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RECORD OF DECISION SITE 28 ORIGINAL BURNING GROUND NSWC INDIAN HEAD MD
01/01/2014
NAVAL SUPPORT ACTIVITY SOUTH POTOMAC

# RECORD OF DECISION

## Site 28 - Original Burning Ground
## for
## Naval Support Facility Indian Head
## Indian Head, Maryland

## January 2014

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# Acronyms and Abbreviations

| | |
|---|---|
| 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 |
| CFR | Code of Federal Regulations |
| COC | constituent of concern |
| COPC | constituent of potential concern |
| CSM | conceptual site model |
| CTE | central tendency exposure |
| DPT | direct-push technology |
| EE/CA | Engineering Evaluation/Cost Analysis |
| ELCR | excess lifetime cancer risk |
| EPA | U.S. Environmental Protection Agency |
| FFS | Focused Feasibility Study |
| HHRA | Human Health Risk Assessment |
| HI | hazard index |
| HQ | hazard quotient |
| IC | institutional control |
| IR | Installation Restoration |
| MDE | Maryland Department of the Environment |
| mg/kg | milligram(s) per kilogram |
| NCP | National Oil and Hazardous Substances Pollution Contingency Plan (40 CFR 300) |
| NSF-IH | Naval Support Facility Indian Head |
| NTCRA | non-time-critical removal action |
| O&M | operation and maintenance |
| PCB | polychlorinated biphenyl |
| 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 |
| SF | slope factor |
| SRG | Site Remediation Goal |
| SVOC | semivolatile organic compound |

| | |
|---|---|
| TAL | target analyte list |
| TCL | target compound list |
| TOC | total organic carbon |
| VOC | volatile organic compound |

SECTION 1

# Declaration

## 1.1 Site Name and Location

Site 28, Original Burning Ground
Naval Support Facility Indian Head
Indian Head, Maryland
CERCLIS ID No. MD7170024684

## 1.2 Statement of Basis and Purpose

This Record of Decision (ROD) presents the Selected Remedy for Installation Restoration (IR) Program Site 28, Original Burning Ground, at Naval Support Facility Indian Head (NSF-IH) in Indian Head, Maryland. The locations of NSF-IH and Site 28 are shown in Figure 1-1. The Selected Remedy was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, also known as Superfund), as amended by the Superfund Amendments and Reauthorization Act, and, to the extent practical, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on information contained in the Administrative Record file for NSF-IH.

The response action presented in this ROD is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances from the site into the environment. The Department of the Navy (Navy), the lead agency that provides funding for the IR Program activities at NSF-IF, including Site 28, and the U.S. Environmental Protection Agency Region III (EPA), the lead regulatory agency, jointly selected the remedy. The Maryland Department of the Environment (MDE) participated throughout the investigation process, reviewed the ROD and the materials on which it is based, and concurs with the Selected Remedy (Appendix A). Public comments received during the public meeting and 30-day comment period on the Proposed Plan for this site are discussed in Section 3, Responsiveness Summary.

## 1.3 Description of the Selected Remedy

The Selected Remedy for surface soil, subsurface soil, and sediment at Site 28, as well as surface water in Mattawoman Creek adjacent to Site 28, is no further remedial action. This is based on an evaluation of site conditions and site-related risks during the remedial investigation (RI) and the Navy's 2008 non-time-critical removal action (NTCRA), which removed the contaminated soil and sediment found at Site 28.

The Selected Remedy for shallow groundwater consists of institutional controls (ICs) to prohibit residential development at Site 28 and any use of shallow groundwater (including use as a drinking water source) until groundwater conditions do not pose an unacceptable risk to human health or the environment and to conduct periodic sampling to monitor contaminant concentrations in shallow groundwater. The Selected Remedy will be re-evaluated as part of the 5-year review process to verify that contaminant concentrations are decreasing and remedial action objectives have been or will be met within a reasonable timeframe (anticipated to be approximately 5 years), and to assess the need for continued implementation of ICs and groundwater monitoring. The Selected Remedy addresses the potential unacceptable human health risk associated with the potable use of groundwater at Site 28. Although potentially unacceptable ecological risks were identified for onsite surface water in Swale 4 during the RI, based on the information provided in geologic cross-sections and potentiometric surface maps in the RI report, the source of the water in Swale 4 is the groundwater from the site; therefore, surface water is not considered a source of contamination at Site 28 and the potentially unacceptable ecological risks in Swale 4 will be addressed by the Selected Remedy for shallow groundwater.

