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RECORD OF DECISION AT SITE 11 NSWC INDIAN HEAD MD
9/1/2009
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RECORD OF DECISION

Site 11 - Caffee Road Landfill

for

Naval Support Facility Indian Head
Indian Head, Maryland

September 2009

Contents

Acronyms and Abbreviations

µg/kg	microgram(s) per kilogram
µg/L	microgram(s) per liter
ARAR	applicable or relevant and appropriate requirement
BERA	baseline ecological risk assessment
bgs	below ground surface
CDI	chronic daily intake
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	constituents of concern
COMAR	Code of Maryland Regulations
COPC	constituents of potential concern
CSF	carcinogenic slope factor
CSM	conceptual site model
CTE	central tendency exposure
ELCR	Excess Lifetime Cancer Risk
EPA	U.S. Environmental Protection Agency
FS	Feasibility Study
HHRA	human health risk assessment
HI	hazard index
HQ	hazard quotient
IAS	Initial Assessment Study
IC	institutional control
IR	Installation Restoration
MCL	maximum contaminant level
MDE	Maryland Department of the Environment
mg/kg	milligram(s) per kilogram
Navy	Department of the Navy
NCP	National Oil and Hazardous Substances Pollution Contingency Plan (40 CFR 300)
NOAEL	no observed adverse effects level
NPL	National Priorities List
NSF-IH	Naval Support Facility Indian Head
O&M	operation and maintenance
PAH	polycyclic aromatic hydrocarbon

RAO	remedial action objective
RBC	risk-based concentration
RCRA	Resource Conservation and Recovery Act
RfD	reference dose
RI	Remedial Investigation
RME	reasonable maximum exposure
ROD	Record of Decision
SERA	screening-level ecological risk assessment
SRG	site remediation goal
SVOC	semivolatile organic compound
TAL	target analyte list
TCL	target compound list
TPH	total petroleum hydrocarbon
TPH-DRO	total petroleum hydrocarbon – diesel range organics
TPH – GRO	total petroleum hydrocarbon – gasoline range organics
VOC	volatile organic compound
VSI	visual site inspection

SECTION 1
Declaration

1.1 Site Name and Location

Site 11, Caffee Road Landfill
Naval Support Facility, Indian Head
Indian Head, Maryland
CERCLIS ID No. MD 170024684

1.2 Statement of Basis and Purpose

This Record of Decision (ROD) presents the Selected Remedy for Site 11, Caffee Road Landfill, at the Naval Support Facility, Indian Head (NSF-IH) in Indian Head, Maryland. The Selected Remedy was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act, and, to the extent practical, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP; 40 CFR Part 300). This decision is based on information contained in the Administrative Record file for NSF-IH.

The Department of the Navy (Navy) and the U.S. Environmental Protection Agency (EPA) jointly selected the remedy and the Maryland Department of the Environment (MDE) concurs with the selected remedy.

1.3 Description of the Selected Remedy

The Selected Remedy is a protective soil cover, institutional controls (ICs), and groundwater monitoring for the soil, solid waste, and nearshore sediment in Area A; and an *in situ* cap and ICs for the nearshore sediment adjacent to Area B along Mattawoman Creek. Based on the human health and ecological risk assessments performed during the Remedial Investigation (RI) (CH2M HILL, 2004), no contaminants of concern (COCs) were identified for surface water; therefore, a remedial action is not warranted for this medium. No further action is warranted for surface soil in Area B because there are no human health risks, and the concentrations of the ecological risk-driving metals are comparable to their respective no observed adverse effect levels (NOAELs) found in toxicity testing conducted at Site 47 and the Lab Area at NSF-IH. Furthermore, site restoration, as part of standard post-construction activities, which will be performed at Area B following the completion of Area A and the nearshore sediment remedies, will minimize the exposure to the surface soil.

Contaminants detected in groundwater beneath the landfill were either below the federal maximum contaminant levels (MCLs) for those with MCL values, or less than their respective background concentrations for those without MCL values. Furthermore, the shallow groundwater at Site 11 is not a potable source and is not expected to be one in the future. In accordance with the *Guideline for Groundwater Classification under the EPA Groundwater Protection Strategy* (EPA, 1986), the shallow water-bearing unit beneath Site 11 does not meet the requirements for classification as an aquifer. Site 11 was previously a wetland that was filled in to create the existing topography. Aerial photographs confirm the filling in of this area in the past. In its original natural setting, the water would have existed as surface water associated with the wetland. Therefore, groundwater remediation is not warranted. Groundwater monitoring, however, is included in the remedial alternatives for soil and solid waste as part of the requirement of the landfill remedy. The locations of NSF-IH and Site 11 are shown in Figure 1-1.

1.4 Statutory Determinations

The Selected Remedy is protective of human health and the environment, complies with applicable or relevant and appropriate federal and state requirements (ARARs), is cost-effective, and utilizes permanent solutions and alternative treatment technologies to the maximum extent possible. A variance pursuant to Code of Maryland Regulations (COMAR) 26.04.07.21, Industrial Sanitary Landfill Closure requirements, has been granted for the remedy for the soil and solid waste. The requirements specify that a Resource Conservation and Recovery Act (RCRA) Subtitle C impermeable cap should be installed for the closure of an industrial landfill. Because of the reasons stated in Section 1.3, MDE has granted a variance for a soil cover (Appendix A).

The Selected Remedy does not include treatment because there are no principal threats at the site that require treatment. Groundwater contamination occurs beneath the landfill at concentrations below the MCLs and background; therefore, remediation of the groundwater is not required. Treatment of the landfill contents is not practicable in a cost-effective manner because of the large volume of waste (22,400 cubic yards) and the presence of munitions and explosives of concern (MEC). Treatment of the sediment is not practicable in a cost-effective manner. Because there is no treatment, there will be no reduction in toxicity or volume. Although this remedy does not meet the statutory preference for treatment, the remedy is expected to adequately meet the remedial action objectives (RAOs) for Site 11. The remedy will reduce the potential for contact with the soil and waste through a soil cover and with sediment through an *in situ* cap. The Selected Remedy for soil, waste, and nearshore sediment in Area A also includes ICs, and a groundwater monitoring program as part of the requirement of the landfill remedy. The Selected Remedy for the nearshore sediment adjacent to Area B also includes ICs. Implementation of the Selected Remedy will result in hazardous substances, pollutants, or contaminants remaining onsite above levels that allow for unlimited use and unrestricted exposure. Therefore, a statutory review will be conducted within 5 years after initiation of the remedial action to ensure that the remedy is protective of human health and the environment.

1.5 ROD Data Certification Checklist

The following information is presented in Section 2, the Decision Summary section of this ROD. Additional information can be found in the Administrative Record file for Site 11:

COCs requiring remediation and their respective concentrations (Section 2.5)

Baseline risk represented by all COCs (Sections 2.7.1 and 2.7.2)

Cleanup levels established for constituents requiring remediation and the basis for these levels (Section 2.8)

Current and reasonably anticipated future land use assumptions and current and potential future beneficial uses of groundwater used in the baseline risk assessment and ROD (Section 2.6)

Estimated capital, annual operation and maintenance (O&M), and total present-worth costs, discount rate, and the number of years over which the remedy cost estimates are projected (Section 2.12.3)

Key factor(s) that led to the selected remedy (Section 2.10)

1.6 Authorizing Signatures

Catherine T. Hanft, CAPT, USN
Commanding Officer
Naval Support Activity South Potomac

5/20/09
Date

9/18/09
Date

Kathryn A. Hodgkiss, Acting Director
Hazardous Site Cleanup Division
U.S. EPA Region 3

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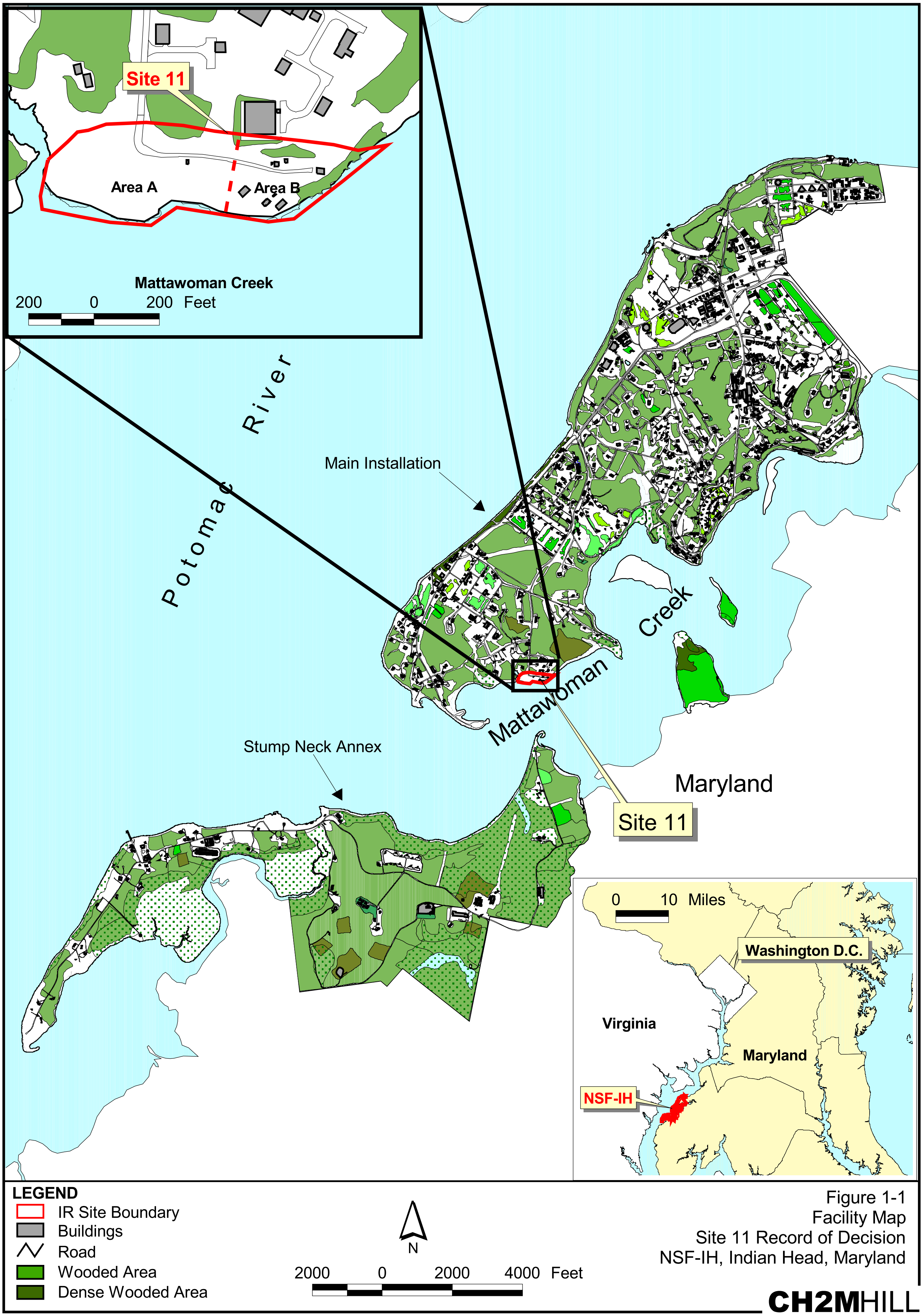

Figure 1-1
Facility Map
Site 11 Record of Decision
NSF-IH, Indian Head, Maryland

CH2MHILL

SECTION 2

Decision Summary

This ROD presents the Navy's and EPA's Selected Remedy for Site 11, Caffee Road Landfill, at NSF-IH. MDE concurs with the Selected Remedy.

2.1 Site Name, Location, and Description

NSF-IH is in northwestern Charles County, Maryland, approximately 25 miles southwest of Washington, D.C. NSF-IH is a Navy facility consisting of the Main Installation on the Cornwallis Neck Peninsula and the Stump Neck Annex on the Stump Neck peninsula. The Main Installation contains approximately 2,500 acres and is bounded by the Potomac River to the northwest, west, and south; Mattawoman Creek to the south and east; and the town of Indian Head to the northeast. Included as part of the Main Installation are Marsh Island and Thoroughfare Island, which are in Mattawoman Creek. Site 11 lies south of the Main Installation (Figure 1-1).

The Navy is the lead agency for site activities and provides funding for site cleanups at NSF-IH. EPA and MDE are support agencies.

2.2 Site History and Previous Investigations

2.2.1 Site History

Site 11, Caffee Road Landfill, is situated at the southern end of Caffee Road, extending about 200 feet on either side of the road. The landfill is bordered by an unnamed creek and wetland to the west and by Mattawoman Creek to the south (Figure 2-1). A review of historical aerial photographs (1956 to 1987) indicated that Site 11 was created by landfilling activities, which occurred after 1956. By 1963, most of the area within Site 11 had been cleared and filled. The filling activities extended the shoreline into Mattawoman Creek by as much as 150 feet from its original position. Currently, much of the Mattawoman Creek shoreline adjacent to Site 11 consists of concrete, debris, and fill (Photographs 1 and 2, located at the end of this section, following the figures).

Because of different historical uses of this site, it is divided into two areas: (1) Area A and the Upland Area because of past landfilling and disposal activities; and (2) Area B because of historic incineration or waste-burning activities. Area A is the landfill where disposal activities occurred and where metal parts were flashed in the area just west of wetland Area Two (IH-02) (Figure 2-1). The Upland Area is northwest of Area A and will be addressed as part of Site 66. A literature search conducted at NSF-IH during the RI (CH2M HILL, 2004) revealed that four open-burning pits previously existed along the eastern edge of Site 11. This area was designated as Area B and was investigated as part of the RI. The original burn location was just west of IH-02 in Area A. Burning in this area stopped when the area was cleaned up and regraded in 2001. Two incinerators on the eastern side of Site 11 were also present in Area B. One was a chemical incinerator (Building 1549) that reportedly was never used, and the other was an incinerator for classified documents (Building 1607).

The Area A landfill was used until the early 1960s for the disposal of bulk metal items and trash, rocket motor casings, exploded building debris, rifles, demilitarized ordnance, propellant grains, and open-burning residues (Fred C. Hart Associates, Inc., 1983). There is no information concerning the date when the landfill was first used. In 1980, the Navy reportedly removed 5,000 to 6,000 cubic yards of flashed metal parts from the wetland area. The Initial Assessment Study (IAS) for Site 11 reported that various materials were dumped or left uncovered for extended periods (Fred C. Hart Associates, Inc., 1983). Because the site was never permitted as a landfill, there were no cover application procedures to secure deposited or stored waste materials.

The surface of the landfill had been used previously as the Caffee Road Thermal Treatment Point Pad to store flashed metal parts, which were periodically removed by a metal recycling contractor. With the exception of a new gravel pad, which is now the Caffee Road Thermal Treatment Point Pad, the landfill area was graded and seeded in 2001.

2.2.2 Previous Investigations

Initial Assessment Study

An Initial Assessment Study (IAS) (Fred C. Hart, 1983) was conducted to identify and assess sites posing a threat to human health or to the environment because of contamination from past operations involving hazardous materials. The IAS identified Site 11 as the Caffee Road Landfill, based on reported disposal of bulk items and trash and observations of uncontrolled spills, uncovered and leaking drums, and dust covering the site vegetation.

Phase II RCRA Facility Assessment

A Phase II RCRA Facility Assessment (A.T. Kearny, Inc. and K.W. Brown & Associates, Inc., 1988) was completed in 1988; it consisted of a preliminary review of available documents and a visual site inspection (VSI). During the VSI, uncontrolled spills and uncovered and leaking drums were not observed, as noted in the IAS. However, a large collection of flashed metal parts was observed at the site.

Remedial Investigation

Surface and subsurface soil sampling, monitoring well installation, and groundwater sampling were conducted in July 2000 and February 2002 as part of the RI conducted at Site 11 and four other sites (CH2M HILL, 2004). The RI was conducted in two phases: the initial RI, conducted in 2000, focused on Area A; the follow-up investigation, conducted in 2002, focused on Area B. The results of the RI showed that much of the solid waste lies below the water table; the solid waste and subsurface soil samples had similar types of semivolatile organic compounds (SVOCs), metals, and explosives, suggesting that the waste has contaminated the soil. However, few constituents were found in groundwater, indicating that the solid waste has not significantly affected groundwater quality.

A baseline human health risk assessment (HHRA) and a screening-level ecological risk assessment (SERA) were performed as part of the RI. The results of the risk assessments are presented in Section 2.7.

Baseline Ecological Risk Assessment

A baseline ecological risk assessment (BERA) was performed because the results of the SERA indicated there were potentially unacceptable risks to ecological receptors from exposures to the soil at the site and the sediment along Mattawoman Creek. The BERA evaluated sediment in the unnamed creek and Mattawoman Creek adjacent to Site 11 (CH2M HILL, 2005a). Soil from the landfill and the Upland Area was not evaluated because the landfill will be capped and soil in the Upland Area will be addressed as part of Site 66. The results of the BERA are presented in Section 2.7.

Wetland Delineation

In February 2005, a wetland delineation was conducted to identify wetland areas that could be affected as a result of placing a soil cover on the landfill (CH2M HILL, 2008a). Two areas were identified: Area One (IH-01) and Area Two (IH-02) (Figure 2-1). Area One, within the western corner of and adjacent to Area A, was classified as a jurisdictional wetland based on the vegetation, hydrology, and hydric soils present. Area Two lies within Area A; it is a small freshwater area that resulted from the grading activities in 2001. It currently serves as a drainage basin for the upper grassy fields and the paved access road. Because the area exhibited vegetation and hydrology consistent with wetlands, but did not have hydric soils, it did not meet the full criteria of a wetland or "water of the U.S.," according to the U.S. Army Corps of Engineers' 1987 wetland delineation manual. As a result, it was considered an atypical wetland subject to a jurisdictional call by the U.S. Army Corps of Engineers and MDE.

Feasibility Study

A Feasibility Study (FS) was conducted to address potential sources of contamination at Site 11 and to evaluate remedial alternatives to mitigate potential hazards associated with the landfill soil, waste, and nearshore sediment adjacent to Area A, and nearshore sediment adjacent to Area B (CH2M HILL, 2008a). Land topographic, geophysical, and hydrographic surveys were conducted in May and July 2005, in May 2006, and in November 2007, respectively, in support of the remedial alternatives evaluation.

2.2.3 Enforcement Activities

In September 1995, NSF-IH was placed on the National Priorities List (NPL). No enforcement actions have occurred to date at Site 11. The Federal Facilities Agreement provides for CERCLA-directed enforcement activities at the site. As a result, an RI, FS, and Proposed Plan have been completed for this site.

2.3 Community Participation

The NSF-IH Restoration Advisory Board is made up of community members, EPA, MDE, and the Navy. Meetings are held two times a year to provide a forum for the exchange of information among all parties regarding Installation Restoration (IR) activities.

In accordance with Sections 113 and 117 of CERCLA, the RI report (CH2M HILL, 2004), FS report (CH2M HILL, 2008a), and Proposed Plan for Site 11 (CH2M HILL, 2008b) were made available to the public in May 2004, July 2008, and August 2008, respectively. These documents, which are included in the Administrative Record file, can be found in the Information Repositories maintained at the following locations:

Indian Head Town Hall	Charles County Public Library	NSF-IH
4195 Indian Head Hwy.	2 Garrett Ave.	General Library
Indian Head, MD 20640	La Plata, MD 20646-5959	Building 620 (The Crossroads)

The notice of the availability of the Proposed Plan was published in the *Maryland Independent* newspaper on August 22, 2008. A public comment period was held from August 25, 2008 to September 23, 2008. In addition, a public meeting was held on September 18, 2008, to present the Proposed Plan to a broader community audience.

At this meeting, representatives from the Navy, EPA, and MDE answered questions about the site and the remedial alternative. Written comments were received during the public comment period. This is documented in Section 3, Responsiveness Summary.

2.4 Scope and Role of Response Action

Site 11 is included in the NSF-IH IR Program. The results of the RI and BERA, including human health and ecological risk assessments conducted for the site, indicated that further action is required for soil, solid waste, and nearshore sediment adjacent to Area A and nearshore sediment adjacent to Area B, and that no action is required for Area B, groundwater, and surface water to protect human health and the environment. This response action affects Site 11 only and does not include or directly affect any other sites at NSF-IH. Separate investigations and assessments are being conducted for other IR sites at NSF-IH in accordance with CERCLA. Separate RODs and other CERCLA decision documents will be prepared for those other IR sites.

