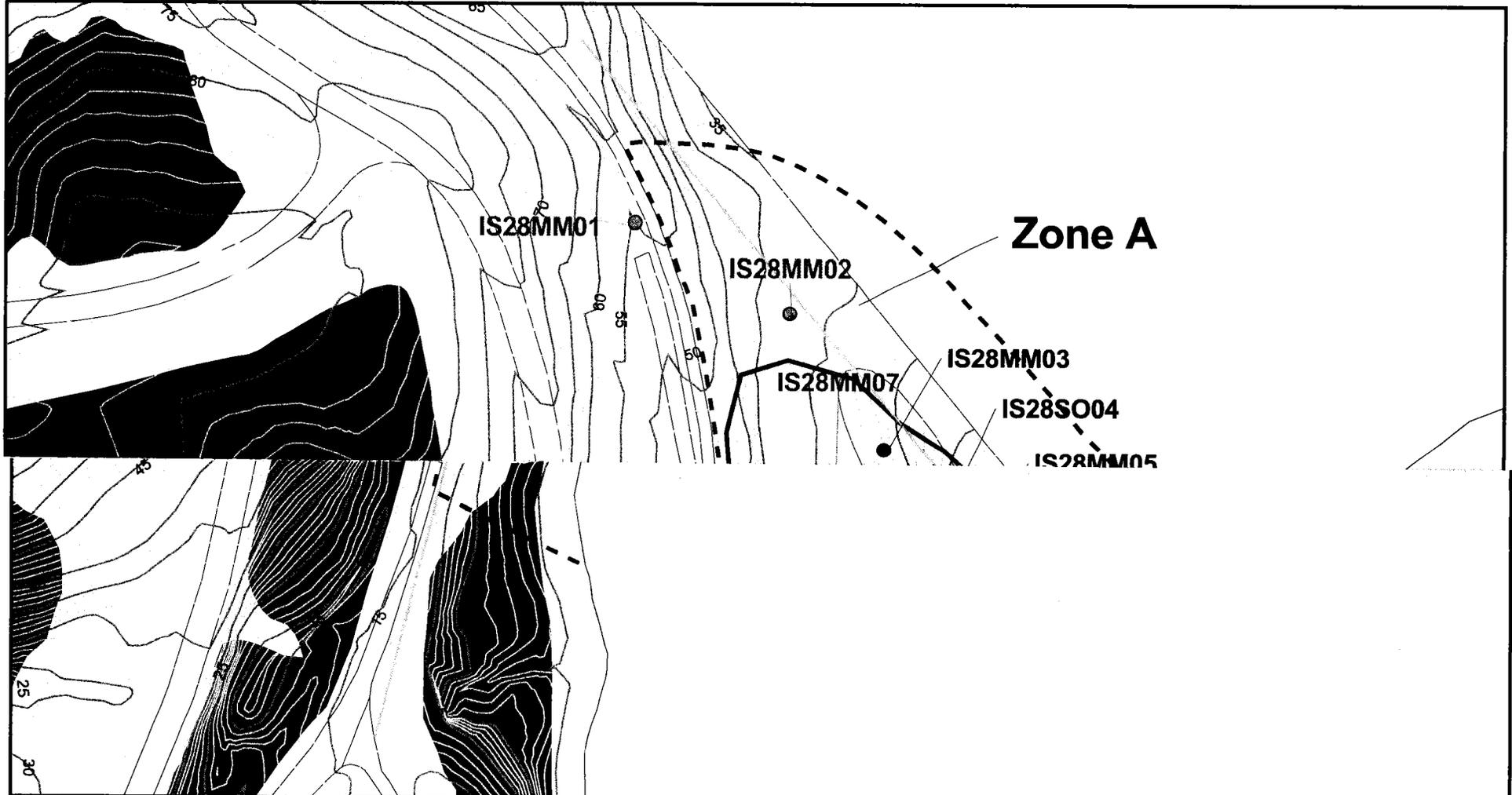
NA - Not analyzed
 B - Blank contamination
 J - Estimated
 K - Biased high
 L - Biased low