The components of the Selected Remedy are as follows:

- Implement ICs to prohibit residential development at Site 28 and any use of shallow groundwater (including use as a drinking water source) until the Site Remediation Goals (SRGs) are met and the contaminants in groundwater are at levels that allow for unlimited use and unrestricted exposure.
- Conduct sampling to monitor arsenic and zinc concentrations in the groundwater to verify that concentrations of these metals are decreasing. Sampling conducted in the two years following the NTCRA has shown a 97 percent decrease in zinc concentrations in the Swale 4 surface water (from the groundwater seep). It is expected that concentrations of both arsenic and zinc will continue to decrease to meet their respective SRGs within a reasonable timeframe (approximately 5 years) because the presumed source of the groundwater contamination (contaminated soil and sediment) was removed during the 2008 NTCRA.
- Evaluate site conditions and modify the long-term monitoring program as appropriate to address changes in groundwater quality.

## 1.4 Statutory Determinations

The Selected Remedy is protective of human health and the environment, complies with federal and state applicable or relevant and appropriate requirements (ARARs), is cost-effective, and uses permanent solutions and treatment technologies to the maximum extent practicable.

There are no principal threats at the site that require treatment. The Selected Remedy does not satisfy the statutory preference for treatment as a principal element of the remedy because it would be less cost effective than the Selected Remedy. The contaminated soil and sediment at Site 28 (Figure 1-1), which were determined to be the source of the shallow groundwater contamination at Site 28, were removed as part of the 2008 NTCRA conducted by the Navy. Therefore, groundwater quality is expected to improve over time.

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 and every 5 years thereafter (if needed) to ensure that the remedy is, or will be, 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 28:

- Contaminants of concern (COCs) requiring remediation and their respective concentrations (Section 2.5)
- 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)
- Baseline risk represented by all COCs (Section 2.7)
- Cleanup levels established for contaminants requiring remediation and the basis for these levels (Section 2.8)
- Key factor(s) that led to the Selected Remedy (Section 2.10)
- Principal threat wastes (Section 2.11)
- 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 2.13.3)

## 1.6 Authorizing Signatures

Peter R. Nette

P.R. Nette
Captain, U.S. Navy
Commanding Officer
NSA South Potomac

9 May 14
Date

Cecil A. Rodrigues

Cecil A. Rodrigues, Director
Hazardous Site Cleanup Division
USEPA--Region III

6/2/2014
Date

SECTION 2

# Decision Summary

## 2.1 Site Name, Location, and Description

NSF-IH is located in northwestern Charles County, Maryland, approximately 25 miles southwest of Washington, DC. 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 located in Mattawoman Creek (Figure 1-1).

Site 28 (Original Burning Ground), also referred to variously as the "Original NOS Burning Ground," the "Slavins Dock Area," and the "Wildlife Area," is located in the northeast portion of the Main Installation (Figure 1-1). The site encompasses a former zinc recovery furnace, observation Well 14, and two former burning cages (Figure 2-1).

## 2.2 Site History and Previous Investigations

### 2.2.1 Site History

During World War I, the Navy initiated a metal-recycling program, which was vital during World War II. In 1928, a zinc recovery furnace, designated Building 415, was built at Site 28 to support the metal recycling program. The last station map on which the building appears is dated October 31, 1952, indicating that the building was demolished in the early 1950s (Dolph, 2001).

Well 14 was installed in 1918 to a depth of 430 feet; it is used by the U.S. Geological Survey as an observation well. A small shoreline burning cage south of Well 14 was used to burn debris, such as wooden crates. The exact location of the former burning cage is unknown. The burning ground is shown outside of the existing perimeter fence on at least one historical map; however, burned debris, glass, and slaglike materials were observed inside the fence in an area adjacent to the mouth of Swale 4 (Figure 2-1).

### 2.2.2 Previous Investigations

The Navy conducted investigation activities at Site 28 between 1983 and 2010. A detailed discussion of each investigation is provided in each referenced document; a chronological summary of these investigations is provided below.

#### Initial Assessment Study

An Initial Assessment Study was conducted in 1983 to evaluate sites at NSF-IH and to determine if a potential threat to human health or the environment existed at these sites. File searches and a site reconnaissance were conducted at Site 28; however, the report concluded that there was not enough information to characterize the potential hazard of the site. Furthermore, the site was not recommended for a Navy Assessment and Control of Installation Pollutants Confirmation Study (Fred C. Hart Associates, 1983).