2.5 Site Characteristics

Characteristics of the site, the nature and extent of contamination, and the human health and ecological risk assessments are presented in greater detail in the *Final Remedial Investigation Report, Sites 11, 13, 17, 21, and 25, Naval District Washington, Indian Head, Indian Head, Maryland* (hereinafter referred to as the RI report) (CH2M HILL, 2004), and are summarized in the following sections.

2.5.1 Physical Setting

The extent of solid waste associated with past waste disposal activities at Site 11 is limited to Area A and the Upland Area. Fill material, consisting of earthen material to reclaim the land, and solid waste are encountered in the shallow subsurface in the central and western portions of Area A, down to a depth of 4 feet below ground surface (bgs) and to depths greater than 10 feet bgs in the center of the landfill (Figure 2-2). Fill was also encountered in the Upland Area. In Area A and the Upland Area, the fill is characterized by clayey sands and gravels containing solid waste (wood fragments, concrete, bricks, glass, ash, and slag).

In Area B, shallow soils (approximately 2 to 4 feet bgs) are characterized by sandy silty clay with organic matter (e.g., roots). Some fill material was encountered in the southwestern portion of Area B contiguous to the fill layer from Area A, with the average fill thickness of about 2 feet. Area B was never used as a disposal area; rather, it was briefly used as an incineration site for classified documents.

The groundwater flow at Site 11 is generally from north to south towards Mattawoman Creek and perhaps towards the unnamed creek. The water table elevation ranges from 1.89 feet above mean sea level along the shoreline to 8.42 feet above mean sea level upgradient of Site 11. Mattawoman Creek is influenced by the tides and, in turn, it is likely that the site water table, at least near the creek, is as well.

The land in the vicinity of Site 11 is an unvegetated open area surrounded by woods. In Area A, the surface covering the landfill has been used recently as the Caffee Road Thermal Treatment Point Pad. This area has been regraded and seeded for the installation of the gravel pad. Two former incinerator buildings, Buildings 1549 and 1607, are in Area B. The site is currently used to burn metal debris to “clean” off the explosives prior to transport to a metal recycling center. There are no known areas of archeological or historical importance at Site 11.

2.5.2 Conceptual Site Model

The CSM integrates information regarding the physical characteristics of the site, potentially exposed populations, sources of contamination, and contaminant mobility (fate and transport) to identify exposure routes and receptors evaluated in the risk assessment. A well-defined CSM allows for a better understanding of the risks at a site and aids in the identification of the potential need for remediation. The potential for the materials disposed of in the landfill to leach into the soil, and then leach from the soil to the shallow groundwater is the source of contamination for the site.

Table 2-1 presents the conceptual site model (CSM) for human receptors at Site 11. Human receptors under the current land use scenario are industrial site workers and adult and adolescent trespassers/visitors exposed to soil, and recreational adults and children exposed to surface water while swimming in the Mattawoman Creek and the unnamed creek. Exposure to the sediment is not considered a complete pathway because it is completely covered with water and there is no shoreline with exposed sediments. Human receptors under the future land use scenario are the adult and child residents, adult and adolescent trespassers/visitors, industrial workers, and construction workers. Hypothetical future residential use of the site was evaluated to determine if restrictions would be necessary at the site. The site is on an industrial facility. It is unlikely that this land use will change in the future.

2.5.3 Sampling Strategy

Area A

Field activities for the RI consisted of surface and subsurface soil sampling, waste sampling, sediment and surface water sampling, direct-push groundwater sampling, and monitoring well installation and sampling. Thirty-two surface soil samples (28 site and 4 background), 7 subsurface soil samples (3 site and 4 background), 2 waste samples, 6 *in situ* groundwater samples, 5 monitoring well groundwater samples (4 site and 1 background), 7 surface water samples, and 7 sediment samples were collected and analyzed for target compound list

(TCL) volatile organic compounds (VOCs), TCL SVOCs, target analyte list (TAL) metals, explosives, and total petroleum hydrocarbons (TPHs). Groundwater samples were analyzed for both total and dissolved metals. Figure 2-3 shows the locations of all sampling points.

Area B

Field activities for the RI consisted of surface and subsurface soil sampling, sediment and surface water sampling, and monitoring well installation and sampling. Eleven surface soil samples, 9 subsurface soil samples, 3 monitoring well groundwater samples, 3 surface water samples, and 1 sediment sample were collected and analyzed for VOCs, SVOCs, TAL metals, explosives, and TPHs. A waste sample was not collected because it was not encountered in Area B. Groundwater samples were analyzed for both total and dissolved metals. Figure 2-3 shows the locations of all sampling points.

2.5.4 Nature and Extent of Contamination

The nature and extent of contamination is described in detail in the RI report (CH2M HILL, 2004), and is summarized below.

Area A:

- Surface soil: VOCs were detected at very low concentrations in the site samples. SVOCs were detected in all site samples and one of the site-specific background samples. Metals were detected in all samples, with the highest concentrations and most number of detections in samples collected around Building 24. In general, samples collected along the northwest and northern parts of the site and in the eastern part of the site had the lowest concentrations of metals. Several explosives were detected in a few samples, particularly in the western part of the site. TPH—diesel range organics (TPH-DRO) were detected in the site samples as well as in three background samples, with the highest concentrations in the samples from the western part of the site.

- Subsurface soil: VOCs were detected at very low concentrations in the site samples. SVOCs were detected in three samples, with the highest concentrations and most number of detections in the sample from location IS11SB04 in the center of the site. Metals also were detected in the samples, with the highest concentration in the sample from location IS11SB04. Low concentrations of 1,3-dinitrobenzene were detected in samples from locations IS11SB12 and IS11SB26. TPH-DRO were detected in one sample (location IS11SB04), and TPH-gasoline range organics (GRO) were not detected in any samples. Overall, concentrations of detected compounds were lower in subsurface soil than in surface soil.

- Waste: VOCs were detected in the sample from location IS11WS02. Several SVOCs were detected in both samples. Metals were detected in both samples, with IS11WS02 exhibiting the most detections and higher concentrations. Three explosives were detected in each of the samples: HMX and 2,6-dinitrotoluene in both samples, with perchlorate in IS11WS01 and RDX in IS11WS02. TPH-GRO and TPH-DRO were detected in both samples, but TPH-GRO were detected at very low concentrations.

- Groundwater: VOCs were detected at very low concentrations in *in situ* samples IS11GW01, IS11GW02, and IS11GW05, and in monitoring wells IS11MW01, IS11MW03, and IS11MW04. SVOCs were detected at very low concentrations in all *in situ* samples except IS11GW04 and in monitoring well IS11MW03. VOCs and SVOCs were not detected in the background monitoring well IS11MW05. Total and dissolved metals were detected in the *in situ* and monitoring well samples. Explosives were detected at very low concentrations in each of the *in situ* groundwater samples; the highest concentrations were detected in sample IS11GW02, collected from near the center of the site. Similarly, very low concentrations of explosives were detected in the samples collected from monitoring wells IS11MW01, IS11MW03, IS11MW04, and IS11MW05. TPH-GRO were not detected in any of the *in situ* groundwater samples, but TPH-DRO were detected in all samples, with the highest concentrations detected in the western part of the sampled area at the site. Neither TPH-GRO nor TPH-DRO were detected in monitoring well samples.

- Surface water: Only one VOC, methyl-tertiary-butyl-ether, and one SVOC, bis(2-ethylhexyl)phthalate, were detected in surface water sample IS11SW01. Several total and dissolved metals were detected in the samples. One explosive was detected in each sample at very low concentrations, except for the sample from location IS11SW07. TPH-GRO were not detected in any of the samples, but low concentrations of TPH-DRO were detected in surface water samples IS11SW01 through IS11SW04, all collected from the Mattawoman Creek.

- Sediment: VOCs were detected at low concentrations in samples IS11SD01, IS11SD05, IS11SD06, and IS11SD07, with most of them located in the unnamed creek. SVOCs were detected in low concentrations in most sediment samples, with the highest concentrations and the most number of detections observed in the sample from location IS11SD02. Several metals were detected in all samples. Very low concentrations of 3-nitrobenzene and 4-nitrobenzene were detected in sediment samples IS11SD01, IS11SD04, and IS11SD06. TPH-GRO were not detected in any of the samples, but TPH-DRO were detected in sediment samples IS11SD02 through IS11SD07.

Area B

- Surface soil: VOCs were detected in 8 of the 11 samples; concentrations of all detected VOCs were less than 5 μg/L. Several SVOCs were detected in all samples. Metals were detected in all samples, with the highest concentrations and most number of detections in samples collected north of Building 1607 to Mattawoman Creek on the eastern side of the sampled area. Two explosives, nitroglycerine and perchlorate, were detected. TPH was not detected in the site samples.

- Subsurface soils: VOCs were detected at very low concentrations in the site samples. SVOCs were detected in all samples except IS11SB50. The highest concentrations of some of the SVOCs were collected from the eastern side of Area B, near the burning pads. Metals also were detected in the samples, with the highest concentrations in the sample from location IS11SB44, a former burning pit. Explosives were not detected in the samples. TPH-DRO were detected in four samples.

- Groundwater: VOCs and SVOCs were detected at very low concentrations in the monitoring well samples. Total and dissolved metals were also detected in all samples.

Explosives were not detected in any sample. TPH-GRO were not detected in any of the samples, but TPH-DRO were detected in monitoring well IS11MW06.

- Surface water: VOCs and SVOCs were not detected in any of the samples. Several total and dissolved metals were detected in the samples. Explosives, TPH-DRO, and TPH-GRO were not detected in any of the samples.
- Sediment: One VOC, 2-butanone, was detected in the sample from location IS11SD08 at a concentration of 3 micrograms per kilogram (µg/kg). Several SVOCs were also detected in the sediment sample. These include benzo(a)anthracene, benzo(a)pyrene, and benzo(b)fluoranthene. Explosives, TPH-DRO, and TPH-GRO were not detected in any of the samples.

2.6 Current and Potential Future Land and Resource Uses

Site 11 is currently maintained as open space. It is an unvegetated, open area surrounded by woods. No future land use changes are projected for Site 11, and no other land use for this site is planned by the Navy. Shallow groundwater beneath the site is not used for any purpose. The Navy has no plans to develop the groundwater resource in the future. It is unlikely that Site 11 would be developed for residential use. However, hypothetical future residential use of the site was evaluated in the risk assessment to determine if restrictions would be necessary at the site.

2.7 Summary of Site Risks

A detailed discussion of risks at Site 11 and the risk evaluation process is presented in the RI report (CH2M HILL, 2004), BERA report (CH2M HILL, 2005a), and FS report (CH2M HILL, 2008a).

2.7.1 Human Health Risk Assessment Process

As part of the RI, a baseline HHRA was performed for soil, surface water, and groundwater at Site 11 to evaluate the current and future effects of constituents in site media on human health. Exposure to sediment was not evaluated during the HHRA because it was not considered to have a complete pathway. The sediment at Site 11 is completely covered with water and there is no shoreline with exposed sediments. In 2005, after the HHRA was submitted (CH2M HILL, 2005b), an additional risk assessment was performed for soil and groundwater for Area B only because of its different historical uses and contaminant sources (CH2M HILL, 2008a). The recalculation of human health risks for Area B provided a more realistic representation of human health risks in Area B.

As noted earlier, Site 11 is within the industrial portion of NSF-IH and it is unlikely that this land use will change in the future. However, the Navy evaluated the residential exposure scenario to determine if land use restrictions would be necessary at the site. A detailed discussion of the HHRA is provided in Sections 3.3 and 4.6 in the RI report and Appendix F in the FS report. The HHRA is composed of four parts, as discussed below—identification of constituents of potential concern (COPCs), exposure assessment, toxicity assessment, and risk characterization.

Identification of COPCs

The identification of COPCs was a conservative screening process that identified those chemicals that may be present at the site in concentrations that could result in risks to exposed receptors. The maximum detected concentration of each constituent in each medium (surface and subsurface soil, surface water, and groundwater) was compared to a human health risk-based screening value to select the COPCs. If the maximum detected concentration of a constituent exceeded the screening value, the constituent was selected as a COPC and retained for further evaluation. The EPA Region III risk-based concentrations (RBCs) for residential receptors were used as the screening levels to identify COPCs (EPA, 2004). The RBCs that are based on carcinogenic risk are conservatively set to represent an excess lifetime cancer risk (ELCR) of $1x10^{-6}$, or a 1 in 1,000,000 chance of developing cancer as a result of site-related exposure. The EPA Region III RBCs that are based on non-cancer effects are based on a target hazard index (HI) of 1. Therefore, to conservatively account for exposure to more than one non-cancer constituent that affects the same target organ (i.e., liver), the EPA Region III RBCs that were based on non-cancer effects were divided by 10. Constituents eliminated from further evaluation at this step present minimal risks to exposed human or ecological receptors.

Section 4.6.2 of the RI report and Appendix D (Area B) in the FS report discuss the identification of COPCs and present the list of COPCs for Site 11 and for Area B, respectively.

Exposure Assessment

The exposure assessment defines and evaluates the type and magnitude of human exposure to the chemicals present at or migrating from a site. The exposure assessment is designed to depict the physical setting of the site, identify potentially exposed populations, and estimate chemical intakes under the identified exposure scenarios. Actual or potential exposures are based on the most likely pathways of contaminant release and transport, as well as human activity patterns. A complete exposure pathway has three components: a source of chemicals that can be released into the environment, a route of contaminant transport through an environmental medium, and an exposure or contact point for a human receptor.

Onsite exposure points are surface and subsurface soil, surface water, and groundwater beneath the site. It is assumed that current trespassers/visitors and industrial workers could be exposed to surface soil through dermal absorption and incidental ingestion. Recreational adults and children could be exposed to surface water while swimming in the Mattawoman Creek and the unnamed creek. Future receptors could be exposed to future exposed soils (a mixture of surface soil and subsurface soil) through dermal absorption and incidental ingestion. Inhalation of fugitive and volatile emissions from both current and future soil was not evaluated because no COPCs were retained for these pathways.

Groundwater from Site 11 is not currently used as a potable water supply at NSF-IH, nor is it expected to be used as such in the future[1]. However, groundwater data from the site were

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[1] The shallow groundwater at the site would not qualify under MDE regulations as an aquifer. The water supply well must be capable of a sustained yield of at least 1 gallon per minute 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) and less than 20 feet of casing may not be used in any area (COMAR 26.04.04.07.D.3.c).

used in a conservative assessment of groundwater quality for future offsite or onsite residents. Additionally, exposure to shallow groundwater in an excavation pit during construction activities was evaluated for future construction workers.

Pathway-specific information for these receptors, such as the values of exposure parameters used to quantify exposure, is presented in Section 4.6.3 of the RI report.

Toxicity Assessment

Toxicity assessment weighs the available evidence regarding the potential for a particular chemical to cause adverse effects in exposed individuals and provides a numerical estimate of the relationship between the extent of exposure and possible severity of adverse effects. Toxicity assessment consists of two steps: hazard identification and dose-response assessment. Hazard identification is the process of determining the potential adverse effects from exposure to a chemical. Dose-response assessment is the process of quantitatively evaluating the toxicity information and characterizing the relationship between the dose of the contaminant administered or received and the incidence of adverse health effects in the exposed population. From this quantitative dose-response relationship, toxicity values (e.g., non-cancer reference doses [RfDs] and carcinogenic slope factors [CSFs]) are derived. These are the toxicity values, used in conjunction with the exposure assessment, to estimate non-cancer hazards and cancer risks associated with exposure to the site media.

EPA has assessed the toxicity of many chemicals and has published the resulting toxicity information and toxicity values in the Integrated Risk Information System and Health Effects Assessment Summary Tables databases (EPA, 1997a). Additionally, toxicity information is available from EPA's National Center for Environmental Assessment.

Health effects are divided into two broad groups: non-cancer hazards and cancer effects. This division is based on the different mechanisms of action currently associated with each category. Chemicals causing non-cancer health effects were evaluated independently from those having cancer effects. Some chemicals may produce both non-cancer and cancer effects, and were evaluated in both groups. Non-cancer health affects are evaluated using the RfDs. Cancer risks are evaluated using CSFs. Section 3.3.3 in the RI report provides more detail about the toxicity assessment.

Risk Characterization - Methodology

The risk characterization summarizes and combines outputs of the exposure and toxicity assessments to characterize baseline risks, both in quantitative expressions and in qualitative statements. For carcinogens, risk is generally expressed as the incremental probability of an individual developing cancer over a lifetime of exposure to the carcinogen. ELCR is calculated from the following equation:

$$ELCR = CDI \times SF$$

where:

ELCR = a unitless probability (e.g., 33 percent) of an individual's developing cancer that is in addition to the incidence of cancer in the general population unaffected by these releases

CDI = chronic daily intake averaged over 70 years (mg/kg-day)

SF = slope factor, (cancer potency factor), expressed as $(mg/kg\text{-}day)^{-1}$

These risks are probabilities that are usually expressed in scientific notation. An ELCR of 1E-06 indicates that an individual experiencing the reasonable maximum exposure (RME) estimate has a 1 in 1,000,000 chance of developing cancer as a result of site-related exposure. This is referred to as an ELCR because exposure to site conditions results in an additional risk in addition to the risks of cancer from other causes, such as smoking. The chance of an individual developing cancer from all other causes has been estimated to be as high as one in three (33 percent or 3E-1) for women and one in two (50 percent or 5E-1) for men. EPA's generally acceptable ELCR range for site-related exposure is 1E-04 to 1E-06 (i.e., 1 in 10,000 to 1 in 1,000,000).

The potential for non-cancer effects is evaluated by comparing an exposure level over a specified time period with an RfD derived for a similar exposure period. An RfD represents a level that an individual may be exposed to that is not expected to cause any deleterious effects. The ratio of exposure to toxicity is called a hazard quotient (HQ). An HQ less than one indicates that a receptor's dose of a single contaminant is less than the RfD and that toxic non-cancer effects from that chemical are unlikely. The HI is generated by adding the HQs for all COPCs that affect the same target organ (e.g., liver) or that act through the same mechanisms of action within a medium or across all media to which a given individual may reasonably be exposed. An HI of less than 1 indicates that, based on the sum of all HQs from different contaminants and exposure routes, toxic noncarcinogenic effects from all contaminants are unlikely. An HI greater than 1 indicates that site-related exposures may present an unacceptable risk to human health.

The HQ is calculated as follows:

Non-cancer HQ = CDI/RfD

CDI and RfD are expressed in the same units and represent the same exposure period (i.e., chronic, subchronic, or short term). The CDI for HQ calculations may not be the same as that used in the ELCR calculations.

A detailed discussion of the risk characterization is provided in Sections 3.3.4 and 4.6.4 of the RI report. Section 3.3.5 in the RI report presents the uncertainty analysis for the HHRA.

Risk Characterization - Results

The following risk assessment tables are all in Appendix G of the RI report. Tables 7.1.RME through 7.16.RME summarize the non-cancer RME hazards to each receptor. Tables 7.17.CT through 7.23.CT summarize the central tendency exposure (CTE) hazards to each receptor with RME hazards above EPA's HI of 1. Tables 8.1.RME through 8.14.RME summarize the cancer RME risks to each receptor. Table 8.15.CT summarizes the cancer CTE risks to each receptor with RME risks above EPA's acceptable risk range.

Tables 10.1.RME through 10.6.RME show only the constituents that contribute an HI greater than 0.1 or a carcinogenic risk greater than 10^{-6} to receptors. Tables 10.7.CT through 10.8.CT show only the constituents that contribute an HI greater than 0.1 or a carcinogenic risk greater than 10^{-6} to receptors with noncarcinogenic hazards or carcinogenic risks greater than EPA's levels of 1.0 for noncarcinogenic hazards and 10^{-4} for carcinogenic risks. In addition, Tables 2-14 and 2-15 summarize the media-specific risks and hazards for RME and CTE, respectively.

Appendix F of the FS report presents the risk calculation tables for Area B soil and groundwater.