Station ID	Action	IS28SO09		IS28SO10	IS28SO24		IS28SO26		IS28SO27		IS28SO29	
Sample Date	Level	05/12/03		05/13/03	05/14/03		05/19/03		05/16/03		05/19/03	
Inorganics (mg/kg)												
Antimony	1.1	0.26	R	0.67	0.19	R	0.28	R	0.34	B	0.84	B
Arsenic	328	25		18	51	L	7	L	141		210	L
Cadmium	1.4	26.50		31.80	0.53	U	2.80		2.50		1.40	K
Copper	40.6	24.80		155.00	8.20		7.60	K	11.20	K	10.40	
Lead	583	526.0		1180.0	17.6		72.8	K	135.0		56.2	K
Mercury	3	0.120	K	1.300	0.060	B	0.060	B	0.080	B	0.090	B
Nickel	16.8	5.70	J	20.60	4.40	J	2.44	U	6.30	B	3.20	J
Selenium	1.8	0.79	B	1.30	0.74	K	0.45	B	0.52	U	0.56	B
Silver	425	0.93	U	16.10	1.00	J	1.00	U	1.19	U	0.92	U
Zinc	219	21,600		13,400	59		1,080		585		284	
Shaded cells exceed Action Level.												

NA - Not analyzed
 B - Blank contamination
 J - Estimated
 K - Biased high
 L - Biased low

Station ID	8SO41	
Sample Date	/19/03	
Inorganics (mg/l)		
Antimony	0.51	R
Arsenic	67	L
Cadmium	1.41	U
Copper	28.80	
Lead	65.3	
Mercury	0.160	B
Nickel	19.00	K
Selenium	0.81	U
Silver	1.84	U
Zinc	647	
Shaded cells exc		

NA - Not analyzed
 B - Blank contamination
 J - Estimated
 K - Biased high
 L - Biased low



LEGEND

- Sample Stations Included in Potential Soil Removal Area
- Sample Stations Not Included in Potential Soil Removal Area
- Soil Removal Based on Potential Ecological Risk
- ▨ Soil/Sediment Removal Based on Potential Ecological Risk (BERA results)
- Soil Removal Based on Potential Human Health Risk
- ⚡ Zone Boundary
- ⚡ Fence Line
- IR Site
- Buildings
- ⚡ Railroads
- Roads
- ⚡ Five foot Contours
- ⚡ One Foot Contours