#### Miscellaneous Sampling Activities

Several soil-sampling events were conducted by base personnel at the site following the Initial Assessment Study. In August 1993, a soil sample was collected approximately 20 feet southwest of Well 14 at Site 28 and analyzed for soil texture, pH, and fertility. The results indicated that copper, magnesium, sulfate, and zinc were present at the site. May 2000 analytical results detected total lead and total zinc in a soil sample collected from Site 28 near Well 14. July 2000 analytical results detected cadmium, lead, and selenium in the soil sample.

### Sediment Toxicity Identification Evaluation Demonstration

In October 2000, a sediment sample was collected in Mattawoman Creek just off the shoreline of Site 28 for a Toxicity Identification Evaluation associated with Site 42. Zinc was detected in the pore water of the sediment (SAIC, 2001).

### Mattawoman Creek Study

Rapid sediment screening technology used in a study of Mattawoman Creek indicated that no volatile organic compounds (VOCs), pesticides, or polychlorinated biphenyls (PCBs) were present in sediment samples collected from the creek in the vicinity of Site 28. However, levels of certain metals, primarily cadmium, copper, lead, and zinc, were found to be elevated in the sediments of the creek adjacent to the site. The study concluded that additional site-specific data were required to evaluate the effect of Site 28 on the environment (Tetra Tech NUS, 2004). The potential human health risks associated with exposure to sediment, as evaluated in this study, are presented in Section 2.7.

### Remedial Investigation

Surface soil, subsurface soil, groundwater, surface water (from onsite swales), and sediment samples were collected from Site 28 during RI activities conducted during 2003. Sampling activities were conducted to verify the presence of contaminants in site media resulting from past activities at the site, to define the extent of contamination, and to evaluate the need for remediation based on the information developed in the human health and ecological risk assessments. Figure 2-1 shows the RI sampling locations. The sampling program is summarized below, and the analytical results are summarized in Section 2.5.3. Detailed results of the RI are presented in the RI report (CH2M HILL, 2005). The results of the baseline human health risk assessment (HHRA) and screening-level ecological risk assessment (SERA) are presented in Section 2.7.

**Surface Soil:** Thirty-nine surface soil samples were collected during the RI and analyzed for Target Compound List (TCL) VOCs and semivolatile organic compounds (SVOCs), Target Analyte List (TAL) metals, explosives, pH, total organic carbon (TOC), and grain size distribution.

**Subsurface Soil:** Thirty-nine subsurface soil samples were collected during the RI and analyzed for TCL VOCs and SVOCs, TAL metals, and explosives.

**Groundwater:** Both direct-push technology (DPT) sampling and permanent monitoring well sampling were used to characterize groundwater during the RI. Fourteen DPT samples and five monitoring well groundwater samples were collected and analyzed for TCL VOCs and SVOCs, TAL metals, dissolved organic carbon (DOC), and explosives.

**Surface Water:** Four surface water samples were collected from the swales and analyzed for TCL VOCs and SVOCs, TAL metals, explosives, DOC, and hardness.

**Sediment:** Four sediment samples were collected from the swales at Site 28 and analyzed for TCL VOCs and SVOCs, TAL metals, explosives, pH, TOC, and grain size distribution. In addition, 31 sediment samples were collected from 15 locations in the creek adjacent to Site 28 and analyzed for SVOCs, explosives, and TAL metals.

### Baseline Ecological Risk Assessment

A Baseline Ecological Risk Assessment (BERA) was performed for Site 28 because the results of the SERA (Steps 1–3A of the ERA, conducted as part of the RI) indicated potentially unacceptable risks to ecological receptors from exposures to surface soil, surface water, and surface sediment in Mattawoman Creek adjacent to the site. The BERA focused on Site 28 shoreline sediment and sediment in the vegetated bar directly across from the site in Mattawoman Creek. Surface soil and surface water were not considered in the BERA because of the planned NTCRA for Site 28.

The BERA field activities performed in October 2005 involved the collection of sediment and fish samples from the locations shown in Figure 2-1. Sediment samples were analyzed for TAL metals, TOC, pH, sulfide, and grain size, and laboratory toxicity tests were conducted on split samples. Benthic grab samples also

were collected from the sediment. Laboratory bioaccumulation bioassays were conducted on the samples, and fish were collected for fish tissue chemical analysis from the shoreline and reference sample locations. Detailed results of the BERA are presented in the BERA report (CH2M HILL, 2006a). The results are summarized in Section 2.7.2 of this report.