Soil

The baseline HHRA performed for soil at Site 11 during the RI (Section 4.6 in the RI report) and the separate risk assessment performed for Area B during the FS (Appendix F in the FS report) evaluated the potential current and future risks associated with the presence of contaminants in soil on human health. Exposure to soil via ingestion and dermal contact was evaluated. The potential receptors evaluated in the risk assessment were as follows:

- For current uses (exposure to surface soil)— adolescent trespasser/visitor, adult trespasser/visitor, and industrial worker
- For potential future uses (exposure to combined surface and subsurface soil)— adolescent trespasser/visitor, adult trespasser/visitor, adult resident, child resident, lifetime resident, construction worker, and industrial worker

The receptors evaluated in the risk assessment for Area B were as follows:

- For current uses (exposure to surface soil)— adolescent trespasser/visitor, adult trespasser/visitor, and industrial worker
- For potential future uses (exposure to combined surface and subsurface soil)—adult resident, child resident, lifetime resident, construction worker, and industrial worker

The risk assessment initially screened the maximum detected concentration of all constituents against their respective EPA Region III residential soil RBCs. For the current scenario, surface soil concentrations were used. For the future scenario, the soil concentration was estimated by pooling the results from the analyses of the surface soil and subsurface soil because it was assumed that future construction or excavation activities would result in mixing of surface and subsurface soils.

Under the current land use conditions, for surface soil, several SVOCs (benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, dibenz[a,h]anthracene, hexachlorobenzene, and indeno[1,2,3-cd]pyrene), perchlorate, and metals (aluminum, antimony, arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, silver, thallium, vanadium, and zinc) were identified as COPCs. The quantitative risk assessment (RME and CTE calculations) was then performed on the COPCs to identify the COCs. COCs are constituents that contribute an individual HI above 0.1 to a scenario with a cumulative HI above 1.0, or an individual carcinogenic risk above 10^{-6} to a cumulative carcinogenic risk above 10^{-4}.

Lead was retained as a COPC for both the surface soil and combined soil. Lead is evaluated differently from other constituents because there are no published toxicity values for this constituent. Exposure to lead in soil is evaluated for adult industrial workers using the adult lead model and for residents using the Integrated Exposure Uptake Biokinetic Model.

Results of these models (presented in the RI) indicate that there would be no unacceptable risks to receptors associated with exposure to lead in surface soil or combined surface soil.

The baseline risk assessment concluded that under current site use conditions, exposure to surface soil does not represent an unacceptable risk to adolescent trespassers/visitors and adult trespassers/visitors. This means that the non-cancer HI was below 1 and the calculated carcinogenic risk was within the EPA's acceptable cancer risk range of 1×10^{-4} to 1×10^{-6}. Under the RME scenario, the HI for the industrial worker (HI = 1.4) exceeds the EPA value of 1; however, there were no constituents or target organs/effects with HIs above 1 and the CTE HI (0.19) was less than 1. Under the RME scenario, potential carcinogenic risk for the industrial worker was within EPA's acceptable risk range. Therefore, no unacceptable risks or hazards were associated with exposure to surface soil, and no COCs were identified for surface soil.

Under future land use conditions, for combined surface and subsurface soil, the COPCs identified are the same as for the current land use conditions. The baseline risk assessment concluded that exposure to the COPCs in combined surface and subsurface soil does not represent unacceptable risks (both non-cancer and cancer) to the adolescent trespassers/ visitors, adult trespassers/visitors, and industrial workers. Under the RME scenario, the HI for the resident child (HI = 7.7), resident adult (HI = 1.4), and construction worker (HI=2.8), exceed EPA's acceptable HI of 1, and are mostly attributable to cadmium and iron. The CTE assessment, however, for the resident child (HI = 1), resident adult (HI = 0.26), and construction worker (HI = 0.75) resulted in non-cancer hazards at or below the target value of 1. The cancer risks associated with exposure to soil by these receptors are within EPA's acceptable risk range. Therefore, no unacceptable risks or hazards were associated with exposure to combined surface and subsurface soil.

The COCs (as defined above) identified in soil (based on the residential child, the most conservative receptor) were aluminum, antimony, arsenic, cadmium, chromium, copper, iron, manganese, nickel, silver, thallium, vanadium, and zinc.

The RME non-cancer risks and cancer risks calculated for Area B during the FS were less than EPA's HI of 1 and less than or within EPA's acceptable risk range, respectively, for all current receptors, and for future construction workers, future industrial workers, future adult residents, and future lifetime residents. The RME non-cancer risk was above 1 for the resident child (HI = 5.6), primarily associated with iron. As discussed in Appendix E of the FS report, iron is a human nutrient, and the concentrations detected in the soil were within levels that would result in intakes within the daily requirements for iron. Additionally, the CTE non-cancer hazard for the child resident was equal to 1. Therefore, soil does not represent an unacceptable risk (non-cancer and cancer) to all receptors. In the FS, the risk assessment for Area B identified aluminum, antimony, arsenic, cadmium, chromium, copper, manganese, thallium, and vanadium as COCs. However, further evaluation (comparison to preliminary remediation goals [PRGs], background concentrations, and human nutrient requirements) eliminated these COCs from further evaluation.

Surface Water

An HHRA was performed for surface water during the RI. The receptors evaluated included the current child recreational user, current adult recreational user, future child recreational user, and future adult recreational user. The surface water data were screened against 10 times the tap water RBCs. The COPCs were antimony, arsenic, lead, thallium, and vanadium. The average concentration of lead in the surface water was 7 µg/L, which is below the Safe Drinking Water Act action level for lead of 15 µg/L. Therefore, it is not expected that exposure to lead in the surface water would result in any adverse effects to child or adult recreational users who swim in the Mattawoman Creek or the unnamed creek. The risk calculations showed that the non-cancer hazard was below the EPA's HI of 1, and the cancer risk was within EPA's acceptable risk range for all receptors. Therefore, no unacceptable human health risks are associated with surface water at Site 11.

Groundwater

The baseline HHRA performed for groundwater at Site 11 and Area B evaluated the future effects of contaminants in groundwater on human health for the adult resident, child resident, and construction worker. The groundwater data were screened against tap water RBCs to select the COPCs.

The COPCs identified during the RI were benzene, bromomethane, chloroethane, 4-methylphenol, aluminum, antimony, arsenic, barium, chromium, iron, lead, manganese, nickel, and vanadium. The baseline risk assessment found that under the RME scenario, the HIs for the child resident (HI=30) and adult resident (HI =13) exceed the EPA value of 1. The CTE HI for each receptor also exceeded 1 (9.8 for child resident and 3 for adult resident). The risks are primarily associated with iron and manganese. The RME cancer risk for the lifetime resident was $2x10^{-4}$, which is higher than EPA's risk range; this risk was associated with arsenic. However, the CTE cancer risk was $2x10^{-5}$, which is within EPA's acceptable risk range. The HI and cancer risk for the construction worker were below EPA's HI of 1 and the risk range, respectively. The COCs identified from the calculation of risk estimates for residential receptors were aluminum, antimony, arsenic, barium, chromium, iron, manganese, nickel, and vanadium.

The risk assessment for Area B identified benzene, bromomethane, antimony, arsenic, iron, lead, and manganese as COPCs. The risk assessment found that the hazards and risks for the construction worker, and the risks for the lifetime resident were below or within EPA acceptable risk levels. The baseline risk assessment found that under the RME scenario, the HIs for the child resident (HI = 22) and the adult resident (HI = 9.3) exceed the EPA value of 1. The CTE HIs for each receptor (child resident HI = 11, adult resident HI = 3.5) also exceed 1. Subsequent risk evaluation in the FS (comparison to PRGs, background concentrations, and human nutrient requirement) showed that under current and future land use conditions, groundwater does not represent an unacceptable risk (non-cancer and cancer) to all receptors.

A further comparison of the concentrations of the COCs to federal drinking water MCLs and the site-specific, risk-based site remediation goals (SRGs) in the FS report indicated that the concentrations of the COCs are lower than the MCLs and SRGs. The shallow groundwater at Site 11 is not a potable source and is not expected to be one in the future. In accordance with the *Guideline for Groundwater Classification under the EPA Groundwater Protection Strategy* (EPA, 1986), the shallow water-bearing unit beneath Site 11 does not meet the requirements for classification as an aquifer. Site 11 was previously a wetland that was filled in to create the existing topography. Aerial photographs confirm that this area was filled in, in the past. In its original natural setting, the water would have existed as surface water associated with the wetland. Therefore, groundwater remediation is not warranted. Groundwater monitoring, however, is included in the remedial alternatives for soil and solid waste as part of the requirement of the landfill remedy.

2.7.2 Ecological Risk Assessment

A SERA was conducted for Site 11 and Site 17 to estimate the risks the site would pose to ecological receptors if no action were taken. The sites were combined for the evaluation because they abut and are hydrologically connected by Mattawoman Creek. The SERA provides a conservative assessment of potential ecological risk. The general approach and site-specific approach for the ecological risk assessment are provided in Sections 3.4 and 4.7, respectively, of the RI report.

Identification of COCs

COPCs are selected in Step 3A of the SERA from the preliminary list of ecological COPCs. The selection process involves consideration of the ecological HQs, based on refined exposure assumptions, frequency of detection, consideration of likely risk from chemicals without screening values, and consideration of background concentrations. If there are COPCs at the end of Step 3A, the risk assessment process continues to Step 3B (revised problem formulation) and Step 4 (BERA work plan). Because COPCs were identified after Step 3A for Site 11, a BERA was performed. Detailed steps for identifying the COPCs are provided in Sections, 3.4.3, 3.4.4, 4.7.3, and 4.7.4 of the RI report.

Exposure Assessment

According to Superfund guidance (EPA, 1997b), Step 3 initiates the problem formulation phase of the BERA. Under Navy guidance (CNO, 1999), the BERA is defined as Tier 2, and the first activity under Tier 2 is Step 3A. In Step 3A, the conservative assumptions employed in Tier 1 are refined and risk estimates are recalculated using the same CSM for the site. This step is conducted to assist with the identification of risk drivers (i.e., chemicals that may pose the greatest risk).

In some cases, additional information is presented that has bearing on whether a chemical is identified as a potential risk driver. Risk estimates were based on maximum concentrations in Step 2 and average concentrations in Step 3A. For upper–trophic-level receptors (i.e., carnivorous animals), average chemical concentrations provide a more representative estimate of the likely level of chemical exposure because the local population (and, in many cases, individual organisms for highly mobile species with large home ranges relative to the size of the site) would be expected to occur throughout the site (where suitable habitat is present) and, in many cases, off the site. Mean concentrations (or some other estimate of central tendency) may also be appropriate for evaluating potential risks to populations of lower–trophic-level terrestrial and aquatic receptors because the members of the population are expected to be found throughout the site (where suitable habitat is present), rather than concentrated in one particular area.

While effects on individual organisms might be important for some receptors, such as rare and endangered species, population- and community-level effects are typically more relevant to ecosystems. In many cases, the average concentration is a conservative representation of the true site average because samples are generally biased toward areas of known or suspected contamination.

Ecological Effects Assessment

The purpose of the effects evaluation is to establish chemical exposure levels (screening values) that represent conservative thresholds for adverse ecological effects. Direct contact screening values were used to assess potential risks to the soil invertebrate and terrestrial plant communities. Ingestion screening values for dietary exposures were derived for each avian and mammalian receptor species and chemical evaluated in the assessment. Section 3.4.2.1 of the RI report provides a detailed description of the screening values used in the ecological risk assessment.

Ecological Risk Characterization

Screening-level Risk Characterization. Section 4.7.4.3 of the RI report provides a detailed description of the ecological risk characterization. A summary of the ecological risks identified at the conservative screening stage (i.e., the SERA) are described below by environmental medium.

Surface Soil: The concentrations of aluminum, cadmium, chromium, copper, iron, lead, mercury, silver, vanadium, and zinc exceeded soil screening values. Of these, aluminum and vanadium were present at concentrations that are consistent with NSF-IH background levels. Cadmium, chromium, copper, iron, lead, mercury, silver, and zinc were present at higher concentrations than those in the NSF-IH background data set and therefore were identified as preliminary COPCs.

Sediment: A similar background comparison was conducted for sediment. Concentrations of arsenic, manganese, mercury, and nickel were consistent with background levels. The other inorganics that exceeded screening values (barium, cadmium, copper, cyanide, lead, silver, and zinc) were all selected as COPCs. Each may pose a risk to sediment invertebrates or aquatic plants. Maximum concentrations of these COPCs were observed in the sediment along the perimeter of the site in Mattawoman Creek, not in the stream or tidal wetland abutting the western edge of Site 11.

Benzo(a)anthracene (HQ=1.4) was detected at two locations (IS11SD02 at 250 μg/kg and IS11SD06 at 91 μg/kg). Benzo(k)fluoranthene (HQ=1.2) was detected at location IS11SD02 at a concentration of 170 μg/kg. In each case, only the maximum detected concentration exceeded the screening value, and both locations of maximum detection were at IS11SD02 in the Mattawoman Creek adjacent to Site 11. Two additional polycyclic aromatic hydrocarbons (PAHs) were detected at location IS11SD02, with average site concentrations in excess of the screening value. The location of maximum detection for four of the seven detected explosives was also at IS11SD02. Two of these detections exceeded the screening value. Because of the number of exceedances of PAH and explosives benchmarks, these groups were selected as COPCs in the area between IS11SD01 and IS11SD03, encompassing sample location IS11SD02. Acetone was also detected in three of seven sediment samples (HQ=3.3). Because acetone is a common laboratory contaminant and was not stored at the site, it was not selected as a COPC.

Groundwater: Manganese was the only detected constituent with an HQ in excess of 1. The total manganese concentration was consistent across all samples, ranging from 87.4 μg/L to 134 μg/L. The dissolved concentration exceeded the screening value of 10 μg/L in four of the six detections. Three of the exceedances were samples taken from the stream and tidal wetland west (IS11SW05, IS11SW06, and IS11SW07) of Site 11. Water depth was shallow (4 to 6 inches) at these locations, increasing the chance of obtaining a sample with more suspended solids. Because the concentrations of total manganese were consistent across the site and manganese is not a COPC in soil or sediment, it likely poses minimal risks to ecological receptors populations. It was therefore not selected as a COPC.

Section 4.7.4.3 in the RI report provides a detailed description of the ecological risk characterization.

Baseline Risk Characterization. The results of the SERA identified several inorganics in sediment and soil as COPCs that could pose a risk to invertebrates, plants, insectivorous birds and mammals, carnivorous terrestrial birds, and piscivorous birds. Sections 4.7.4.4 and 4.7.4.5 of the RI report present the uncertainty and conclusions, respectively, of the ecological risk assessment.

Following the SERA, a BERA was performed because the results of the SERA indicated there were potentially unacceptable risks to ecological receptors from exposures to the soil at the site and the sediment along Mattawoman Creek. The spatial distribution of the COPCs at Site 11 and a toxicity evaluation of the risk-driving COPCs are discussed in the BERA report. The BERA evaluated sediment in the unnamed creek and Mattawoman Creek adjacent to Site 11 (CH2M HILL, 2005a). Soil from the landfill and the Upland Area was not evaluated because the landfill will be capped and soil in the Upland Area will be addressed as part of Site 66. Soil in Area B was not evaluated for several reasons:

- The concentrations of risk-driving metals are comparable to their respective no observed adverse effect levels (NOAELs) found in toxicity testing conducted at Site 47 and the Lab Area at NSF-IH
- Area B has been extensively disturbed and graded to support construction activities at other sites, and the risk of estimates are based on the samples collected in 2002 before the disturbances
- Area B will likely be disturbed further because it will be used as a staging area for construction material and equipment in support of the Area A remedy
- Site restoration, as part of standard post-construction activities, which will be performed at Area B following the completion of Area A and the nearshore sediment remedies, will minimize exposure to surface soil.

To further refine the risk estimates, additional data were collected and analyses were conducted to support the BERA for Site 11 and the unnamed creek. The COPC list for upper-trophic-level receptors was expanded to include zinc because it was estimated to exceed the NOAEL-based toxicity threshold for piscivorous birds and insectivorous wetland birds. Additionally, silver was added as a COPC for upper trophic level receptors to reduce the uncertainty in the risk estimate for this metal, although silver was not identified as exceeding the NOAEL-based toxicity value.

Potential risks to fishes from site-related chemicals in the sediments were not evaluated directly in the SERA. To address this data gap, epibenthic fishes were included in the BERA as potential receptors. Potential risks to epibenthic fishes were evaluated for the four bioaccumulative metals (lead, mercury, silver, and zinc) identified for other upper-trophic-level receptors. Benzo(a)anthracene and explosives-related chemicals were detected at low frequencies and at low concentrations. PAHs, in general, are metabolized and depurated rapidly. The fate and transport information for the nitroaromatic (explosives-related) compounds suggests their limited persistence in aquatic environments. Therefore, PAHs and nitroaromatics are unlikely to pose a significant risk to mobile aquatic receptors and were not included as COPCs for fishes.

The results of the BERA showed that: (1) conditions in the unnamed creek pose an unacceptable risk to benthic invertebrates, but evidence suggests that the risk is not related to COPCs from Site 11; (2) there is the potential for an unacceptable risk to epibenthic fishes from zinc in sediment along portions of the shoreline of Site 11; and (3) the bioaccumulative COPCs (lead, mercury, silver, and zinc) do not pose unacceptable risk to piscivorous birds and wetland insectivorous birds.

The degraded benthic invertebrate community in the unnamed creek is not related to COPCs from Site 11. The physical nature of the creek (high biological oxygen demand and low dissolved oxygen) may be contributing to the degraded condition of the benthic invertebrate community, in addition to a potential upstream contaminant source, which will be addressed under Site 66. The apparent risk to fishes from zinc in sediment is along the immediate shoreline of Site 11 because of the high zinc concentrations detected in the sediments. Zinc concentrations are considerably lower in sediments away from the immediate shoreline, where the samples were collected to support the BERA and where no unacceptable risk to the benthic invertebrate community was found. It is likely that the source for the zinc contamination in the nearshore sediment is the metal debris that is present along the shoreline. Sections 8.7.4.4 and 8.7.4.5 of the BERA report present the uncertainty and conclusions, respectively.

2.8 RAOs

Based on the evaluation of site conditions, an understanding of the contaminants, the physical properties in media of concern, the results of risk assessments, and an analysis of ARARs, the following RAOs for Site 11 soil, solid waste, and nearshore sediment were developed:

Reduce or minimize human and ecological receptors' direct contact with the solid waste in the former landfill in Area A

Reduce or minimize exposures to COCs in soil that pose unacceptable risks to humans in Area A

Reduce or minimize potential risk to ecological receptors (e.g., fish) from sediment

Minimize and control soil erosion and runoff to surface water and migration of COCs to Mattawoman Creek

The HHRA discussed in Section 2.7.1 concluded that no unacceptable risk is posed by contamination in groundwater, sediment, and surface water in Area A, and in surface soil, combined surface and subsurface soil, sediment, surface water, and groundwater in Area B. The ecological risk assessment presented in Section 2.7.2 concluded that no unacceptable risk is posed by contamination in surface water and groundwater at Site 11.

The RAOs will, therefore, address contamination in soil, solid waste, and nearshore sediment in Area A and nearshore sediment adjacent to Area B. In the FS, several alternatives that would satisfy the RAOs were developed. Before the remedial alternatives in the FS were evaluated, risk-based PRGs were calculated for the COCs identified in soil and sediment. The PRGs for soil were calculated based on the non-carcinogenic human health risks, and the PRG for sediment was calculated based on the ecological risks. Appendices F and G of the FS report provide details on the human health and ecological risk PRG calculations, respectively.

Following the PRG calculations for the COCs, the SRGs were developed, based on the greater of the site-specific, risk-based PRGs or background concentrations. The SRG for sediment was developed based on the risk-based PRG. Section 2.5 of the FS report presents details on development of the SRGs.

In the FS report, it was noted that the COCs were further screened to identify which contaminants require remediation. A contaminant was deemed to require remediation if its maximum detected concentration exceeded its SRG and the detection was not considered isolated in nature. For soil in Area A, the contaminants requiring remediation are arsenic, cadmium, copper, and manganese. For soil in Area B, no constituents require remediation. For the nearshore sediment (within 10 feet of the shoreline adjacent to Site 11), zinc is the only contaminant that requires remediation. For groundwater at Site 11, no contaminants require remediation. For the Upland Area, contaminants requiring remediation will be addressed under Site 66. Areas within Site 11 that require remediation are shown in Figure 2-1. Table 2-2 lists the FS COCs and those COCs that drive the remediation for the soil and solid waste, as well as the shallow groundwater. Table 2-3 shows the SRG for each contaminant requiring remediation in Area A and the nearshore sediment.