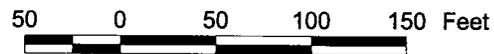
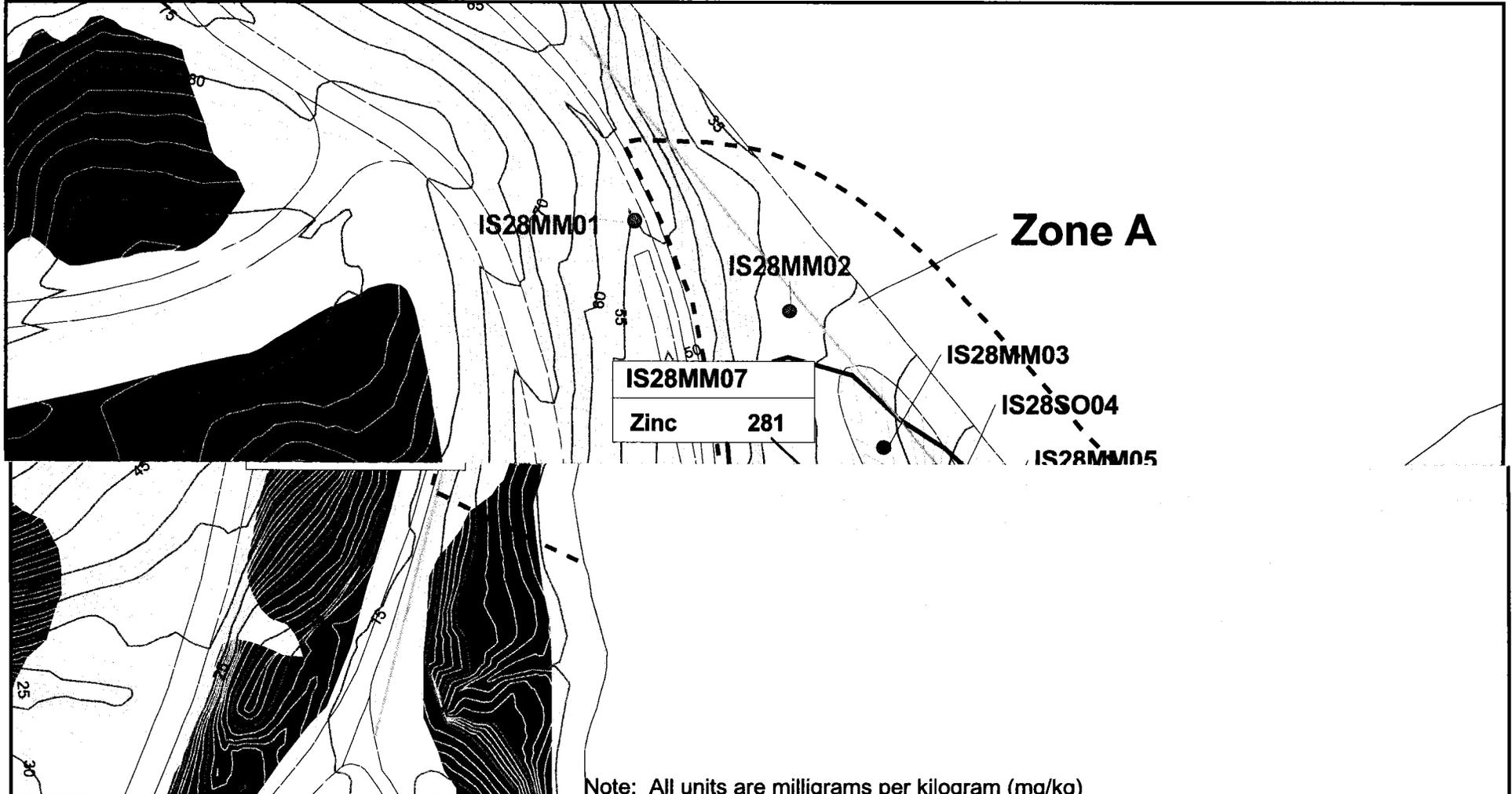


Figure 1
 Area of Potential Soil Removal
 Site 28
 NSF-IH, Indian Head, Maryland

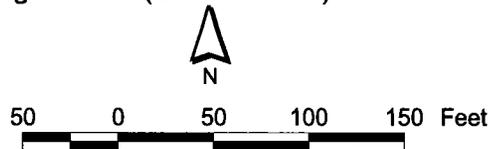


Note: All units are milligrams per kilogram (mg/kg)

LEGEND

- Sample Stations Included in Potential Soil Removal Area
- Sample Stations Not Included in Potential Soil Removal Area
- Soil/Sediment Removal Based on Ecological Risk on Potential Ecological Risk (BERA results)
- Soil Removal Based on Potential Ecological Risk
- Soil Removal Based on Potential Human Health Risk
- - - Zone Boundary
- - - Fence Line
- IR Site
- Buildings
- ≡ Railroads
- Roads
- ∧ Five foot Contours
- ∧ One Foot Contours

Figure 2
 Distribution of COCs that Exceed Action Levels
 Outside the Removal Area
 Site 28
 NSF-IH Indian Head, Maryland



Appendix C
Detailed Cost Estimates for Removal
Alternatives

Alternative: Alternative 2: Soil Removal for Human Health and Ecological Risks		COST ESTIMATE SUMMARY			
Location: Site 28 EE/CA NSF-IH, Indian Head, Maryland		Description: Engineers estimate of cost to excavate and dispose of soil in areas of potentially unacceptable human health and ecological risks			
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES
PROJECT SETUP AND CONTROL					
Field project manager	150	hr	\$ 55.00	\$ 8,250	3 weeks, 10hr/day
Construction superintendent	150	hr	\$ 55.00	\$ 8,250	3 weeks, 10hr/day
Health and safety officer	150	hr	\$ 40.00	\$ 6,000	3 weeks, 10hr/day
Field technician-sampling	100	hr	\$ 146.60	\$ 14,660	2 weeks, 10hr/day; unit cost includes daily sampling, decontamination, and health & safety expendables
Mobilize/demobilize crew, 100 mi, per person	8	ea	\$ 102.64	\$ 821	33 01 0204; mob/demob are separate; 4 crew members
MOBILIZATION AND PREPARATORY WORK					
Equipment mobilization/demobilization, above 150 HP	8	ea	\$ 819.95	\$ 6,560	02305 250 0100; Backhoe, bull dozer, front end loader, vibrating screen unit; mob/demob are separate
Temporary storage trailer	1	ea	\$ 984.19	\$ 984	01520 500 1350; vendor quote (Williams Scotsman); includes mob/demob and one month rental
Temporary decontamination trailer	1	ea	\$ 984.19	\$ 984	01520 500 1350; vendor quote (Williams Scotsman); includes mob/demob and one month rental
Construction survey	5	day	\$ 1,036.00	\$ 5,180	Navy CLEAN average surveyor BOA rates for MD/DC/eastern VA; includes mob/demob, onsite 2-man crew, and report preparation
Install silt fence	500	lf	\$ 2.63	\$ 1,315	18 05 0206
EXCAVATION					
Clear, Grub, Chip Brush & Trees (Level D)	1.47	ac	\$ 6,321.69	\$ 9,293	17 01 0106; entire site
Building 415 foundation demolition, 6" concrete slab on grade (Level D)	168	sf	\$ 7.74	\$ 1,300	02220 130 0400; assumes half of Building 415 area needs to be removed
Excavation, bulk, dozer, open site, 300 HP, 50' haul clay (Level D)	2419	cy	\$ 3.20	\$ 7,741	2315 432 5040; assumes entire HH risk area and 1/2 eco risk area to be excavated
Confirmation sampling (lead)	10	ea	\$ 49.14	\$ 491	Navy CLEAN average lab BOA rates for MD/DC/eastern VA; 1d TAT @ 100% mark up--human health risk area;
Confirmation sampling (metals)	20	ea	\$ 220.00	\$ 4,400	Navy CLEAN average lab BOA rates for MD/DC/eastern VA; 1d TAT @ 100% mark up--ecological risk area
Sample shipping, 90 lbs	10	ea	\$ 105.00	\$ 1,050	Navy CLEAN BOA rates: cooler shipment to laboratory
Dewatering of excavated material	86	cy	\$ 15.00	\$ 1,290	Professional judgement: similar project (Fox River Remediation; includes labor, equipment, materials); for additional sediment area
STOCKPILING AND SOIL DISPOSAL					
HDPE, 30 mil, sheeting for liner and cover	6000	sf	\$ 1.69	\$ 10,140	33 08 0571
Staked hay bales for berm	50	lf	\$ 2.65	\$ 133	02370 700 1250
Stockpile sample testing (TCLP metals, RC1)	1	ea	\$ 184.05	\$ 184	Navy CLEAN average lab BOA rates for MD/DC/eastern VA
Sample shipping, 90 lbs	1	ea	\$ 105.00	\$ 105	Navy CLEAN BOA rates: cooler shipment to laboratory; includes shipment of decon, site restoration samples
Mobilization/demobilization for waste pickup	1	ea	\$ 325.00	\$ 325	Vendor (Capitol Environmental; Navy CLEAN BOA rate for MD/DC/eastern VA)
Bulk soil loading into dump truck	2419	cy	\$ 4.37	\$ 10,571	33 19 0150
Manifesting, transport, and disposal of non-hazardous soil to offsite landfill	3788	ton	\$ 90.00	\$ 340,920	Vendor (Capitol Environmental; Navy CLEAN BOA rate for MD/DC/eastern VA)
DECONTAMINATION					
Temporary equipment decontamination pad	1	ea	\$ 400.00	\$ 400	Navy CLEAN BOA rates for MD/DC/eastern VA
Steam cleaner	1	mo	\$ 1,658.44	\$ 1,658	33 17 0819
Mobilization/Demobilization/Cleaning of Tank (3,000 to 7,000 capacity tanks)	1	ls	\$ 2,700.00	\$ 2,700	Vendor (Capitol Environmental; Navy CLEAN BOA rate for MD/DC/eastern VA)
3000 gal decon water storage tank	4	wk	\$ 210.00	\$ 840	Vendor (Capitol Environmental; Navy CLEAN BOA rate for MD/DC/eastern VA)
Decon water	3000	gal	\$ 0.05	\$ 150	Navy CLEAN BOA rates for MD/DC/eastern VA
Spent decon water storage tank	12	wk	\$ 210.00	\$ 2,520	Navy CLEAN BOA rates for MD/DC/eastern VA; storage between sampling and removal from site