2.9 Summary Descriptions of Remedial Alternatives

Section 4.1 of the FS provides a detailed description of each remedial alternative. Summary descriptions are provided in this section.

Soil, Solid Waste, and Nearshore Sediment in Area A

- **Alternative 1—No Action**: This alternative is required by the NCP as a baseline. Under this alternative, no remediation is planned.
- **Alternative 2—Protective Soil Cover, ICs, and Groundwater Monitoring**: The components of this alternative are construction of a soil cover over Area A, stabilization of the shoreline adjacent to Area A, implementation of ICs, and long-term groundwater monitoring. Stabilization of the shoreline will also address the nearshore sediment contamination because the landfill toe would be extended between 30 and 40 feet into Mattawoman Creek, providing a cover for the contaminated nearshore sediment in Area A. The ICs are land- and groundwater-use restrictions. The objectives of the ICs are to: (1) prohibit digging into or disturbing the existing cover or contents of the landfill, (2)

prohibit residential development on the site, and (3) prohibit the use of the shallow groundwater beneath the site. Long-term groundwater monitoring is required under the soil cover or capping remedy, regardless of the absence of groundwater risks. Five-year reviews will be implemented to ensure that the remedy remains protective.

- **Alternative 3—RCRA Equivalent Subtitle C Cap, ICs, and Groundwater Monitoring**: This alternative is similar to Alternative 2 except that an RCRA Equivalent Subtitle C cap will be installed instead of a soil cover.
- **Alternative 4—Excavation, Offsite Disposal, and Wetland Creation:** The components of this alternative are excavation of the waste and contaminated soil in Area A and disposing of it offsite. The excavated area will be restored as a tidal wetland. ICs will not be implemented and 5-year reviews will not be conducted because all waste and contaminated soil will be removed from the site.

Nearshore Sediment Adjacent to Area B

- **Alternative 1—No Action**: This alternative is required by the NCP as a baseline. Under this alternative, no remediation is planned.
- **Alternative 2—Long-Term Monitoring and ICs**: The components of this alternative are long-term monitoring of the sediment for zinc and implementation of ICs. The ICs will prohibit swimming and vessel anchoring and establish a no-wake zone. The reduction of zinc concentration in sediment would depend entirely on the natural recovery processes.
- **Alternative 3—*In Situ* Capping and ICs:** The components of this alternative are *in situ* capping of the nearshore sediment, implementation of ICs, and post-closure reviews. The *in situ* cap will be constructed as a gravel blanket on the nearshore sediment area that encompasses approximately 5,000 square feet. ICs include waterway-use restrictions, such as prohibiting swimming and the anchoring of vessels. Five-year reviews will be implemented to ensure that the remedy remains protective.

The alternatives were evaluated against the nine criteria defined in the NCP (40 CFR Part 300). The criteria permit comparison of the relative performance of the alternatives and provide a means to identify their advantages and disadvantages.

2.10 Summary of Comparative Analysis of Alternatives

The NCP outlines the approach for comparing remedial alternatives. Evaluation of the alternatives uses “threshold,” “primary balancing,” and “modifying” criteria. To be considered for remedy selection, an alternative must meet the following threshold criteria:

- Overall protection of human health and the environment
- Compliance with ARARs

The primary balancing criteria are then considered to determine which alternative provides the best combination of attributes. The primary balance criteria are:

- Long-term effectiveness and permanence

- Reduction in toxicity, mobility, or volume through treatment
- Implementability
- Short-term effectiveness
- Cost

The alternatives are evaluated further against the two modifying criteria:

- Acceptance by the state
- Acceptance by the community

A comparative analysis for the threshold and primary balancing criteria was conducted in the FS for the four remedial alternatives for soil, solid waste, and nearshore sediment in Area A and the three remedial alternatives for the nearshore sediment adjacent to Area B.

Soil, Solid Waste, and Nearshore Sediment in Area A

The four remedial alternatives were analyzed based on the criteria set forth by the NCP. Alternative 2 satisfies all of the threshold and the primary balancing criteria. Alternatives 2 and 3 are equally protective of human health and the environment because most of the solid waste is in contact with the groundwater. Alternative 3, however, entails a higher cost associated with the construction of the low permeability cap. Alternative 4 provides the greatest protection of human health and the environment through the removal and offsite disposal of solid waste; this alternative, however, entails the highest cost and short-term risks to the remediation workers and the environment because of the management and handling of MEC, as well as the greatest disruption to facility's daily mission. In summary, the added benefits provided by Alternatives 3 and 4 are considered marginal.

Nearshore Sediment Adjacent to Area B

The three remedial alternatives were analyzed based on the criteria set forth by the NCP. Alternative 3 satisfies all of the threshold and the primary balancing criteria. Alternative 3 mitigates the predominant source for the zinc contamination in the nearshore sediment by capping the area and using natural processes to mitigate the zinc-elevated nearshore sediment. Although contaminants would remain onsite, they would be prevented from entering potential exposure pathways by the presence of the gravel blanket or clean soil fill and ICs. Over time, protection will also be enhanced because of the natural recovery processes through further burial of the contaminated sediment with the clean sediment deposited in the future. Disturbance to the existing ecological habitat would be moderate during construction of the cap; however, the long-term benefit of the habitat recovery would outweigh the short-term disturbance. Furthermore, the RAO, and therefore the SRG, would be achieved shortly following the placement of the gravel blanket.

A summary of the comparative analysis for the soil, solid waste, and nearshore sediment in Area A and for the nearshore sediment adjacent to Area B are provided in Tables 2-4 and 2-5, respectively. Section 4 of the FS report provides a detailed description of the comparative analysis of the remedial alternatives.

2.11 Principal Threat Wastes

The NCP establishes an expectation that EPA will use treatment to address "principal threats" posed by a site wherever practicable [40 CFR Section 300.430 (a)(1)(iii)(A)]. The "principal threat" concept is applied to the characterization of "source materials" at a Superfund site. A source material is material that includes or contains hazardous substances, pollutants, or contaminants that act as a reservoir for migration of contamination to groundwater, surface water, or air, or acts as a source for direct exposure. Contaminated groundwater generally is not considered to be a source material. Principal threat wastes are those source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur.

There are no principal threats in any of the media at Site 11, and the contaminants onsite are not categorized as "highly toxic" or "highly mobile."

2.12 Selected Remedy

The Selected Remedy for Site 11 is:

Alternative 2 - protective soil cover, ICs, and groundwater monitoring for soil, solid waste, and nearshore sediment in Area A

Alternative 3 - *in situ* capping and ICs for nearshore sediment adjacent to Area B

No further action for Area B groundwater and surface water

The Upland Area will be addressed as part of Site 66

2.12.1 Description of the Selected Remedy

Soil, Solid Waste, and Nearshore Sediment in Area A

The components of the remedy are:

- Constructing 2 feet of soil cover in Area A, consisting of 18 inches of clean fill and 6 inches of topsoil or topsoil created using Class "A" pelletized sewage sludge per COMAR 26.04.07; the seed mixture for the cover vegetation will be designed so that it will serve as a bio-barrier to burrowing animals;
- Stabilizing the existing shoreline by partially removing surface rubble from the top of the slope, creating a rock and gravel foundation fill to the high tide level, installing an earth fill to extend the soil cover over the remaining rubble and foundation fill, installing a permanent high-velocity erosion control matting, and vegetating the slope with wetland plants and native grasses;
- Implementing ICs, which consist of land-use and groundwater-use restrictions; these restrictions will prohibit any intrusive activities that will compromise the integrity of the soil cover and ensure compliance with the ARARs; the objectives of the ICs are to: (1) prohibit digging into or disturbing the existing cover or contents of the landfill, (2)

prohibit residential development on the site, and (3) prohibit the use of the shallow groundwater beneath the site;

- Performing long-term groundwater quality monitoring. The detailed description of the monitoring program will be included in the long-term monitoring plan (LTMP), which will be prepared after the ROD is signed; and
- Conducting 5-year reviews.

Figure 2-4 depicts the conceptual design for Alternative 2.

Nearshore Sediment Adjacent to Area B

The components of the remedy are:

- Constructing a gravel blanket on the nearshore sediment area. The area encompasses approximately 5,000 square feet;
- Implementing ICs in the form of waterway use restrictions, such as prohibiting swimming and anchoring of vessels; and
- Conducting 5-year reviews.

After the ROD is signed, as part of the remedial design, the Navy will also prepare the IC plan (ICP). Both the LTMP and the ICP will be submitted to EPA and MDE for review before implementing the Selected Remedy.

Throughout the implementation of the Selected Remedy, the Navy will be responsible for implementing, maintaining, reporting periodically, and enforcing the ICs in accordance with the ICP. Although the Navy may transfer these responsibilities to another party by contract, property transfer agreement, or through other means, the Navy shall remain ultimately responsible for the remedy integrity and shall: 1) perform CERCLA 121(c) 5-year reviews; 2) notify the appropriate regulators and/or local government representatives of any known IC deficiencies or violations; 3) provide access to the property to conduct any necessary responses; 4) retain the ability to change, modify, or terminate ICs and any related deed or lease provisions; and 5) ensure that IC objectives are met to maintain remedy protectiveness.

2.12.2 Summary of Estimated Remedy Costs

Soil, Solid Waste, and Nearshore Sediment in Area A

A summary of the estimated costs for the Selected Remedy is presented in Tables 2-6a and 2-6b. The estimated total cost of the selected remedy is $1.75 million, and the estimated present worth cost is $2.19 million. For cost estimating purposes, the long-term maintenance activities primarily consist of mowing and field inspections, which are assumed to be performed semiannually for the duration of 30 years.

This cost estimate is based on the best available information regarding the anticipated scope and conceptual design of the remedial alternative at the time of this ROD. The actual cost of the project would depend on the final scope and design of the selected remedial action, the schedule of implementation, competitive market conditions, and other variables. Changes in the cost elements may occur as a result of new information and data collected during implementation of the remedial alternative. Major changes may be documented in the form of a memorandum in the Administrative Record file, an Explanation of Significant Differences document, or a ROD amendment. The cost estimates presented in this ROD provide an accuracy of +50 percent to -30 percent.

Nearshore Sediment Adjacent to Area B

A summary of the estimated costs for the Selected Remedy is presented in Tables 2-7a and 2-7b. The estimated total cost of the selected remedy is $78,800. O&M cost is approximately $120,800 in 2007/2008 dollars, assuming a lifetime of 30 years. The estimated present worth cost is $150,000.

This cost estimate is based on the best available information regarding the anticipated scope and conceptual design of the remedial alternative at the time of this ROD. The actual cost of the project would depend on the final scope and design of the selected remedial action, the schedule of implementation, competitive market conditions, and other variables. Changes in the cost elements may occur as a result of new information and data collected during implementation of the remedial alternative. Major changes may be documented in the form of a memorandum in the Administrative Record file, an Explanation of Significant Differences document, or a ROD amendment. The cost estimates presented in this ROD provide an accuracy of +50 percent to -30 percent.

2.12.3 Estimated Outcomes of Selected Remedy

The Navy has no plans to disturb the soil cover that will be placed on the landfill and nearshore sediment in Area A or the gravel blanket on the nearshore sediment adjacent to Area B. In accordance with the IC objectives, the Navy shall restrict future land, surface water, and groundwater uses in both areas. The integrity of the soil cover and the gravel blanket will be evaluated as part of the 5-year review process. The groundwater at Site 11 is currently not used for any beneficial uses and will not likely be used as a potable water supply in the future and does not meet requirements to be classified as an aquifer. None of the groundwater final COCs exceed state or federal drinking water MCLs or the site-specific risk-based cleanup levels. No community impacts from the selected remedy are expected. The anticipated environmental benefit of the Selected Remedy is the restoration of sensitive habit in the nearshore sediment at Site 11.

2.13 Statutory Determinations

Remedial actions must meet the statutory requirements of Section 121 of CERCLA. Remedial actions undertaken at NPL sites must achieve adequate protection of human health and the environment, comply with ARARs of both federal and state laws and regulations, be cost-effective, and use, to the maximum extent practicable, permanent solutions and alternative treatment or resource recovery technologies. In addition, CERCLA includes a preference for remedies that employ treatment that permanently and significantly reduces the volume, toxicity, and/or mobility of hazardous waste as the principal element and a bias against offsite disposal of untreated wastes. The following discussion summarizes the statutory requirements that are met by the Selected Remedy.

2.13.1 Protection of Human Health and the Environment

The Selected Remedy would be protective of human health and the environment. Although contaminants would remain onsite, they would be prevented from entering potential exposure pathways by the presence of the soil cover, gravel blanket, and ICs.

2.13.2 Compliance with ARARs

The Selected Remedy will comply with all identified ARARs. Federal and state ARARs are provided by classification in Tables 2-8 to 2-10. The classifications of ARARs identified include chemical-specific (Table 2-8), location-specific (Table 2-9), and action-specific (Table 2-10). The landfill cover will be constructed in accordance with MDE's variance provided in Appendix A. Compliance would be met through eliminating the exposure pathways. The landfill soil cover will be maintained, and land-use and water-use restrictions will be documented. Because most of the solid waste volume lies below the water table and the shallow water-bearing unit is not a naturally formed aquifer, reduced water infiltration would not be a critical criterion to be achieved. Therefore, the Selected Remedy is adequate for Site 11.

2.13.3 Cost-Effectiveness

The Selected Remedy is cost-effective and represents a reasonable value for the money to be spent. In making this determination, the following definition was used: "A remedy shall be cost-effective if its costs are proportional to its overall effectiveness." This determination was accomplished by evaluating the overall effectiveness of those alternatives that satisfied the threshold criteria. Overall effectiveness was evaluated by assessing the five balancing criteria in combination. Overall effectiveness was then compared to cost to assess cost-effectiveness. The relationship of the overall effectiveness of the Selected Remedy was found to be proportional to its cost, and therefore represents a reasonable value for the money to be spent.

The estimated present worth cost for Alternative 2 for soil, solid waste, and nearshore sediment in Area A is $3.01 million, with an approximate capital cost of $2.52 million. The total lifetime O&M cost in 2007/2008 dollars is estimated at $860,000. However, these total present-worth costs do not account for the cost associated with treatment or demilitarization of MEC. Though the cost for this alternative is lower than the costs for Alternatives 3 and 4, it does provide an overall level of protection comparable to the other alternatives.

The estimated present worth cost for Alternative 3 for the nearshore sediment adjacent to Area B is $150,000, with an approximate capital cost of $78,800. The total lifetime O&M cost in 2007/2008 dollars is estimated at $120,800. Although Alternative 2 is less expensive, zinc contamination is not addressed; therefore, the Selected Remedy is cost-effective.

2.13.4 Utilization of Permanent Solutions and Alternative Treatment Technologies (or Resource Recovery Technologies) to the Maximum Extent Practicable

The Navy, EPA, and MDE have concluded that the Selected Remedy represents the maximum extent to which permanent solutions and treatment technologies can be used in a practical manner at Site 11. Of those alternatives that are protective of human health and the environment and comply with ARARs, the Navy, EPA, and MDE believe that the Selected

Remedy provides the best balance of tradeoffs in terms of the balancing criteria, while also considering the statutory preference for treatment as a principal element and bias against offsite treatment and disposal, and considering state and community acceptance.

The Selected Remedy represents the maximum extent to which permanent solutions and treatment are practicable at Site 11. The Selected Remedy provides the best balance of tradeoffs compared to the other alternatives. In particular, the Selected Remedy provides a level of long-term protection equivalent to the other alternatives (except the No Action Alternative), but at greatly reduced costs. The selected remedy is, therefore, the most cost-effective.

None of the alternatives evaluated includes treatment as a principal element, for several reasons. First, there is no principal threat waste at this site that requires treatment. Second, treatment of the landfill contents is not practicable in a cost-effective manner because of the presence of MEC. Third, groundwater contamination beneath the landfill occurs at low concentrations, below the MCLs and background levels. EPA does not expect to use treatment as a remedy for constituents detected below the MCLs. Fourth, treatment of the sediment is not practicable in a cost-effective manner.

2.13.5 Preference for Treatment as a Principal Element

The Selected Remedy does not use treatments for the reasons given above. It, therefore, does not satisfy the statutory preference for treatment as a principal element. The EPA generally expects to use treatment to address principal threat wastes and no principal threat wastes exist at Site 11.

2.13.6 5-Year Review Requirements

Because this remedy will result in hazardous substances, pollutants, or contaminants remaining onsite above levels that allow for unlimited use and unrestricted exposure, the Navy will conduct a statutory remedy review within 5 years after initiating the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

2.14 Documentation of Significant Changes

The Selected Remedy is slightly modified from the the recommended alternative in the Proposed Plan that was presented at the public meeting on September 18, 2008. Prohibition on swimming has been added to the ICs in the Selected Remedy as the result of the public comment.

TABLE 2-1
Conceptual Site Model
Site 11 Record of Decision
NSF-IH, Indian Head, Maryland

Surface Soil:

- Transport of organic and inorganic contaminants via erosion and deposition as sediment in Mattawoman Creek and Unnamed Creek. Once deposited as sediment, limited desorption and dissolution into surface water, with subsequent transport in the surface water.
- Limited leaching of organic and inorganic contaminants from the surface soil to the subsurface soil via the infiltration of precipitation.
- Some bioaccumulation of inorganic and organic compounds in ecological receptors.
- Very slow biodegradation of organic compounds.
- Entrainment of inorganics and perhaps some SVOCs on soil into the air by wind.

Subsurface Soil:

- Limited leaching of inorganic contaminants to the groundwater via the infiltration of precipitation and direct contact with groundwater when the water table is high.

Groundwater:

- Movement of dissolved contaminants with the groundwater flow southward from the site to Mattawoman Creek. Contaminant concentration will decrease with distance from the source area due to the dilution caused by advection and dispersion and due to the removal of inorganics from the aqueous phase via precipitation and transformation.

TABLE 2-2
COCs Requiring Remediation
Site 11 Record of Decision
NSF-IH, Indian Head, Maryland

COC	Max. Detection (Area A / Area B)	Site 95% UCL	Risk-Based PRG	Facility-wide Background Conc.	Comment	SRG	# of Samples > SRGs – Range of Exceedance	Requiring Remediation?
Area A and the Upland Area (All concentration units are in mg/kg)								
Aluminum	25,600	11,326	38,000	11,500	Max < PRG	38,000	0	No
Antimony	19	13	14	1.8	Max > PRG, Background; UCL < PRG	14	4 - (14.6 – 18.9 mg/kg)	No – Isolated detections. However, they are within the solid waste area.
Arsenic	42.7	11	7.3	18.3	Max > PRG UCL< Background	18.3	4 - (21.8 – 42.7 mg/kg)	Yes
Cadmium	147	74	36	0.18	Max > PRG, Background	36	6 - (39.9 – 147 mg/kg)	Yes
Chromium	156	42	130	46.5	Max > PRG, Background; UCL < PRG	130	2 - (143 and 153 mg/kg)	No – isolated detections. However, they are within the solid waste area.
Copper	4,960	2,150	1,500	26	Max > PRG, Background	1500	3 - (1,840 – 4,960 mg/kg)	Yes
Manganese	1,330	403	533	266	Max > PRG, Background; UCL < PRG	533	6 - 595 – 1,330 mg/kg)	Yes
Silver	62.5	29	88	2.2	Max < PRG	88	0	No
Zinc	10,000	4,663	11,500	70	Max < PRG	11,500	0	No
Area B (All concentration units are in mg/kg)								
Aluminum	23,400	10,850	38,000	11,500	Max < PRG	38,000	0	No
Antimony	9.5	7.3	13	1.8	Max < PRG	13	0	No
Arsenic	25	15	22	18.3	UCL < PRG	22	3 - (23.4 – 25.5 mg/kg)	No – isolated detections and 95% UCL was below SRG.
Cadmium	20	11	37	0.18	Max < PRG	37	0	No
Chromium	151	59	110	46.5	UCL < PRG	110	1 - (151 mg/kg)	No – isolated detection
Copper	1,380	467	3,000	26	Max < PRG	3,000	0	No
Manganese	733	392	460	266	UCL < PRG	460	4 - (566 – 733 mg/kg)	No – isolated detection and 95% UCL was below SRG.

COC	Max. Detection (Area A / Area B)	Site 95% UCL	Risk-Based PRG	Facility-wide Background Conc.	Comment	SRG	# of Samples > SRGs – Range of Exceedance	Requiring Remediation?
Groundwater (Area A and Area B) – (All concentration units are in µg/L)								
Antimony	4.2 / 2.9	ND	6.0	ND	Max < PRG, MCL (6.0)	6.0	0	No – maximum concentration was below MCL
Barium	(1,680 / -178)	688	-	688	Max < Background	688[1]	2/5 (Area A) 0 (Area B)	No – maximum concentration was below MCL and detected in well IS11MW01 which is located within the area where soil cover is to be constructed; therefore indirectly addressing the groundwater contamination
Manganese	2,570 / 3,020	2,290	270	2,290	Max ~ Background	2,290	2/5 (Area A) 1/3 (Area B)	No - maximum concentrations are considered consistent with background
Note: Background concentrations 95% UCL (TetraTech NUS, 2002).								

[1] MCL is 2,000 µg/L

TABLE 2-3
Site Remediation Goals for COCs Requiring Remediation
Site 11 Record of Decision
NSF-IH, Indian Head, MD

COCs	SRGs (mg/kg)
Area A Soil and Solid Waste	
Arsenic	18.3
Cadmium	36
Copper	1,500
Manganese	533
Sediment	
Zinc	450

TABLE 2-4
Summary of Comparative Analysis of NCP Evaluation Criteria for Soil and Solid Waste Remedial Alternatives
Site 11 Record of Decision
NSF-IH, Indian Head, Maryland

NCP Evaluation Criteria	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Overall Protection of Human Health and the Environment	Would not protect human health or the environment. The risk to human and ecological receptors posed by the landfill contents and surface soil would not be mitigated. Residual risks are identical to those identified in the baseline risk assessment.	Would be protective of human health and environment. Although contaminants would remain on site, they would be prevented from entering potential exposure pathways by the presence of the soil cover and ICs.	Would be protective of human health and environment. Although contaminants would remain on site, they would be prevented from entering potential exposure pathways by the presence of the cap and ICs.	Alternative 4 satisfies the protection of human health and environment criterion because solid waste and contaminated soil that may represent a potential source of contamination will be removed from the site, minimizing the residual contamination and therefore minimizing the potential exposure of human and ecological receptors to the contaminated soil and solid waste. The restoration of the site as a wetland will further enhance the quality of the habitat.
Compliance With ARARs	If no action is taken, no ARARs are invoked. However, the risks posed by the contaminants at the site would not be addressed.	Will comply with the location-, action-, and chemical-specific ARARs. Compliance would be met through elimination of the exposure pathways. With regard to the implementation of Alternative 2, MDE has approveda variance from the requirements of COMAR 26.04.07.21—Industrial Sanitary Landfill Closure, a State ARAR that requires an impermeable cap to be installed for the closure of an industrial landfill, the category that was the best fit for the landfill at Site 11.	Will comply with the location-, action-, and chemical-specific ARARs. Compliance would be met through elimination of the exposure pathways.	Will comply with the location-, action-, and chemical-specific ARARs.

TABLE 2-4
Summary of Comparative Analysis of NCP Evaluation Criteria for Soil and Solid Waste Remedial Alternatives
Site 11 Record of Decision
NSF-IH, Indian Head, Maryland

NCP Evaluation Criteria	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Long-Term Effectiveness and Permanence	Does not provide long-term effectiveness and permanence. The risk currently associated with the site would not be decreased and may be increased through continued erosion and migration of landfill contaminants to groundwater.	Risks to potential human and ecological receptors from the solid waste and contaminated soil would be eliminated as long as the soil cover is maintained and ICs are properly enforced. However, if items in the solid waste deteriorate or otherwise break down, contaminants may be released to the environment via a groundwater pathway. Potential releases will be detected through groundwater monitoring.	Risks to potential human and ecological receptors from the solid waste and contaminated soil would be eliminated as long as the soil cap is maintained and ICs are properly enforced. However, if items in the solid waste deteriorate or otherwise break down, contaminants may be released to the environment via a groundwater pathway. Potential releases will be detected through groundwater monitoring.	Because the potential sources of contamination will be permanently removed from the site, Alternative 4 provides the highest level of compliance with the long-term effectiveness and permanence.
Reduction of Toxicity, Mobility, or Volume Through Treatment	Does not reduce toxicity, mobility, or volume of contaminants through treatment.	Does not reduce toxicity, mobility, or volume of contaminants through treatment.	Does not reduce toxicity, mobility, or volume of contaminants through treatment.	Does not reduce the toxicity, mobility, or volume of contaminants through treatment.
Short-Term Effectiveness	No immediate increased risk to the remediation workers or surrounding community would be realized by implementing this alternative because no activities are planned.	Onsite exposure of construction workers to contaminants during placement of the soil cover would be minimal. However, short-term safety risks to the remediation workers may be encountered because of the potential presence of MEC. The risks can be minimized by following the appropriate MEC removal procedures. Remedial action duration would be approximately 6 months.	Onsite exposure of construction workers to contaminants during placement of the soil cap would be minimal. However, short-term safety risks to the remediation workers may be encountered because of the potential presence of MEC. The risks can be minimized by following the appropriate MEC removal procedures. Remedial action duration would be approximately 7 months.	Under Alternative 4, RAOs would be met within 4 months (i.e., solid waste and soil would be removed and disposed of offsite within 4 months). Alternative 4 poses the greatest risk to the remediation workers because of the excavation safety risks due to the potential presence of MEC.
Implementability	Alternative 1 would be technically feasible because no activities would be planned.	Alternative 2 would be implementable. Material and services for the technologies are available and considered standard	Alternative 3 is equally implementable as Alternative 2.	Excavation and landfill disposal are technically and adminis-tratively feasible because the technologies have become

TABLE 2-4
Summary of Comparative Analysis of NCP Evaluation Criteria for Soil and Solid Waste Remedial Alternatives
Site 11 Record of Decision
NSF-IH, Indian Head, Maryland

NCP Evaluation Criteria	Alternative 1	Alternative 2	Alternative 3	Alternative 4
		practices.		standard practices. Because of the potential to encounter MEC, Alternative 4 may involve rigorous procedures associated with MEC avoidance, removal, treatment/demilitarization, and disposal. Another challenge is associated with the effort to dewater the high volume of excavated material because 75 percent of the soil that requires excavation is in contact with the groundwater.
Cost	Taking no action would require no expenditure of money for either capital or O&M investments.	2007/2008 Capital Cost: $2.52 million Lifetime O&M Cost: $874,400 Lifetime Present-Worth O&M Cost: $488,500 Total Present-Worth Cost: $3.01 million	2007 Capital Cost: $3.19 million Lifetime O&M Cost: $970,400 Lifetime Present-Worth O&M Cost: $532,900 Total Present-Worth Cost: $3.72 million	2007 Capital Cost: $9.26 million Lifetime O&M Cost: $72,400 Lifetime Present-Worth O&M Cost: $63,200 Total Present-Worth Cost: $9.32 million

TABLE 2-5
Summary of Comparative Analysis of NCP Evaluation Criteria for Nearshore Sediment Remedial Alternatives
Site 11 Record of Decision
NSF-IH, Indian Head, Maryland

NCP Evaluation Criteria	Alternative 1	Alternative 2	Alternative 3
Overall Protection of Human Health and the Environment	Implementation of Alternative 1 would not protect the environment. The risk posed by the impacted nearshore sediment to potential human and ecological receptors would not be decreased because no action would be taken. Residual risks are identical to those identified in the baseline risk assessment. No unacceptable human health risks were associated with exposure to the nearshore sediment.	This alternative would satisfy the protection of the environment criterion solely through reliance on natural recovery processes, such as isolation and mixing of contaminants through burial and physical transports as mechanisms to mitigate the exposure of ecological receptors to the impacted sediments. Although no unacceptable human health risks were identified, the ICs would provide an enforcement mechanism to minimize anthropogenic disruptions in order for the impacted sediment to remain isolated.	Alternative 3 would be protective of the environment because an in situ gravel cap will eliminate the exposure of ecological receptors to the contamination in the nearshore sediment. Although no unacceptable human health risks were identified, the ICs would provide an enforcement mechanism to minimize anthropogenic disruptions in order to maintain the integrity of the cap.
Compliance With ARARs	If no action is taken, no ARARs are invoked. However, the risks posed by the contaminants at the site would not be addressed.	This alternative will comply with the location-, and action-specific ARARs. Compliance with the chemical-specific ARARs would rely on natural processes.	Alternative 3 will comply with the location-, action-, and chemical-specific ARARs.
Long-Term Effectiveness and Permanence	Alternative 1 does not provide long-term effectiveness and permanence. The risk currently associated with the nearshore sediment would not be decreased.	Alternative 2 is considered effective and permanent only if the contaminated sediment remains isolated; however, the isolation relies on slow and unverified natural processes.	Alternative 3 is effective and permanent in the long term because the risks to the potential ecological receptors from the contaminated sediment would be eliminated immediately after the placement of the in situ gravel cap.
Reduction of Toxicity, Mobility, or Volume Through Treatment	Alternative 1 does not reduce the toxicity, mobility, or volume of contaminated sediment through treatment.	Alternative 2 will not reduce toxicity, mobility, or volume of contaminants through treatment.	Alternative 3 will not reduce toxicity, mobility, or volume of contaminants through treatment.
Short-Term Effectiveness	Alternative 1 would result in no short-term risk to the surrounding community because no action would be undertaken. The level of risk to human health and the environment would remain the same as those described in the baseline risk	The short-term effectiveness of Alternative 2 would be comparable to Alternative 1.	Disturbance to the existing ecological habitat would be high during the construction of the in situ cap. However, the long-term benefit of the habitat recovery would outweigh the short-term disturbance. Furthermore, the RAO, and

TABLE 2-5
Summary of Comparative Analysis of NCP Evaluation Criteria for Nearshore Sediment Remedial Alternatives
Site 11 Record of Decision
NSF-IH, Indian Head, Maryland

NCP Evaluation Criteria	Alternative 1	Alternative 2	Alternative 3
	assessment. Similarly, there would be no disturbance to the existing ecological community.		therefore the SRG, would be achieved shortly following the completion of the cap. The risk to remediation workers would be acceptable because the construction activities would be considered standard practices.
Implementability	Alternative 1 would be technically feasible because no activities would be planned.	This alternative is very easy to implement and maintain because IC measures and the long-term monitoring of sediment are standard practices. Alternative 2 would require a long-term commitment of administrative resources to enforce ICs and the long-term sediment monitoring.	Alternative 3 is technically implementable. The cap construction can be implemented using common heavy equipment. Alternative 3 would require a long-term commitment of administrative resources to enforce ICs and maintain the integrity of the cap.
Cost	Taking no action would require no expenditure of money for either capital or O&M investments.	2007/2008 Capital Cost: $17,400 Lifetime O&M Cost: $120,800 Lifetime Present-Worth O&M Cost: $71,300 Total Present-Worth Cost: $88,600	2007/2008 Capital Cost: $78,800 Lifetime O&M Cost: $54,000 Lifetime Present-Worth O&M Cost: $21,900 Total Present-Worth Cost: $100,600

Table 2-6a
Detailed Cost Estimate of Alternative 2 for Soil and Solid Waste
Site 11 Record of Decision
NSF-IH, Indian Head, Maryland

Construction time: **16** weeks | **Operation time:** **30** years | **Post Remediation Monitoring:** **Included in the groundwater monitoring component**

DESCRIPTION OF ALTERNATIVE:

Installation of soil cover to prevent contact with waste and contaminated soil. The cover shall have a minimum 24-inch thickness of soil. Implementation of operation and maintenance and ICs for 30 years, including biannual field inspection and mowing, fiv

ASSUMPTIONS:

	Square Feet (SF)		acres
1) Area of Attainment	121,078		2.78
2) Area of Excavation	0		0

	Cubic feet (CF)		Cubic yards (CY)	tons (0.058 tons/CF)
3) Excavation and disposal costs for removal of soil at Site 17 included since the selection of an alternative for Site 11 directly impacts Site 17.	12960	or	480	752

4) Total cut and fill volume to crate the base grade fro the landfill cover is (from Figure 4-1 FS): 63 **CY** 99 **tons**

5) The soil cover area is approx. 121,078 **SF** 2.78 **acres**

6) Required soil fill material to install the 2' soil cover and to create the base grade for the cover is approx. 8969 **CY**

7) Total fill material in place: 9032 **CY**

8) No wetland mitigation.

9) Swelling factor: 10%

10) Perimeter of the soil cover area is approx. 1,320.00 **Feet (ft)**

11) Surface water management would be accomplished through rip rap ditches along the perimeter the cover.

12) Asphalt paved area requiring demolition 780 **SF**

13) Length of shoreline for stabilization: 900 LF; Width: 15 ft; Low tide water line: 6 ft

14) Volume of shoreline debris to be removed and rip-rap to be installed (to low tide water line) assuming % void of : 50% 40500 CF 2349 tons

15) Sampling includes three years of quarterly sampling, and annual sampling in years 4 & 5.

16) Wells to be abandoned: 3 Wells to be installed: 3 Wells to be sampled: 7

17) Sources of costs are 2004 RS Means Site Work & Landscape Cost Data, RS Means Environmental Remediation Cost Data - Unit Price, vend quotes, and professional judgment based on similar projects.

18) Inflation factor to adjust 2004 cost to 2007 cost: 4% (applied to the total capital cost)

Cost Component	Qty	Unit	Cost Source/Assumptions	Estimated Activity Duration (day)	Labor Unit Cost	Labor Total Cost	Equipment Unit Cost	Equipment Total Cost	Material Unit Cost	Material Total Cost	Subcontractor	Total Cost
CAPITAL COSTS												
Institutional Controls/Planning												**$5,000.00**
Site-Specific LUC	1	lump sum	Allowance		$5,000.00	$5,000.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5,000.00
Permitting, Planning, and Reporting												**$7,500.00**
Health and Safety Plan	1	lump sum	Professional Judgment		$2,500.00	$2,500.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2,500.00
FSP, QAPP, and DQOs	1	lump sum	Professional Judgment		$5,000.00	$5,000.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5,000.00
Site Preparation				**10**								**$16,307.81**
Site clearing (dozer light)	2.78	acre	M 31 11 10 10 0020	5	$1,780.90	$4,950.90	$1,297.95	$3,608.30	$0.00	$0.00	$0.00	$8,559.20
Site demolition (road demolition - assume asphalt paved)	780	SY	M 02 41 13 17 5010	2	$2.29	$1,786.20	$1.57	$1,224.60	$0.00	$0.00	$0.00	$3,010.80
Survey	3	days	M02 21 13 13 0200	3	$1,509.24	$4,527.72	$70.03	$210.09	$0.00	$0.00	$0.00	$4,737.81
Site 17 Excavation and transport of soil to offsite landfill				**7**								**$75,980.25**
Landfill Fees	752	ton	E 33 19 7269		$0.00	$0.00	$0.00	$0.00	$90.33	$67,899.25	$0.00	$67,899.25
Dump Truck Transportation Minimum Charge	672	miles	E 33 19 0210		$0.00	$0.00	$0.00	$0.00	$2.85	$1,915.20	$0.00	$1,915.20
Loading soil into truck	480	CY	E 33 19 0150	7	$0.74	$355.20	$1.41	$676.80	$0.00	$0.00	$0.00	$1,032.00
Excavation	70	hrs	E 17 03 0431	1	$40.37	$2,825.90	$32.97	$2,307.90	$0.00	$0.00	$0.00	$5,133.80
Excavation and Bckfill of Upland Area and Area Outside Soil Cover Within AA				**2**								**$1,035.09**
Excavation, 1 CYcap	63	CY	E 17 03 0276	1	$1.98	$124.74	$2.64	$166.32	$0.00	$0.00	$0.00	$291.06
Borrow, loading, and spreading - common earth, shovel, 1CY bucket (18"	63	CY	E 17 03 0401 & 0420	1	$1.76	$110.88	$2.89	$182.07	$7.16	$451.08	$0.00	$744.03
Soil Cover Construction				**45**								**$206,996.20**
Borrow, loading, and spreading - top soil, shovel, 1CY bucket (6" thick)	2,468	CY	M 31 23 23 15 7000	3	$0.78	$1,924.80	$1.32	$3,257.35	$20.00	$49,353.74	$0.00	$54,535.89
Borrow, loading, and spreading - common earth, shovel, 1CY bucket (18" thick)	10,886	CY	M 31 23 23 15 4000	19	$0.78	$8,491.16	$1.65	$17,962.07	$9.78	$106,466.07	$0.00	$132,919.30
Grading - large area	13,453	SF	M 31 22 16 10 0100	7	$0.18	$2,421.56	$0.19	$2,556.09	$0.00	$0.00	$0.00	$4,977.65
Compaction - sheepsfoot, 12" lifts, 4 passes	9,032	CY	M 31 23 23 23 5720	7	$0.19	$1,716.08	$0.49	$4,425.68	$0.00	$0.00	$0.00	$6,141.76
Trenching for dikes and ditches- 1-4' deep, 3/8 CY backhoe	1,320	CY	M 31 23 16 13 0050	9	$4.23	$5,583.60	$2.15	$2,838.00	$0.00	$0.00	$0.00	$8,421.60
Shoreline Stabilization				**27**								**$385,499.02**
Silt curtain	900	LF	M 31 25 13 10 1100	2	$0.58	$522.00	$0.18	$162.00	$0.41	$369.00	$0.00	$1,053.00
Biaxial Geogrid Reinforcement	964	SY	CH2M HILL CCI Estimate	2	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$6,750.00	$6,750.00
Debris removal to low-tide water line and crushing	2,466	CY	CH2M HILL CCI Estimate	10	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$17,264.83	$17,264.83
Grouting below the low-tide water line	250	CY	CH2M HILL CCI Estimate	3	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$75,000.00	$75,000.00
Rip-rap installation	1,500	CY	CH2M HILL CCI Estimate	7	$8.25	$12,375.00	$7.80	$11,700.00	$19.15	$28,725.00	$0.00	$52,800.00
Transportation for off-site disposal of removed debris	3453	miles	E 33 19 0210	3	$0.00	$0.00	$0.00	$0.00	$2.85	$9,840.95	$0.00	$9,840.95
Off-site disposal fee	2,466	CY	E 33 19 7269	0	$0.00	$0.00	$0.00	$0.00	$90.33	$222,790.25	$0.00	$222,790.25

Table 2-6a
Detailed Cost Estimate of Alternative 2 for Soil and Solid Waste
Site 11 Record of Decision
NSF-IH, Indian Head, Maryland