Alternative: **Alternative 2: Soil Removal for Human Health and Ecological Risks** **COST ESTIMATE SUMMARY**
 Location: **Site 28 EE/CA**
NSF-IH, Indian Head, Maryland

Description: Engineers estimate of cost to excavate and dispose of soil in areas of potentially unacceptable human health and ecological risks

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES
Decon water testing (TCLP metals, RCI)	1	ea	\$ 169.32	\$ 169	Navy CLEAN average lab BOA rates for MD/DC/eastern VA
Decon water disposal	3000	gal	\$ 0.85	\$ 2,550	Vendor (Capitol Environmental); Navy CLEAN BOA rate for MD/DC/eastern VA
SITE RESTORATION					
Confirm imported material meets clean soil criteria	2	ea	\$110.00	\$ 220	Navy CLEAN average lab BOA rates for MD/DC/eastern VA (TCL Metals, standard TAT)
Standard proctor compaction test for backfill soil	2	ea	\$179.04	\$ 358	
Purchase, Import, Place and Compact Clay Backfill from Off-Site Source to Backfill Excavation	2419	cy	\$18.29	\$ 44,244	
Purchase, Import, Place and Compact Clay Backfill from Off-Site Source for Achieving 6:1 Slope	3562	cy	\$18.29	\$ 65,149	Assumes average of 1.5' of fill material needed across site
Borrow, loading, and spreading - top soil, shovel, 1CY bucket (6" thick)	1187	cy	\$26.81	\$ 31,828	02055 150 0800; 6" of topsoil across site
Finish Grading Slopes	7123	sy	\$0.23	\$ 1,638	02310 100 3300; entire site
Hydroseeding	48	m.sf	\$52.35	\$ 2,513	02920 320 2400; 75% of site
Planting of native wetland species	0.37	ac	\$25,000.00	\$ 9,250	Professional judgement: similar project (Norfolk Naval Shipyard Site 2); includes labor and materials; 25% of site
Straw Mulch, hand spread 1" deep	7123	sy	\$0.91	\$ 6,482	02910 500 0600; entire site
Remove silt fence	500	lf	\$2.63	\$ 1,315	18 05 0206
MEC POST-EXCAVATION SUPPORT					
UXO Tech mob/demob	1	ea	\$ 750.00	\$ 750	Vendor (USA Environmental; Navy CLEAN BOA rates for MD/DC/eastern VA)
UXO Tech II (vibrating screen operator)	15	day	\$ 490.00	\$ 7,350	Vendor (USA Environmental; Navy CLEAN BOA rates for MD/DC/eastern VA)
Vibrating screening unit	1	ea	\$ 22,548.48	\$ 22,548	33 18 8601; 1 month rental
LAND USE CONTROLS					
Establish groundwater LUCs and incorporate them to the Base Master Plan	1	LS	\$ 5,000.00	\$ 5,000	Professional judgement: similar Navy projects
Subtotal				\$ 650,580	
Contingency (10% scope, 15% bid)	25%			\$162,645	
Project Management	6%			\$39,035	
Remedial Design	12%			\$78,070	
Construction Management	8%			\$52,046	
TOTAL COST					
Removal with Stockpiling				\$982,376	
Upper Limit of Cost Accuracy	150%			\$1,473,564	
Lower Limit of Cost Accuracy	70%			\$687,663	

SOURCE INFORMATION

1. R.S. Means Company. 2004. Environmental Remediation Cost Data - Unit Price, 10th Edition. R.S. Means Company and Talisman Partners, Ltd. Kingston, MA.
2. R.S. Means Company. 2004. Site Work and Landscape Cost Data - Unit Price, 23rd Edition. R.S. Means Company and Talisman Partners, Ltd. Kingston, MA.
3. United States Environmental Protection Agency. July 2000. A Guide to Preparing and Documenting Cost Estimates During the Feasibility Study. EPA 540-R-00-002. (USEPA, 2000).

Alternative: Alternative 3: Soil Removal for Human Health Risks and In Situ Treatment for Ecological Risks		COST ESTIMATE SUMMARY				
Location: Site 28 EE/CA NSF-IH, Indian Head, Maryland		Description: Engineers estimate of cost to excavate and dispose of soil in areas of potentially unacceptable human health risk and in situ treatment of soil in areas of potentially unacceptable ecological risk				
DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES	
PROJECT SETUP AND CONTROL						
Field project manager	200	hr	\$ 55.00	\$ 11,000	4 weeks, 10hr/day	
Construction superintendent	200	hr	\$ 55.00	\$ 11,000	4 weeks, 10hr/day	
Health and safety officer	200	hr	\$ 40.00	\$ 8,000	4 weeks, 10hr/day	
					1 week, 10hr/day; unit cost includes daily sampling, decontamination, and health & safety	
Field technician-Sampling	50	hr	\$ 146.60	\$ 7,330	expendables	
Field technician-Soil Amendment	150	hr	\$ 80.00	\$ 12,000	3 weeks, 10hr/day	
					33 01 0204; mob/demob are separate; 5 crew members	
Mobilize/demobilize crew, 100 mi, per person	10	ea	\$ 102.64	\$ 1,026		
MOBILIZATION AND PREPARATORY WORK						
Equipment mobilization/demobilization, above 150 HP	8	ea	\$ 819.95	\$ 6,560	02305 250 0100; Backhoe, bull dozer, front end loader, vibrating screen unit; mob/demob are separate	
Small equipment mobilization/demobilization, on flatbed trailer behind pickup truck	2	ea	\$ 216.74	\$ 433	02305 250 1150; Tiller; mob/demob are separate	
Temporary storage trailer	1	ea	\$ 984.19	\$ 984	01520 500 1350; vendor quote (Williams Scotsman); mob/demob plus one month rental	
Temporary decontamination trailer	1	ea	\$ 984.19	\$ 984	01520 500 1350; vendor quote (Williams Scotsman); mob/demob plus one month rental	
Construction survey	5	day	\$ 1,036.00	\$ 5,180	Navy CLEAN average surveyor BOA rates for MD/DC/eastern VA; includes mob/demob, 2-man crew, and report preparation	
Install silt fence	500	lf	\$ 2.63	\$ 1,315	18 05 0206	
EXCAVATION (HUMAN HEALTH RISK)						
Clear, Grub, Chip Brush & Trees (Level D)	1.47	ac	\$ 6,321.69	\$ 9,293	17 01 0106; entire site	
Building 415 foundation demolition, 6" concrete slab on grade (Level D)	168	sf	\$ 7.74	\$ 1,300	02220 130 0400; assumes half of Building 415 area needs to be removed	
Excavation, bulk, dozer, open site, 300 HP, 50' haul clay (Level D)	1642	cy	\$ 3.20	\$ 5,254	2315 432 5040; assumes HH risk area to be excavated	
Confirmation sampling (lead)	10	ea	\$ 49.14	\$ 491	Navy CLEAN average lab BOA rates for MD/DC/eastern VA; 1d TAT @ 100% mark up-- human health risk area	
Sample shipping, 90 lbs	3	ea	\$ 105.00	\$ 315	Navy CLEAN BOA rates: cooler shipment to laboratory	
STOCKPILING AND SOIL DISPOSAL						
HDPE, 30 mil, sheeting for liner and cover	6000	sf	\$ 1.69	\$ 10,140	33 08 0571	
Staked hay bales for berm	50	lf	\$ 2.65	\$ 133	02370 700 1250	
Stockpile sample testing (TCLP metals, RCI)	1	ea	\$ 184.05	\$ 184	Navy CLEAN average lab BOA rates for MD/DC/eastern VA	
Sample shipping, 90 lbs	1	ea	\$ 105.00	\$ 105	Navy CLEAN BOA rates: cooler shipment to laboratory; includes shipment of decon, site restoration samples	
Mobilization/demobilization for waste pickup	1	ea	\$ 325.00	\$ 325	Vendor (Capitol Environmental; Navy CLEAN BOA rate for MD/DC/eastern VA)	
Bulk soil loading into dump truck	1642	cy	\$ 4.37	\$ 7,176	33 19 0150	
Manifesting, transport, and disposal of non-hazardous soil to offsite landfill	2572	ton	\$ 90.00	\$ 231,480	Vendor (Capitol Environmental; Navy CLEAN BOA rate for MD/DC/eastern VA)	
SOIL AMENDMENT (ECOLOGICAL RISK)						
Purchase phosphatic reagent	36	ton	\$ 600.00	\$ 21,600	UFA Ventures, assumes application of 3% amendment by weight; 50% of eco risk area to be treated	
Ship phosphatic reagent	36	ton	\$ 600.00	\$ 21,600	UFA Ventures, ships via 20 ton containers	
Tiller, 13HP, rear tine	3	week	\$ 315.00	\$ 945	Vendor (ABC Rental Center, Columbia, MD); mob/demob, field tech costs included above; till soil before and after application	
Spread material, no compaction, dozer, 300HP	777	cy	\$ 5.48	\$ 4,258	02315 520 0190	
DECONTAMINATION						
Temporary equipment decontamination pad	1	ea	\$ 400.00	\$ 400	Navy CLEAN BOA rates for MD/DC/eastern VA	
Steam cleaner	1	mo	\$ 1,658.44	\$ 1,658	33 17 0819	
Mobilization/Demobilization/Cleaning of Tank (3,000 to 7,000 capacity tanks)	1	ls	\$ 2,700.00	\$ 2,700	Vendor (Capitol Environmental; Navy CLEAN BOA rate for MD/DC/eastern VA)	