Construction time:			16 weeks	Operation time:			30 years	Post Remediation Monitoring:	Included in the groundwater monitoring component			
Cost Component	**Qty**	**Unit**	**Cost Source/Assumptions**	**Estimated Activity Duration (day)**	**Labor Unit Cost**	**Labor Total Cost**	**Equipment Unit Cost**	**Equipment Total Cost**	**Material Unit Cost**	**Material Total Cost**	**Subcontractor**	**Total Cost**
Site Restoration and Surface Water Management				**9**								**$52,437.71**
Rip rap , 3' bottom, 3' deep, 2:1 side slope	1,320	LF	E 33 05 0804	7	$3.57	$4,712.40	$5.78	$7,629.60	$24.75	$32,670.00	$0.00	$45,012.00
Hydroseeding	121	M.SF	M 02920 320 2400	2	$11.65	$1,410.56	$6.82	$825.75	$42.86	$5,189.40	$0.00	$7,425.71
MEC Avoidance Survey and Screening (only during intrusive activities)												**$59,597.50**
Mob/Demob	2	person	CH2M HILL Rates		$750.00	$1,500.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1,500.00
OE Avoidance Team	15	day	CH2M HILL Rates		$1,170.10	$17,551.50	$0.00	$0.00	$0.00	$0.00	$0.00	$17,551.50
OE Excavation Team	10	day	CH2M HILL Rates		$1,583.80	$15,838.00	$0.00	$0.00	$0.00	$0.00	$0.00	$15,838.00
OE Disposal Team	10	day	CH2M HILL Rates		$1,468.80	$14,688.00	$0.00	$0.00	$0.00	$0.00	$0.00	$14,688.00
OE Avoidance Equipment	15	day	CH2M HILL Rates		$0.00	$0.00	$85.00	$1,275.00	$0.00	$0.00	$0.00	$1,275.00
OE Avoidance Report												
OE Avoidance Plan (Draft and Final)	1	each	CH2M HILL Rates		$1,000.00	$1,000.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1,000.00
Health and Safety Plan (including briefing)	1	each	CH2M HILL Rates		$1,000.00	$1,000.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1,000.00
After Action Report	1	each	CH2M HILL Rates		$1,600.00	$1,600.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1,600.00
Lodging and Per diem	35	day			$0.00	$0.00	$0.00	$0.00	$147.00	$5,145.00	$0.00	$5,145.00
Abandonment and Installation of Monitoring Wells				**2**								**$2,354.88**
Well abandonment	24	LF	BOA Rates		$0.00	$0.00	$0.00	$0.00	$22.33	$535.92		$535.92
8" Diameter soil boring for well advancement	24	LF	BOA Rates		$0.00	$0.00	$0.00	$0.00	$22.33	$535.92		$535.92
2" diameter, 5' PVC well screen	3	Unit	BOA Rates		$0.00	$0.00	$0.00	$0.00	$37.67	$113.00		$113.00
Installation of flush-mounted covers	3	Unit	BOA Rates		$0.00	$0.00	$0.00	$0.00	$258.33	$775.00		$775.00
Well Development	3	hrs	BOA Rates						$96.67	$290.01		$290.01
Well Installation 2" PVC riser, minimum of 6' per each of the 3 wells to be replaced	9	LF	BOA Rates		$0.00	$0.00	$0.00	$0.00	$11.67	$105.03		$105.03
Construction Oversight												**$122,159.36**
Engineer (P2)	15	weeks	Professional Judgement		$2,450.00	$37,240.00	$0.00	$0.00	$0.00	$0.00	$0.00	$37,240.00
Site Health and Safety (P2)	15	weeks	Professional Judgement		$2,450.00	$37,240.00	$0.00	$0.00	$0.00	$0.00	$0.00	$37,240.00
Superintendent (P3)	15	weeks	Professional Judgement		$3,136.80	$47,679.36	$0.00	$0.00	$0.00	$0.00	$0.00	$47,679.36
Preconstruction Submittals												**$110,738.41**
Preconstruction survey, design basis, pre-draft, draft, and final design, specifications, and H&S plans	1	lump sum	15% of total construction cost		$110,738.41	$110,738.41	$0.00	$0.00	$0.00	$0.00	$0.00	$110,738.41
Draft and Final ESS	1	lump sum	4% of total construction cost		$29,530.24	$29,530.24	$0.00	$0.00	$0.00	$0.00	$0.00	$29,530.24
General Conditions												**$73,825.61**
Decontamination, temp. facilities, sed. & erosion control, temp. fence, etc.	1	lump sum	10% of total construction cost		$73,825.61	$73,825.61	$0.00	$0.00	$0.00	$0.00	$0.00	$73,825.61
Contractor Overhead and Profit												**$110,738.41**
Home office cost, etc.	1	lump sum	15% of total construction cost		$110,738.41	$110,738.41	$0.00	$0.00	$0.00	$0.00	$0.00	$110,738.41
Mob/Demob												**$36,912.80**
Mob & demob of equip & personnel	1	lump sum	5% of total construction cost		$36,912.80	$36,912.80	$0.00	$0.00	$0.00	$0.00	$0.00	$36,912.80
2004 SUBTOTAL CAPITAL COST						**$603,421.04**		**$61,007.62**		**$533,169.83**	**$99,014.83**	**$1,296,613.32**
2007 SUBTOTAL CAPITAL COST (ADJUSTED WITH INFLATION FACTOR)						**$627,557.88**		**$63,447.92**		**$554,496.63**	**$102,975.42**	**$1,348,477.85**
Scope Contingency	20%											**$269,695.57**
Bid Contingency	10%											**$134,847.79**
TOTAL CAPITAL COST												**$1,753,021.21**
OPERATION & MAINTENANCE AND PERIODIC ACTIVITIES - PER EVENT COST												
Cover Maintenance												**$3,306.09**
Biannual mowing - tractor with rotary mower	121	M.SF	M 02935 300 1660		$12.25	$1,483.21	$10.10	$1,222.89	$0.00	$0.00	$0.00	$2,706.09
Biannual inspection	8	hrs	E 99 11 0403		$75.00	$600.00	$0.00	$0.00	$0.00	$0.00	$0.00	$600.00
Cover Repair - every five years												**$35,060.42**
Assume 2% of total capital cost	1	lump sum	Professional Judgment		$35,060.42	$35,060.42	$0.00		$0.00	$0.00	$0.00	$35,060.42
Groundwater Sampling and Analysis												**$10,881.14**
Sample Collection												**$2,629.66**
Sample collection - 2 crew, 10 hrs/day, $50/hr	2	days	Professional Judgment		$1,000.00	$2,000.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2,000.00
Disposable and decon materials per sample	7	samples	E 33 02 0401, 33 02 0402, 33 02 0561		$0.00	$0.00	$0.00	$0.00	$24.90	$174.30	$0.00	$174.30
Equipment Rental	2	days	E 33 02 0573, 33 02 0578		$0.00	$0.00	$227.68	$455.36	$0.00	$0.00	$0.00	$455.36
Lab Analysis (30% QA/QC)												**$3,251.48**
Metals (total and dissolved)	19	samples	BOA Rates		$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2,601.48	$2,601.48
Chloride, nitrite/nitrate, sulfate	10	samples	BOA Rates		$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$650.00	$650.00
Report	1	lump sum	Professional Judgment		$5,000.00	$5,000.00	$0.00		$0.00	$0.00	$0.00	**$5,000.00**
Five-Year Review												**$10,000.00**
Report - Engineer	1	lump sum	Professional Judgment		$10,000.00	$10,000.00	$0.00	$0.00	$0.00	$0.00	$0.00	$10,000.00
Site Closure												**$15,000.00**
Report development	1	lump sum	Allowance		$15,000.00	$15,000.00	$0.00		$0.00	$0.00	$0.00	$15,000.00

Table 2-6b

Present Worth Calculation of RemedialAlternative 2 for Soil and Solid Waste

Site 11 Record of Decision

NSF-IH, Indian Head, Maryland

Location:	Site 11, Caffee Road Landfill, NSF-IH, Indian Head, Maryland	Construction time:	16 weeks
Media:	Soil and Solid Waste - Area A	Operation time:	30 years
		Discount Rate:	5.2%
		O&M Contingency:	20%

Year	Real Cost Incurred	Cost Description	Cost Type	Discount Factor	Present Worth
0	$1,753,021	Cost associated with construction of soil cover system, ICs, planning, and relocation of 3 GW monitoring wells	Capital	1.00	$1,753,021
1	$50,137	Two biannual field inspections, mowings, and quarterly samplings	O&M	1.05	$47,659
2	$50,137	Two biannual field inspections, mowings, and quarterly samplings	O&M	1.11	$45,303
3	$50,137	Two biannual field inspections, mowings, and quarterly samplings	O&M	1.16	$43,063
4	$17,493	Two biannual field inspections, mowings and annual sampling	O&M	1.22	$14,283
5	$62,554	Two biannual field inspections, mowings, 5 year cover repair, groundwater sampling and five year review	O&M, Periodic	1.29	$48,548
6	$6,612	Two biannual field inspections and mowings	O&M	1.36	$4,878
7	$6,612	Two biannual field inspections and mowings	O&M	1.43	$4,637
8	$6,612	Two biannual field inspections and mowings	O&M	1.50	$4,408
9	$6,612	Two biannual field inspections and mowings	O&M	1.58	$4,190
10	$51,673	Two biannual field inspections, mowings, 5 year cover repair, and five year review	O&M, Periodic	1.66	$31,125
11	$6,612	Two biannual field inspections and mowings	O&M	1.75	$3,786
12	$6,612	Two biannual field inspections and mowings	O&M	1.84	$3,599
13	$6,612	Two biannual field inspections and mowings	O&M	1.93	$3,421
14	$6,612	Two biannual field inspections and mowings	O&M	2.03	$3,252
15	$51,673	Two biannual field inspections, mowings, 5 year cover repair, and five year review	O&M, Periodic	2.14	$24,156
16	$6,612	Two biannual field inspections and mowings	O&M	2.25	$2,938
17	$6,612	Two biannual field inspections and mowings	O&M	2.37	$2,793
18	$6,612	Two biannual field inspections and mowings	O&M	2.49	$2,655
19	$6,612	Two biannual field inspections and mowings	O&M	2.62	$2,524
20	$51,673	Two biannual field inspections, mowings, 5 year cover repair, and five year review	O&M, Periodic	2.76	$18,748
21	$6,612	Two biannual field inspections and mowings	O&M	2.90	$2,280
22	$6,612	Two biannual field inspections and mowings	O&M	3.05	$2,168
23	$6,612	Two biannual field inspections and mowings	O&M	3.21	$2,061
24	$6,612	Two biannual field inspections and mowings	O&M	3.38	$1,959
25	$51,673	Two biannual field inspections, mowings, 5 year cover repair, and five year review	O&M, Periodic	3.55	$14,550
26	$6,612	Two biannual field inspections and mowings	O&M	3.74	$1,770
27	$6,612	Two biannual field inspections and mowings	O&M	3.93	$1,682
28	$6,612	Two biannual field inspections and mowings	O&M	4.13	$1,599
29	$6,612	Two biannual field inspections and mowings	O&M	4.35	$1,520
30	$66,673	Two biannual field inspections, mowings, sampling and five year review and site closure.	O&M, Periodic, Site Closure	3.55	$18,774
CAPITAL COST	**$1,753,021**				
2007 Dollar LIFETIME O&M	**$763,277**		**Lifetime Present Worth O&M**		**$437,192**
TOTAL IMPLEMENTATION COST	**$2,516,298**		**TOTAL PRESENT WORTH**		**$2,190,214**

Table 2-7a
Detailed Cost Estimate of RemedialAlternative 2 for Nearshore Sediment
Site 11 Record of Decision
NSF-IH, Indian Head, Maryland

Construction time: 1 week | **Operation time:** 30 years | **Post Remediation Monitoring:** included in the operation time

DESCRIPTION OF ALTERNATIVE:
Removal and offsite disposal of visible loose metal debris within the sediment and crushing concrete rubble on the surface for removal of metal when it is apparent within the concrete (i.e. protruding rebar). Alternative also includes ICs and long term m

Assumptions:

1) Source Control (removal of metal debris on the shoreline) — 10,300.00 square feet; 0.24 acres

2) Annual monitoring of sediment for total metals for 30 years from six locations along the shoreline.

3) All samples would be analyzed for Zinc. — 6 samples

4) Data interpretation and report would be prepared following a sampling event.

4) It is estimated that a percentage of the total area will require concrete to be broken up to remove metal debris (i.e. rebar) that is visible in addition to removal of visible loose metal debris. While it is unlikely that metal bound within the concr — 20%

5) Five-year reviews and a site closure report.

6) Sources of costs are 2004 RS Means Site Work & Landscape Cost Data, RS Means Environmental Remediation Cost Data - Unit Price, vendor quotes, and professional judgment based on similar projects.

7) Sampling includes one year of quarterly sampling, annual sampling in years 2, 3, 4 & 5, and sampling every 5 years thereafter for the remaining timeframe up to 30 years

8) Inflation factor to adjust 2004 cost to 2007 cost: 4% (applied to the total capital cost)

Cost Component	Qty	Unit	Cost Source	Estimated Activity Duration (day)	Labor Unit Cost	Labor Total Cost	Equipment Unit Cost	Equipment Total Cost	Material Unit Cost	Material Total Cost	Subcontractor	Total Cost
CAPITAL COSTS												
Institutional Controls/Planning												**$5,000.00**
Site-Specific LUC	1	lump sum	Professional Judgment		$5,000.00	$5,000.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5,000.00
Permitting, Planning, and Reporting												**$7,500.00**
Health and Safety Plan	1	lump sum	Professional Judgment		$2,500.00	$2,500.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2,500.00
FSP, QAPP, and DQOs	1	lump sum	Professional Judgment		$5,000.00	$5,000.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5,000.00
Site Preparation				**2**								**$2,410.66**
Site clearing (dozer light)	0.24	acre	M 022030 200 0500	1	$239.00	$57.36	$430.00	$103.20	$0.00	$0.00	$0.00	$160.56
Minimum fees		lump sum	10 x cost								$1,605.60	$1,605.60
Survey	1	days	M 01103 700 1100	1	$585.00	$585.00	$59.50	$59.50	$0.00	$0.00	$0.00	$644.50
Excavation and transport of metal debris to offsite landfill				**1**								**$3,730.32**
Landfill Fees	30	ton	Charles County Landfill Fee		$0.00	$0.00	$0.00	$0.00	$65.00	$1,941.55	$0.00	$1,941.55
Dump Truck Transportation Minimum Charge	23	miles										
Minimum fees for hauling soil			E 33 19 0209 13278 8111		$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$735.00	$735.00
Loading soil into truck	30	CY	E 33 19 0150 02225 2332	1	$0.64	$19.12	$1.16	$34.65	$0.00	$0.00	$0.00	$53.77
Minimum fee for soil loading			Professional Judgement		$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1,000.00	$1,000.00
Shoreline Metal Removal				**7**								**$6,984.29**
Site Debris Clean-up & Removal	0.24	Acres	E 01714 0300	1	$179.36	$43.05	$114.34	$27.44	$0.00	$0.00	$0.00	$70.49
Minimum fees		lump sum	30 x clean-up cost		$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2,114.64	$2,114.64
Break Concrete with Air Hammer	76.30	cubic yards	M 02238 0600	4	$24.54	$1,872.31	$6.25	$476.85	$0.00	$0.00	$0.00	$2,349.16
Oversight of Subcontractors (P2)	1	week	Professional Judgement	7	$2,450.00	$2,450.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2,450.00
Summary of Construction Costs												$25,625.27
General Conditions												**$2,562.53**
Decontamination, temp. facilities, sed. & erosion control, temp. fence, etc.	1	lump sum	10% of total construction cost		$2,562.53	$2,562.53	$0.00	$0.00	$0.00	$0.00	$0.00	$2,562.53
Contractor Overhead and Profit												**$2,562.53**
Home office cost, etc.	1	lump sum	15% of total construction cost		$3,843.79	$3,843.79	$0.00	$0.00	$0.00	$0.00	$0.00	$3,843.79
Mob/Demob												**$2,562.53**
Mob & demob of equip & personnel	1	lump sum	10% of total construction cost		$2,562.53	$2,562.53	$0.00	$0.00	$0.00	$0.00	$0.00	$2,562.53
SUBTOTAL CAPITAL COST						**$26,495.68**		**$701.64**		**$1,941.55**	**$5,455.24**	**$34,594.11**
2007 SUBTOTAL CAPITAL COST (ADJUSTED WITH INFLATION FACTOR)						**$27,555.51**		**$729.71**		**$2,019.21**	**$5,673.45**	**$35,977.88**
Scope Contingency	25%											**$8,648.53**
Bid Contingency	10%											**$3,459.41**
TOTAL CAPITAL COST												**$48,085.81**
OPERATION & MAINTENANCE AND PERIODIC ACTIVITIES - PER EVENT COST												
Sampling and Analysis												
Sample Collection												**$2,654.56**
Sample collection - 2 crew, 10 hrs/day, $50/hr	2	days	Professional Judgment		$1,000.00	$2,000.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2,000.00
Disposable and decon materials per sample	8	samples	E 33 02 0401, 33 02 0402, 33 02 0561		$0.00	$0.00	$0.00	$0.00	$24.90	$199.20	$0.00	$199.20
Equipment Rental	2	days	E 33 02 0573, 33 02 0578		$0.00	$0.00	$227.68	$455.36	$0.00	$0.00	$0.00	$455.36
Lab Analysis												**$196.56**
Metals by graphite furnace (individual element) (7000 series)	8	samples	BOA Rates 2005		$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$196.56	$196.56
Data Interpretation												**$1,750.00**
Report	1	lump sum	Professional Judgment		$1,750.00	$1,750.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1,750.00
Five-Year Review												**$6,000.00**
Report	1	lump sum	Professional Judgment		$5,000.00	$5,000.00	$0.00	$0.00	$0.00	$0.00	$0.00	$5,000.00
Field Inspection	1	lump sum	Professional Judgment		$1,000.00	$1,000.00	$0.00	$0.00		$0.00	$0.00	$1,000.00
Site Closure												**$15,000.00**
Report development	1	lump sum	Professional Judgment		$15,000.00	$15,000.00	$0.00	$0.00	$0.00	$0.00	$0.00	$15,000.00

Table 2-7b
Present Worth Calculation of RemedialAlternative 2 for Nearshore Sediment
Site 11 Record of Decision
NSF-IH, Indian Head, Maryland

Location:	Site 11, Caffee Road Landfill, NSF-IH, Indian Head, Maryland	Construction time:	1 week
Media:	Sediment	Operation time:	30 years
		Discount Rate:	5.2%
		O&M Contingency:	20%

Year	Real Cost Incurred	Cost Description	Cost Type	Discount Factor	Present Worth
0	$48,086	Capital cost	Capital	1.00	$48,086
1	$18,404	Quarterly sediment sampling for zinc	O&M	1.05	$17,495
2	$4,601	Annual sampling	O&M	1.11	$4,157
3	$4,601	Annual sampling	O&M	1.16	$3,952
4	$4,601	Annual sampling	O&M	1.22	$3,757
5	$10,601	Annual sampling and five-year review	O&M, Periodic	1.29	$8,228
6	$0	Annual sampling	NA	1.36	$0
7	$0	Annual sampling	NA	1.43	$0
8	$0	Annual sampling	NA	1.50	$0
9	$0	Annual sampling	NA	1.58	$0
10	$10,601	Annual sampling and five-year review	O&M, Periodic	1.66	$6,385
11	$0	Annual sampling	NA	1.75	$0
12	$0	Annual sampling	NA	1.84	$0
13	$0	Annual sampling	NA	1.93	$0
14	$0	Annual sampling	NA	2.03	$0
15	$10,601	Annual sampling and five-year review	O&M, Periodic	2.14	$4,956
16	$0	Annual sampling	NA	2.25	$0
17	$0	Annual sampling	NA	2.37	$0
18	$0	Annual sampling	NA	2.49	$0
19	$0	Annual sampling	NA	2.62	$0
20	$10,601	Annual sampling and five-year review	O&M, Periodic	2.76	$3,846
21	$0	Annual sampling	NA	2.90	$0
22	$0	Annual sampling	NA	3.05	$0
23	$0	Annual sampling	NA	3.21	$0
24	$0	Annual sampling	NA	3.38	$0
25	$10,601	Annual sampling and five-year review	O&M, Periodic	3.55	$2,985
26	$0	Annual sampling	NA	3.74	$0
27	$0	Annual sampling	NA	3.93	$0
28	$0	Annual sampling	NA	4.13	$0
29	$0	Annual sampling	NA	4.35	$0
30	$15,000	Annual sampling and site closure.	O&M, Periodic, Site Closure	4.58	$3,278
CAPITAL COST	**$48,086**				
2005 Dollar LIFETIME O&M	**$120,256**		**Lifetime Present Worth O&M**		**$70,847**
TOTAL IMPLEMENTATION COST	**$168,342**		**TOTAL PRESENT WORTH**		**$118,933**

TABLE 2-8
Chemical-Specific ARARs
Site 11 Record of Decision
NSF-IH, Indian Head, Maryland

Chemicals & Relevant Media	Requirement	Prerequisites	Citation	ARAR or TBC	Comments
Groundwater, residential water supplies	Meet National Primary DrinkingStandards for maximum contaminant levels (MCLs).	Drinking water source or potential potable source	Safe Drinking Water Act (SDWA): 40 CFR 141.62 National Primary Drinking Water Regulations for inorganics	Relevant and appropriate	MCLs are considered in the determination of SRGs for Site 11 groundwater.
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 antidegradation of the State's surface water.	Activities that will pollute the State's surface waters	COMAR 26.08.02.04-1 antidegradation policy, 26.08.02.13 (general water quality certification for placement of rip rap for shoreline protection) (Mattawoman Creek is a Tier II water body per MD regulations)	Relevant and appropriate	Necessary measures will be implemented during the remediation activities to minimize impact to surface water quality.

Notes:
The chemical-specific ARARs are the substantive requirements included in the regulations cited in this table.