Alternative: Alternative 3: Soil Removal for Human Health Risks and In Situ Treatment for Ecological Risks
 Location: Site 28 EE/CA
 NSF-IH, Indian Head, Maryland

COST ESTIMATE SUMMARY

Description: Engineers estimate of cost to excavate and dispose of soil in areas of potentially unacceptable human health risk and in situ treatment of soil in areas of potentially unacceptable ecological risk

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES
3000 gal decon water storage tank	4	wk	\$ 210.00	\$ 840	Vendor (Capitol Environmental; Navy CLEAN BOA rate for MD/DC/eastern VA)
Decon water	3000	gal	\$ 0.05	\$ 150	Navy CLEAN BOA rates for MD/DC/eastern VA
Spent decon water storage tank	12	wk	\$ 210.00	\$ 2,520	Navy CLEAN BOA rates for MD/DC/eastern VA; storage between sampling and removal from site
Decon water testing (TCLP metals, RCI)	1	ea	\$ 169.32	\$ 169	Navy CLEAN average lab BOA rates for MD/DC/eastern VA
Decon water disposal	3000	gal	\$ 0.85	\$ 2,550	Vendor (Capitol Environmental; Navy CLEAN BOA rate for MD/DC/eastern VA)
SITE RESTORATION					
Confirm imported material meets clean soil criteria	2	ea	\$110.00	\$ 220	Navy CLEAN average lab BOA rates for MD/DC/eastern VA (TCL Metals, standard TAT)
Standard proctor compaction test for backfill soil	2	ea	\$179.04	\$ 358	
Purchase, Import, Place and Compact Clay Backfill from Off-Site Source to Backfill Excavation	1642	cy	\$18.29	\$ 30,032	
Purchase, Import, Place and Compact Clay Backfill from Off-Site Source for Achieving 6:1 Slope	3562	cy	\$18.29	\$ 65,149	Assumes average of 1.5' of fill material needed across site
Borrow, loading, and spreading - top soil, shovel, 1CY bucket (6" thick)	1187	cy	\$26.81	\$ 31,828	02055 150 0800; 6" of topsoil across site
Finish Grading Slopes	7123	sy	\$0.23	\$ 1,638	02310 100 3300; entire site
Hydroseeding	48	m.sf	\$52.35	\$ 2,513	02920 320 2400; 75% of site
Planting of native wetland species	0.37	ac	\$25,000.00	\$ 9,250	Professional judgement: similar project (Norfolk Naval Shipyard Site 2); includes labor and materials; 25% of site
Straw Mulch, hand spread 1" deep	7123	sy	\$0.91	\$ 6,482	02910 500 0600; entire site
Remove silt fence	500	lf	\$2.63	\$ 1,315	18 05 0206
MEC POST-EXCAVATION SUPPORT					
UXO Tech mob/demob	1	ea	\$ 750.00	\$ 750	Vendor (USA Environmental; Navy CLEAN BOA rates for MD/DC/eastern VA)
UXO Tech II (vibrating screen operator)	5	day	\$ 490.00	\$ 2,450	Vendor (USA Environmental; Navy CLEAN BOA rates for MD/DC/eastern VA); needed during excavation only
Vibrating screening unit	1	ea	\$ 22,548.48	\$ 22,548	33 18 8601; 1 month rental
LAND USE CONTROLS					
Establish groundwater LUCs and incorporate them to the Base Master Plan	1	LS	\$ 5,000.00	\$ 5,000	Professional judgement: similar Navy projects
LONG-TERM MONITORING					
Signage for Institutional Controls	10	ea	\$ 250.00	\$ 2,500	Professional judgement: similar Navy projects
Present worth of long term monitoring	1	ea	\$ 38,273.82	\$ 38,274	See table C-3
Subtotal				\$ 611,707	
Contingency (10% scope, 15% bid)	25%			\$152,927	
Project Management	6%			\$36,702	
Remedial Design	12%			\$73,405	
Construction Management	8%			\$48,937	
TOTAL COST					
Removal and In Situ Treatment				\$923,678	
Upper Limit of Cost Accuracy	150%			\$1,385,517	
Lower Limit of Cost Accuracy	70%			\$646,575	

SOURCE INFORMATION

1. R.S. Means Company. 2004. Environmental Remediation Cost Data - Unit Price, 10th Edition. R.S. Means Company and Talisman Partners, Ltd. Kingston, MA.

Alternative: Alternative 3: Soil Removal for Human Health Risks and in Situ Treatment for Ecological Risks	COST ESTIMATE SUMMARY																					
Location: Site 28 EE/CA NSF-IH, Indian Head, Maryland	Description: Engineers estimate of cost to excavate and dispose of soil in areas of potentially unacceptable human health risk and in situ treatment of soil in areas of potentially unacceptable ecological risk																					
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">DESCRIPTION</th> <th style="text-align: center;">QTY</th> <th style="text-align: center;">UNIT</th> <th style="text-align: center;">UNIT COST</th> <th style="text-align: center;">TOTAL</th> <th style="text-align: left;">NOTES</th> </tr> </thead> <tbody> <tr> <td colspan="6" data-bbox="131 430 1458 478"> 2. R.S. Means Company. 2004. Site Work and Landscape Cost Data - Unit Price, 23rd Edition. R.S. Means Company and Talisman Partners, Ltd. Kingston, MA. </td> </tr> <tr> <td colspan="6" data-bbox="131 478 1458 527"> 3. United States Environmental Protection Agency. July 2000. A Guide to Preparing and Documenting Cost Estimates During the Feasibility Study. EPA 540-R-00-002. (USEPA, 2000). </td> </tr> </tbody> </table>					DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES	2. R.S. Means Company. 2004. Site Work and Landscape Cost Data - Unit Price, 23rd Edition. R.S. Means Company and Talisman Partners, Ltd. Kingston, MA.						3. United States Environmental Protection Agency. July 2000. A Guide to Preparing and Documenting Cost Estimates During the Feasibility Study. EPA 540-R-00-002. (USEPA, 2000).					
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