ARAR - Applicable or relevant and appropriate requirement
RCRA - Resource Conservation and Recovery Act
CFR - Code for Federal Regulations
CWA - Clean Water Act
EPA - U.S. Environmental Protection Agency
OSHA - Occupational Safety and Health Administration
CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act
SDWA - Safe Drinking Water Act
SMCLs - Secondary Maximum Contaminant Levels
TBC - To be considered

TABLE 2-9
Location-Specific ARARs and Performance Standards
Site 11 Record of Decision
NSF-IH, Indian Head, Maryland

Location	Requirement	Prerequisite	Citation	Applicability Determination	Comments
Federal Location-Specific ARARs					
Fish and Wildlife Coordination Act					
Area affecting streams or other water body	The Fish and Wildlife Coordination Act requires Federal agencies involved in actions that will result in the control or structural modification of any natural stream or body of water for any purpose, to take action to protect the fish and wildlife resources which may be affected by the action. The responsible official shall consult with the Fish and Wildlife Service and the appropriate State agency to ascertain the means and measures necessary to mitigate, prevent, and compensate for project-related losses of wildlife resources and to enhance the resources. Reports and recommendations of wildlife agencies should be incorporated into the environmental assessment or environmental impact statement. Consultation procedures are detailed in 16. U.S.C. 662.	Diversion, channeling or other activity that modifies a stream or other water body and affects fish or wildlife.	16 U.S.C. 662(a),(b) *et seq*	Selected Performance Standard	Response actions will incorporate protection for any area water body, wetlands, or protected habitats.
Executive Order 11990, Protection of Wetlands					
Wetland	Executive Order 11990, Protection of Wetlands, requires Federal agencies conducting certain activities to avoid, to the extent possible, the adverse impacts associated with the destruction or loss of wetlands if a practicable alternative exists. EPA's Statement of Procedures on Floodplain Management and Wetlands Protection (dated January 5, 1979) requires EPA programs to determine if proposed actions will be in or will affect wetlands. If so, the responsible official shall prepare a floodplains/wetlands assessment, which will be part of the environmental assessment or environmental impact statement. The responsible official shall either avoid adverse impact or minimize them if no practicable alternative to the action exists.	Wetlands as defined by Executive Order 11990 Section 6.	E.O 11990	Selected Performance Standard	This regulation may be an ARAR for activities occurring in areas that meet the definition of a wetland. Remedial activities must 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 6.	40 CFR 230.10; 40 CFR 231 (231.1, 231.2, 231.7)	Applicable	Wetlands and navigable waters are present in the vicinity of Site 11. Remedial activities will comply with the requirements of this section of the Clean Water Act.

TABLE 2-9
Location-Specific ARARs and Performance Standards
Site 11 Record of Decision
NSF-IH, Indian Head, Maryland

Location	Requirement	Prerequisite	Citation	Applicability Determination	Comments
Executive Order 11988, Protection of Floodplains					
Within floodplain	Executive Order 11988, Floodplain Management, requires Federal agencies to evaluate the potential effects of actions they may take in a floodplain to avoid, to the extent possible, adverse effects associated with direct and indirect development of a floodplain. EPA's Statement of Procedures on Floodplain Management and Wetlands Protection (dated January 5, 1979), requires EPA programs to determine whether an action will be located in or will affect a floodplain. If so, the responsible official shall prepare a floodplain/wetlands assessment. The assessment will become part of the environmental assessment or environmental impact statement. The responsible official shall either avoid adverse impacts or minimize them if no practicable alternative exists.	Action that will occur in a floodplain, i.e., lowlands, and relatively flat areas adjoining inland and coastal waters and other flood-prone areas.	E.O 11988	Selected Performance Standard	Portions of Site 11 are within the 100-year flood zones, therefore the requirements of this regulation are applicable for any response actions that might involve the use of these areas.
State Location-Specific ARARs					
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.	COMAR 26.08.02.02 (Designated Uses),	Applicable	Fish species inhabit Mattawoman Creek. If response actions affect these species, the requirements of this title are applicable.
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.	COMAR 26.08.02 COMAR 26.08.03.01	Applicable	Wildlife species are present at NSF-IH. If response actions may affect these species, the requirements of this title are applicable.
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 26.23.02.01 (substantive requirements of application), 26.23.02.04 (criteria), 26.23.03.01-02 (letter of exemption)	Applicable	Nontidal wetlands are present at Site 11.
Hazardous Waste Control Act (HWCA)					
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.	COMAR 26.13.05.02-1	Relevant and Appropriate	Portions of Site 11 are within the 100-year flood zones. However, actions are not expected to involve hazardous waste.
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 26.17.04	Applicable	Any remedial actions involving alteration to the streams bounding Site 11 or floodplains (including temporary construction) are subject to these requirements.
Maryland Tidal Wetland Act					
Tidal Wetlands	Requirements for filling, construction, and dredging of open water and vegetated wetlands and marsh establishment.	Activities that affect tidal wetlands	COMAR 26.24.03	Applicable	Wetlands (tidal and nontidal) are present at Site 11. The requirements of this title are applicable for any response actions that may affect the integrity of these wetlands.

Notes:
The location-specific ARARs are the substantive requirements included in the regulations cited in this table.

ARARs - Applicable or relevant and appropriate requirements.
RCRA - Resource Conservation and Recovery Act.
CFR - Code of Federal Regulations.
CWA- Clean Water Act.
COMAR - Code of Maryland Regulations

TABLE 2-10
Action-Specific ARARs
Site 11 Record of Decision
NSF-IH, Indian Head, Maryland

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comments
Federal Action-Specific ARARs					
Resource Conservation and Recovery Act (RCRA) 42 USC 6901 et seq.					
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	Applicable	Applicable to disposal of soil to a new location and placement in or on land containing land-disposal-restricted RCRA hazardous waste. The wastes generated from response actions at Site 11 NSF-IH may be RCRA hazardous wastes.
State Action-Specific ARARs					
Maryland Hazardous Waste Regulations					
Storage, treatment or disposal, and transportation of hazardous waste	Regulations and procedures for the identifications, listing, transportation, treatment, storage, and disposal of hazardous wastes must be met.	Handling of hazardous wastes	COMAR 26.13.01 through COMAR 26.13.03 COMAR 26.13.05 COMAR 26.13.10	Applicable	Any hazardous waste found during site remediation will be disposed of according to regulations. Any residues or by-products from treatment systems that are hazardous must be disposed of properly.
Solid Waste Management - Landfill Closure					
Sanitary Landfill Closure	Requirments for landfill closure	Design specifications of various closure caps	COMAR 26.04.07.21	Applicable	The requirements of this regulation are applicable for the design of the soil cover and the impermeable cap to address the solid waste and soil at Site 11.
Solid Waste and Water Supply Regulations					
Well Construction and Abandonment	Specifications for well construction and abandonment must be met. Also provides a mechanism to provide the State of Maryland with a database of existing and abandoned wells.		COMAR 26.04.04.02 through 26.04.04.05; COMAR 26.04.04.07-.08; COMAR 26.04.04.10 - .11	Applicable	Applicable for the abandonment and installation of monitoring wells as part of the remedy to be implemented at Site 11.
Stormwater Management					
Design and construction	Regulations require the design and construction of a system necessary to control stormwater.	Design and construction activities	COMAR 26.17.02.02 (definitions), 26.17.02.06 (min. control requirements), 26.17.02.08 (stormwater management measures), 26.17.02.09 (stormwater management plans)	Applicable	The remedial action will incorporate measures to control and manage stormwater as necessary.

TABLE 2-10
Action-Specific ARARs
Site 11 Record of Decision
NSF-IH, Indian Head, Maryland

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comments
Erosion and Sediment Control					
Land clearing, grading, and earth disturbances	Regulations require the preparation and implementation of a plan to control erosion and sediment for activities involving land clearing, and grading and earth disturbances. Erosion and sediment control criteria are also established.	Land clearing, grading, and earth disturbances	COMAR 26.17.01.01 (definitions); 26.17.01.05 (activities for which erosion and sediment control plans required); 26.17.01.07(B) & (C) (substantive standards /information required in applications); and 26.17.01.11 (design standards)	Applicable	The 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 Commission's erosion- and sedimentation-control regulations.
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 people in the State of Maryland. The maximum permitted levels for construction activities may not exceed 90 dBA during the day and 75 dBA during night.	Action that will generate noise	COMAR 26.02.03.02A (2) and B(2), COMAR 26.02.03.03A	Applicable	During site remediation work, the maximum allowable noise levels will not be exceeded at site boundaries.
Air Quality					
Actions that involve emissions to air	Provides ambient air quality standards, general emissions standards, and restrictions for air emissions from construction activities, vents, and treatment technologies such as incinerators. Also includes nuisance and odor control. Construction activities may emit particulate matter into the ambient air. Remedial activities must follow regulations.	Actions that involve emissions specifically particulates to air above specific limits.	COMAR 26.11.06.03	Applicable	May apply to earthwork activities that potentially generate particulate emissions.

Notes:
The action-specific ARARs are the substantive requirements included in the regulations cited in this table.

Statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs. Specific potential ARARs are addressed in the table below each heading.

Acronyms used in the table:
ARAR - Applicable or relevant and appropriate requirement
CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act
CFR - Code for Federal Regulations
COMAR - Code of Maryland Regulations
dBA - deciBell
NSF-IH - Naval Support Facility, Indian Head

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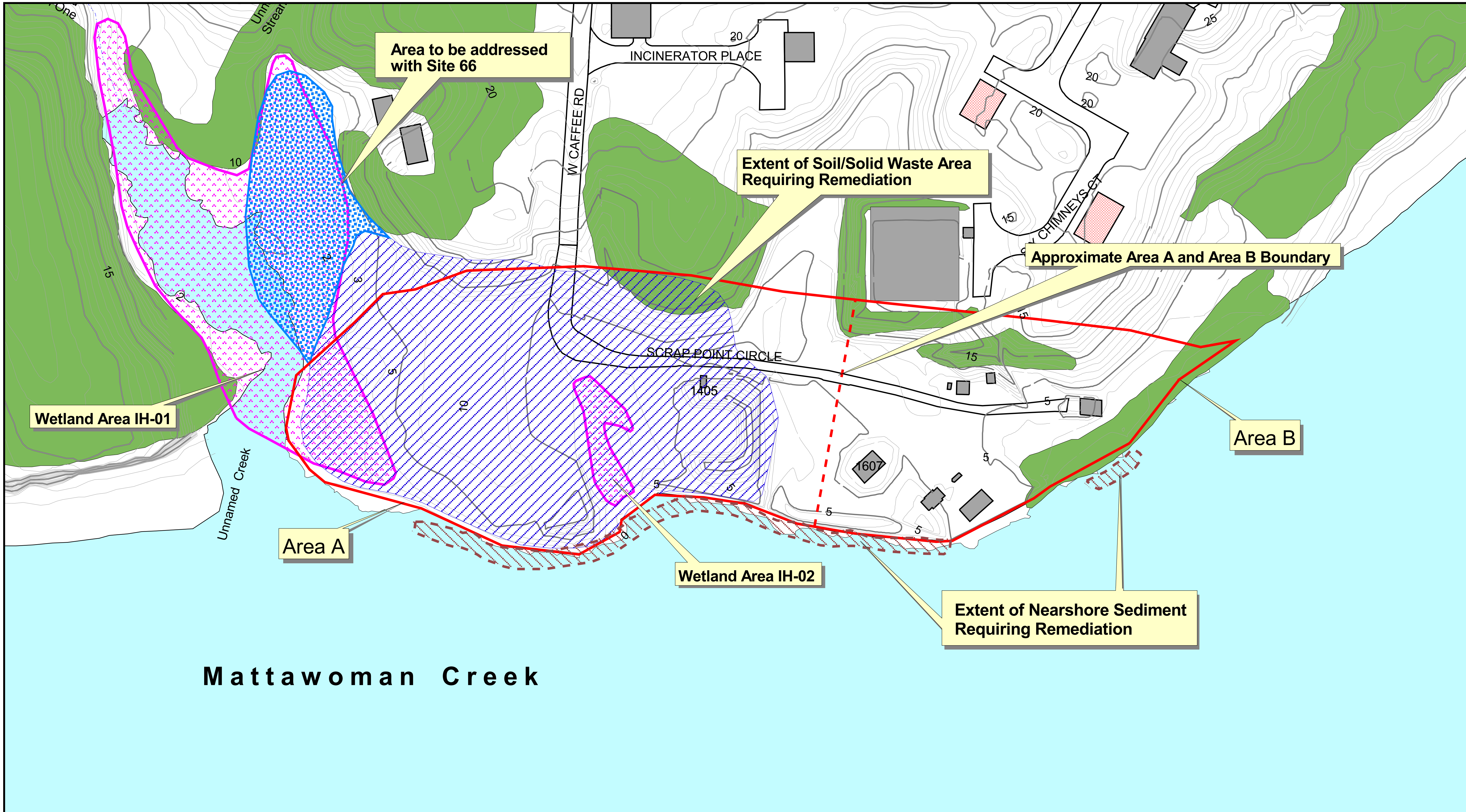

LEGEND

- Approximate Site Boundary
- Limits of Waste
- Area to be addressed with Site 66
- Wetland Area
- Sediment Area of Attainment
- Wooded Area
- Buildings
- Demolished Buildings
- Boundary between Area A and Area B
- Topographic Index Contours (5 foot Interval)
- Stream
- Roads

5.5 = Estimated Thickness of Waste (feet)

N

0 50 100 Feet

1 inch = 100 feet

Figure 2-1
Site Layout
Site 11 Record of Decision
NSF-IH, Indian Head, Maryland

CH2MHILL

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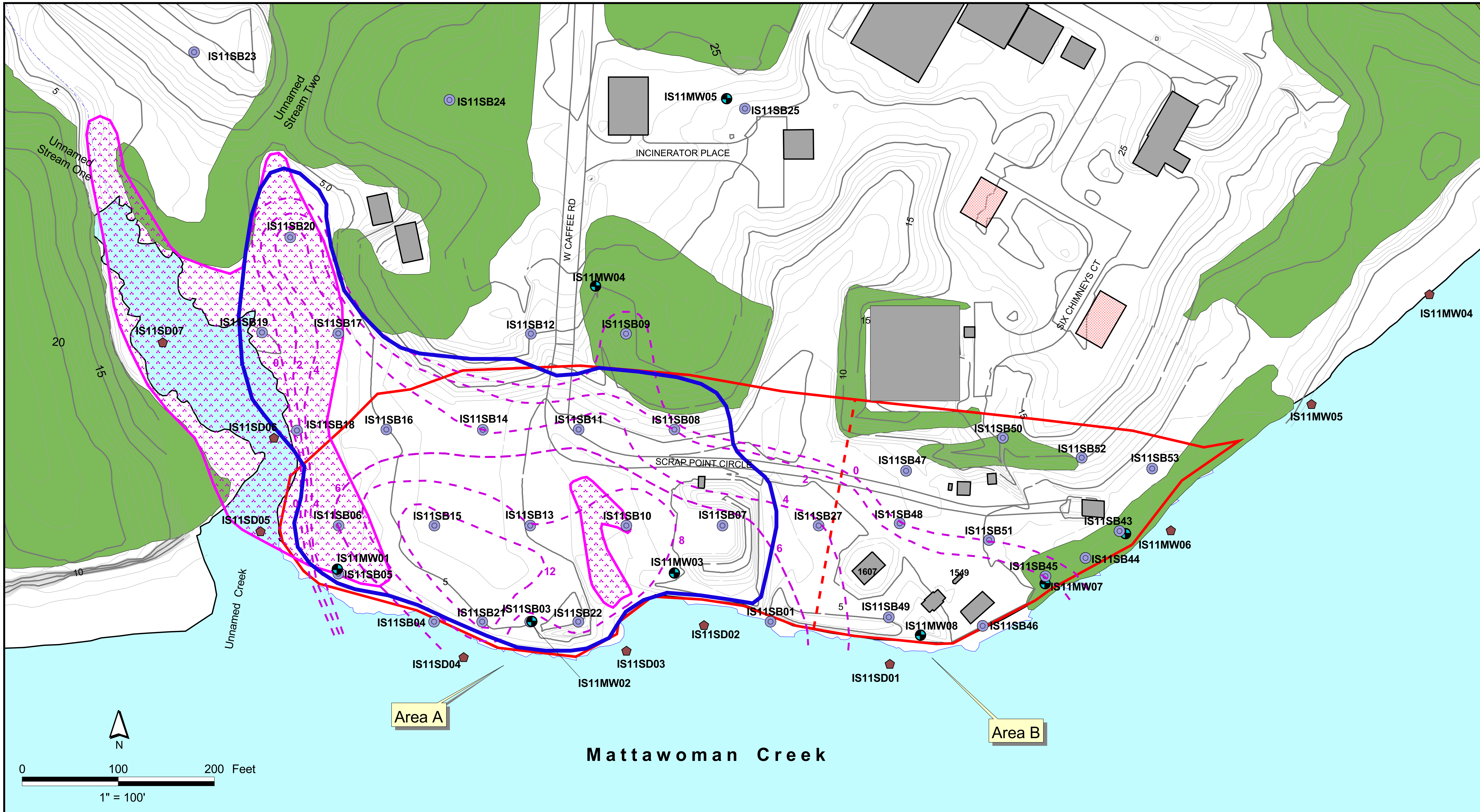

LEGEND

- Monitoring Well Location
- Soil Boring Location
- Sediment Sample Location
- Stream
- Approximate Site Boundary
- Buildings
- Demolished Buildings
- Extent of Solid Waste Requiring Remediation (Based on the Final RI)
- Contour of Equal Fill Thickness (feet)
- Roads
- Topographic Contours (5 foot Intervals)
- Topographic Index Contours (1 foot Intervals)
- Wetland Areas
- Wooded Area

Notes:
Fill depth based on native/fill contact called out in Boring Logs.
Solid waste determined by the presence of all material except wood, concrete, and brick.

Figure 2-2
Extent of Fill and Solid Waste Post 2001 Regrading
Site 11 Record of Decision
NSF-IH, Indian Head, Maryland

CH2MHILL

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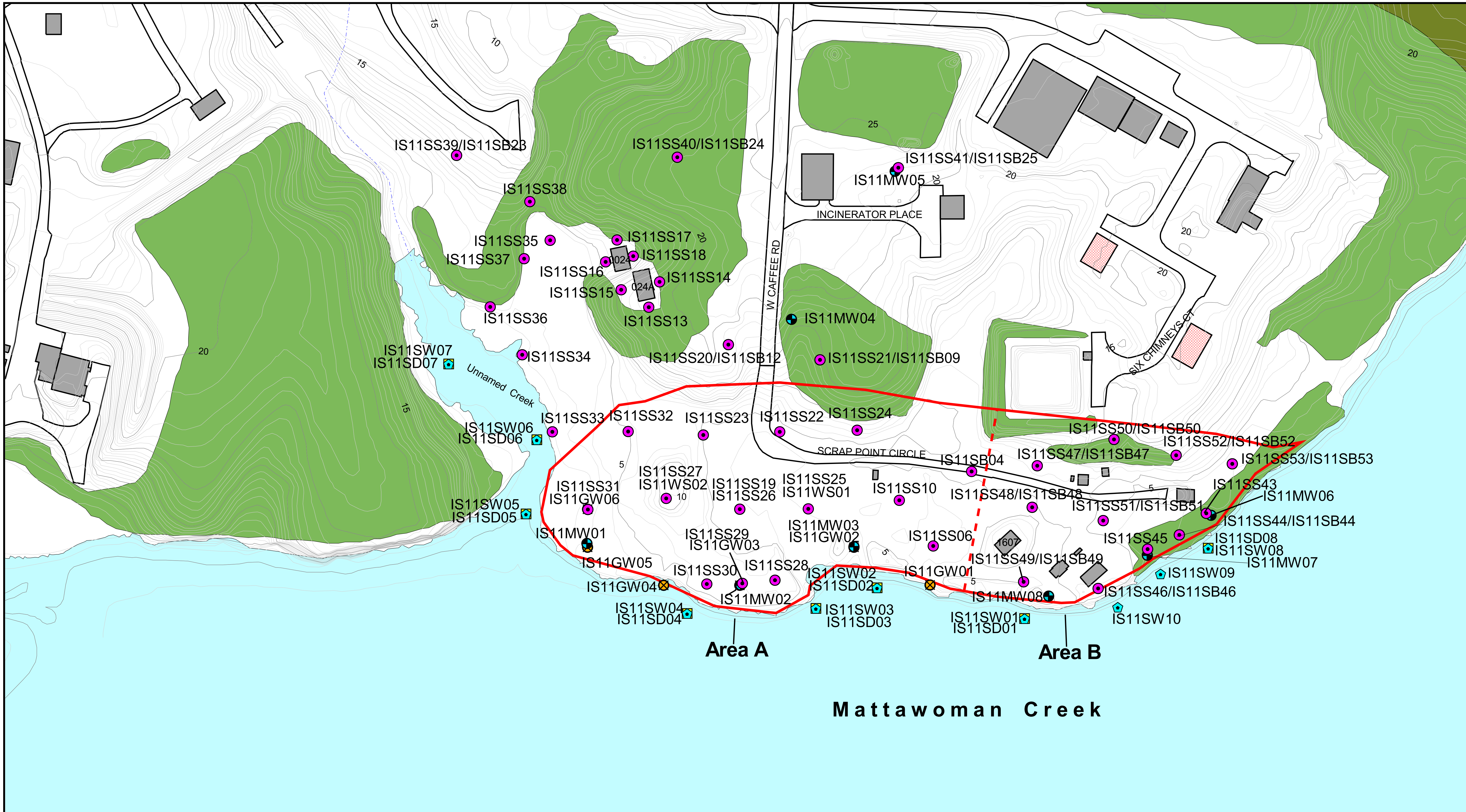


LEGEND

- Soil or Waste Samples
- Surface Water
- Sediment Samples
- Monitoring Wells
- *In Situ* Ground Water
- Road
- Drainage Ditch
- 5-foot Topographic Contours
- 1-foot Topographic Contours
- Boundary Between Area A and Area B
- Approximate Site Boundary
- Demolished Buildings
- Buildings
- Wooded Area
- Dense Wooded Area

-- Area A Sampled July 20, 2000 - August 9, 2000

-- Area B Sampled February 25, 2002 - March 26, 2002

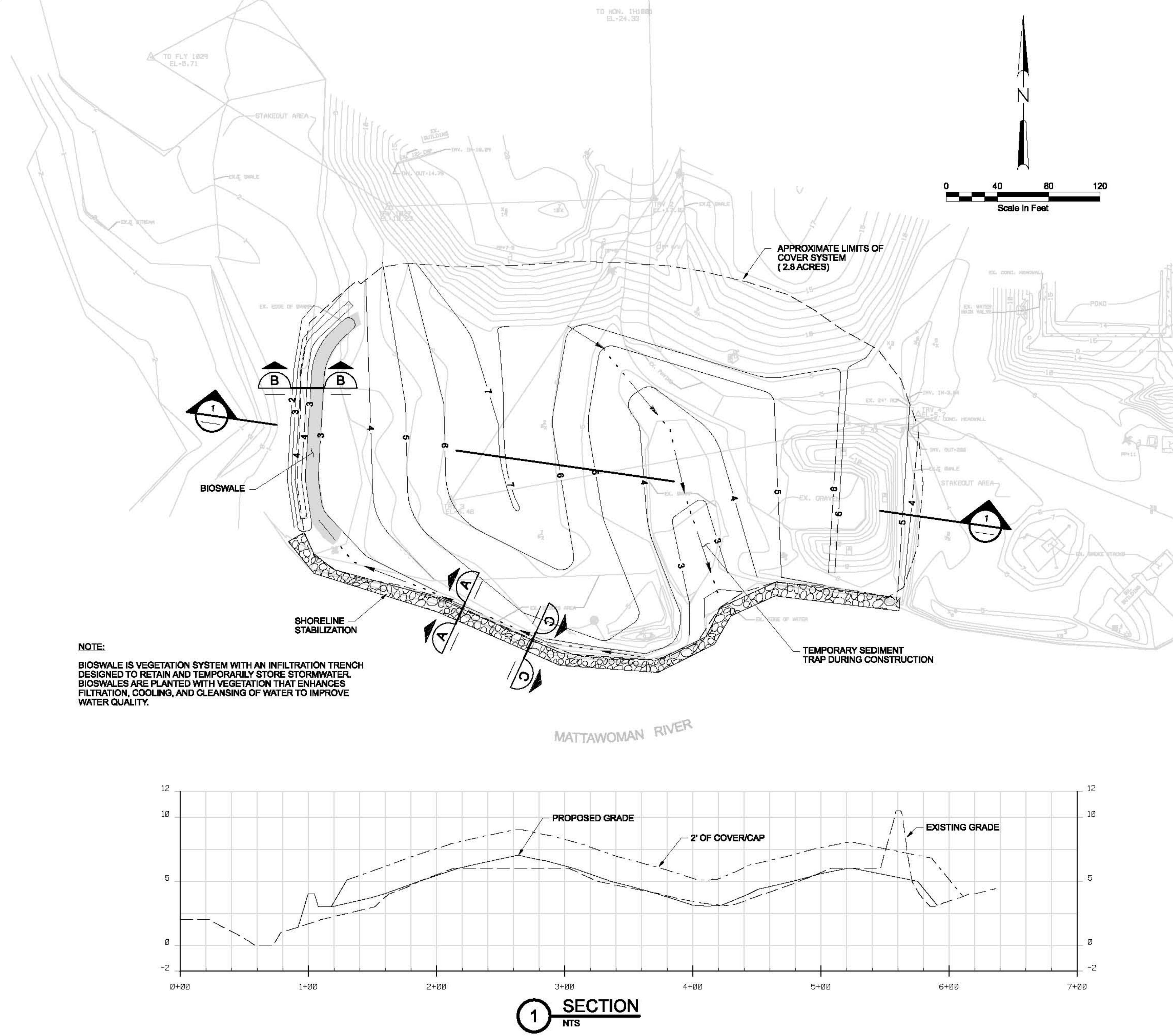
N

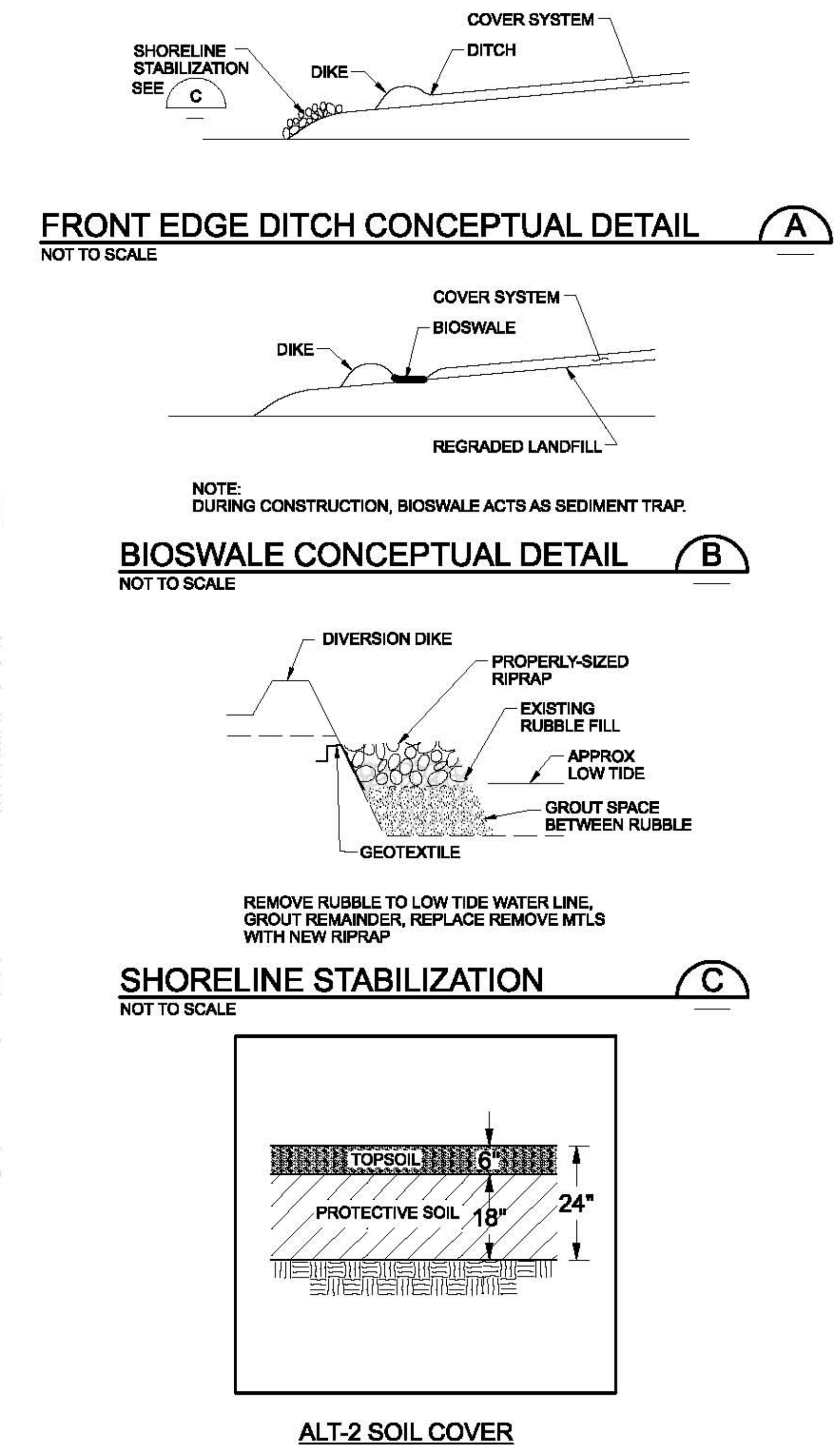
0 62.5 125 Feet

1 inch = 125 feet

Figure 2-3
Site 11 Sampling Locations
Site 11 Record of Decision
NSF-IH, Indian Head, Maryland

CH2MHILL





AREA

SOIL COVER/CAP = 121078 SF (2.8 ACRES)

GRADING VOLUMES

CUT VOLUME= 913 CY
FILL VOLUME = 976 CY
(TO CREATE THE BASE GRADE FOR LANDFILL COVER/CAP)

2 FEET OF COVER = 8969 CY

Figure 2-4
Conceptual Design of Alternative 2 for Soil and Solid Waste
Site 11 Record of Decision
NSF-IH, Indian Head, Maryland

CH2MHILL

Photograph 1 – Northern View of Area A Shoreline from Mattawoman Creek

Photograph 2 – Northern View of Area B Shoreline from Mattawoman Creek

SECTION 3

Responsiveness Summary

This Responsiveness Summary represents a concise and complete summary of significant comments received from the public on the Proposed Plan and includes responses to these comments. It was prepared after the public comment period ended on September 23, 2008, in accordance with guidance in *Community Relations in Superfund: A Handbook* (EPA, 1992). This Responsiveness Summary provides the decision maker with information about the views of the community. It also documents how the Navy, EPA, and MDE considered public comments during the decision making process and provided answers to major comments.

3.1 Stakeholder Comments and Lead Agency Responses

The 30-day public comment period for the Selected Remedy for Site 11 began on August 25, 2008, and ended on September 23, 2008. A public meeting was held on September 18, 2008 at the Indian Head Senior Center, 100 Cornwallis Square, Indian Head, Maryland, to accept oral and written comments on this decision. The list of attendees of the public meeting is included in Appendix B.

Comments are received from Mr. Elmer Biles, a Restoration Advisory Board member on September 22, 2008. The comments and responses thereto are summarized in Table 3-1.

3.2 Technical and Legal Issues

No technical or legal issues have been identified for Site 11 with respect to this ROD.

TABLE 3-1
Responses to Public Comments
Site 11 Record of Decision
NSF-IH, Indian Head, Maryland

No.	Comment	Responses
1.	The proposed plan (Alternative 2) calls for a "long-term" groundwater monitoring. (The text indicates that monitoring is **required** as an Institutional Control since there is a soil cover or capping remedy. Why?)	The Code of Maryland Regulations (COMAR) 26.04.07.22, Sanitary Landfills--Post-Closure Monitoring and Maintenance stipulates that landfills in Maryland shall be subject to post-closure monitoring and maintenance by the permittee as specified in this regulation, for a period of time not less than 5 years after the complete installation of the landfill cap. This time period may be extended by the Department if significant maintenance situations occur at the landfill during the 5-year period after closure.
	What do we mean by "long term"?	Long-term groundwater monitoring as described in the Site 11 remedies and for the purpose of the remedy cost estimate assumes 5 years. The details of "long-term monitoring" will be outlined in a Long-term Monitoring Plan, which will be prepared after the record of decision has been signed.
	Is the estimated cost for the "long term" included in the Total Present Worth Cost? What is the cost for the "long-term groundwater monitoring"?	The cost for "long term" is included in the Total Present Worth Cost. The cost for "long-term groundwater monitoring" for 5 years is approximately $183,000 in 2007/2008 dollars or $162,500 in present worth. Per EPA guidance for conducting an RI/FS (EPA, 1988) and preparing the FS cost estimate (EPA, 2000), the accuracy of the FS cost estimate ranges between -30 and +50 percent because the cost is based on a conceptual design. The actual cost will be determined during the remedial design.
	Incidentally how do we define Present Worth Cost?	Present worth cost is the dollar amount needed to be set aside at an initial point in time (base year) to assure that funds will be available in the future as they are needed, assuming certain economic conditions.
2.	Staff present at the Thursday Public meeting stated that the cost ($80,000) for five years of groundwater monitoring on a quarterly basis are included in the cost estimate. Does this mean that the funding received for this project is good for five years?	Please refer to the response to Comment #1. The FS-level cost estimate as described in the response to Comment #1 was based on the conceptual remediation design. The Navy will use the cost estimate as a basis for future budgetary planning. During the remedial design phase, the design of the remedy including the long-term operation and maintenance and monitoring cost will be refined. Therefore, the Navy will fund the long-term monitoring cost for Site 11 after the remedial design is complete, which is anticipated in 2009. At that time, based on the risks posed by other sites at NSF-IH, the Navy may fund the 5-year groundwater monitoring cost in its entirety or partially.
3.	How many wells are planned for the groundwater monitoring? Will monitoring include measuring the contamination run off into Mattawoman Creek?	Seven monitoring wells will be used for long-term groundwater monitoring following construction of the soil cover and shoreline. No, monitoring for measuring the contamination run off into Mattawoman Creek will not be included because the contamination runoff into the Creek is not anticipated.

No.	Comment	Responses
4.	Since the report concludes that groundwater remediation is not warranted (page 8), why are we spending so much money on monitoring?	Please refer to the response to Comment #1. Groundwater monitoring is required by State Regulations.
5.	How many Sites do we have at Indian Head that are requiring groundwater remediation, wherein the objective is to have the quality of groundwater safe for ingestion by humans? To what extend are these required by either the U.S. Environmental Protection Agency or the Maryland Department of the Environment?	There are 4 sites at NSF-IH that are currently undergoing remedial alternative evaluation or have an ongoing remediation for the shallow groundwater. Although the shallow groundwater is not a potable water source and its future use is anticipated to remain unchanged, to the extent practicable, the remediation objective for the shallow groundwater is to return the groundwater to its beneficial use, as mandated by the State of Maryland and the Environmental Protection Agency.
	As I have suggested in prior correspondence I believe we should simply prohibit/restrict the use of groundwater for human or animal consumption from any source or location within the Restricted Area at Indian Head. We do not know the total extent of contamination within this area and I think it would pose a Potential Health Hazard to think at any time we have. More than 50% of residential water is supplied by the Charles County Municipal System and the balance is almost totally supplied by residential wells drilled into deep aquifers. The use of shallow groundwater for residential use is almost a thing of the past.	The Navy does not currently use shallow groundwater at NSF-IH as a potable water source and does not intend to use it as a potable water source in the future. Although the entire NSF-IH facility is a Superfund site, there are currently only 12 sites that have impacted or have the potential to impact shallow groundwater at NSF-IH and the Annex at Stump Neck. Most of these sites range in size from less than 1 acre up to 5 acres, and the impacted or potentially impacted groundwater from these sites represents a small portion of the total shallow groundwater at NSF-IH. Therefore, the Navy does not want to restrict use of all shallow groundwater at the facility in the rare case that a need arises that could be satisfied from using shallow groundwater.
	If there are federal or state requirements that impose that groundwater for all sites must be at a quality for human consumption I think we should request an exception for the Restricted Area of Indian Head. We do have a responsibility, however, to see to it that in doing so we do not impose additional pollution on Mattawoman Creek.	The beneficial use of the groundwater is typically assumed to be as a potable water source; therefore the federal drinking water standard (or referred to as maximum contaminant levels) which is also adopted by the State is used as the cleanup goals for remediating the shallow groundwater. The practicality and feasibility of reaching these cleanup goals, however, will be evaluated throughout the remedy implementation. If it is considered impractical or infeasible to achieve these goals, EPA and MDE may consider waiving the achievement of the goals on technical impracticability grounds. At all sites, during the remedy implementation, land use control measures to restrict the use of the groundwater for potable use will be enforced.
6.	In reviewing the details proposed for Alternative 2 for Area B, I would suggest that in addition to prohibiting vessel anchoring and establishing a no-wake zone that swimming also be prohibited.	Comment noted. Prohibition for swimming will be incorporated into Alternative 2 for the nearshore sediment adjacent to Area B.

SECTION 4

References

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Appendix A
MDE Variance Letter Pursuant to COMAR 26.04.07.21

MDE

MARYLAND DEPARTMENT OF THE ENVIRONMENT
1800 Washington Boulevard • Baltimore MD 21230
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Martin O'Malley
Governor

Anthony G. Brown
Lieutenant Governor

Shari T. Wilson
Secretary

Robert M. Summers, Ph.D.
Deputy Secretary

August 22, 2008

Mr. Joseph Rail, P.E.
NAVFAC Washington
Washington Navy Yard, Bld. 212
1314 Harwood Street SE
Washington, DC 20374-5018

Re: NSF Indian Head Caffee Road Landfill (Site 11) Request for Variance, letter dated July 23, 2008

Dear Mr. Rail:

The Federal Facilities Division (FFD) of the Maryland Department of the Environment's (MDE) Hazardous Waste Program has completed its review of the above referenced letter. This letter describes the Navy's proposed final remedy for Site 11, which is a former disposal area in the restricted area of the Naval Support Facility Indian Head. The proposed final remedy for Site 11 is a permeable soil cover over the landfill area, soft shoreline stabilization, institutional controls with groundwater restrictions, and long-term monitoring . The Navy is conducting this action in compliance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

The proposed remedy requires a variance to the State's landfill closure regulations for landfills, which are Applicable or Relevant and Appropriate Requirement under CERCLA. The FFD in consultation with MDE's Solid Waste Program has reviewed the proposed action and the requested variance. If implemented and monitored adequately, the proposed remedy should be as protective as the State's landfill closure regulations as stated in Code of Maryland Regulations (COMAR) 26.04.07.10 and 26.04.07.21. Consequently, in accordance with the variance provision contained in COMAR 26.04.07.26, the Navy's request for a variance will be considered favorably if the following conditions are adequately addressed in the Record of Decision for this site:

i. The permeable cover must be constructed of 18 inches of clean fill and 6 inches of top soil or top soil created using Class "A" pelletized sewage sludge per COMAR 26.04.07.

ii. Long-term operations and maintenance activities will be implemented to protect the integrity of the permeable cover and soft shoreline with monitoring adequate to meet the needs of the FFD.

iii. Long-term monitoring of groundwater will be implemented to monitor the effectiveness of the permeable cover at Site 11 and to evaluate the potential migration of contaminants toward Mattawoman Creek. Again this monitoring program must meet the needs of the FFD in evaluating the adequacy of the remedy and the continued use of the variance provision contained in COMAR.

If you have any questions, please contact me at (410) 537-3791.

Sincerely,

Curtis DeTore
Section Head
Federal Facilities Division

CD:cd

cc: Mr. Dennis Orenshaw
Mr. Horacio Tablada
Mr. Harold L. Dye, Jr.
Mr. Edward Dexter

Appendix B
Public Meeting Attendees List

INDIAN HEAD - SITE 11 PUBLIC MEETING SIGN-IN

NAME	ORGANIZATION	PHONE #	EMAIL ADDRESS
NATHAN DELONG	NAVY	202-685-3279	nathan.delong@navy.mil
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