### Engineering Evaluation and Cost Analysis

An Engineering Evaluation and Cost Analysis (EE/CA) was prepared to address contaminated soil and sediment at Site 28 (CH2M HILL, 2006b). The objective of the action was to remove the potential source for contaminants detected in the soil, groundwater, sediment, and surface water at the site. Soil and sediment removal with offsite disposal was selected because the removal of soil and sediment would decrease lead and zinc concentrations in these media to acceptable levels, thereby reducing risks to human health and ecological receptors.

Confirmation samples were proposed to be collected from the bottom of the excavation in areas that presented a risk to human health, except for those areas where the excavation extended to the groundwater table. The goal of the removal action was to further reduce the sitewide average lead concentration by removing lead hot spots (the sitewide average lead concentration before implementing the NTCRA was below the EPA residential child soil screening value of 400 mg/kg and did not pose an overall risk to human receptors). Because the soil removal would reduce the average lead concentration in subsurface soil for the entire human health risk area below the 1,000 mg/kg action level, the Navy, EPA, and MDE later decided that postexcavation confirmation sampling was not required at Site 28 for the human health risk areas.

Confirmation samples were proposed to be collected from the lateral extent of the excavation in the areas that presented a risk to ecological receptors. Following the finalization of the EE/CA, the Navy, EPA, and MDE decided that postexcavation confirmation sampling was not required at Site 28 for the ecological risk areas due to the defined removal depth (1 foot below ground surface [bgs]), which eliminated the ecological risk pathway.

### Non-Time-Critical Removal Action

The NTCRA, which executed the recommended alternative presented in the EE/CA, was completed in 2008. Soil was removed from the ground surface to an average of 2 feet bgs in the area that presented potentially unacceptable human health risks and 1 foot bgs in the area that presented potentially unacceptable risks to ecological receptors, in accordance with the EE/CA. The exact excavation depth depended on the depth to groundwater and the grading of the slope, as soil and debris were not excavated below groundwater. The limits of the removal area were clearly defined by the extensive delineation achieved through the RI sampling. Therefore, as indicated earlier in this section, the Navy, EPA, and MDE decided prior to the NTCRA that confirmation sampling following the excavation was not required. The NTCRA removed the clearly delineated areas posing unacceptable human health and ecological risks in the soil and sediment, and the excavated area was restored with clean fill material and re-vegetated. Based on these actions, unacceptable human health and ecological risks from exposure to soil and sediment were eliminated at the site.

Approximately 5,734 tons (3,200 $yd^3$) of contaminated soil and sediment (Figure 2-1) were removed and disposed of offsite. In addition to the contaminated soil, approximately 490 pounds of propellant grains and 34 tons of material potentially presenting an explosive hazard were removed from the site. A detailed description of the removal action is presented in the Final Closeout Report for the Removal Action at Site 28 (Shaw, 2009).

### Focused Feasibility Study

A Focused Feasibility Study (FFS) was conducted to address potential sources of contamination at Site 28 and to evaluate remedial alternatives for mitigation of potential hazards associated with the shallow groundwater (CH2M HILL, 2010). The evaluation conducted as part of the FFS concluded that the elevated arsenic concentrations observed in groundwater were likely caused by both the contaminated soil and

sediment found at Site 28 (and later removed during the NTCRA) and a reducing, or oxygen-deprived, aquifer condition exacerbated by propellant grains found in the soil (and also removed during the NTCRA). The propellant (explosives and fuel) contained in propellant grains is a mixture of organic compounds; the presence of such organic compounds would increase both the biological and chemical oxygen demand in the subsurface, resulting in an oxygen-deprived aquifer condition. This oxygen-deprived condition would then cause the mobilization of metals, such as arsenic, into the shallow groundwater. Because the 2008 NTCRA removed the sources of groundwater contamination (contaminated soil and sediment and propellant grains), the geochemistry of the shallow groundwater at Site 28 is expected to return to its natural aerobic setting, which would mitigate the mobilization of metals, such as arsenic.

Two remedial alternatives—no action and ICs to restrict groundwater use along with sampling to monitor arsenic and zinc concentrations in the shallow groundwater—were evaluated. The Selected Remedy is discussed further in Section 2.12 of this ROD.

#### Post-NTCRA Surface Water Monitoring at Site 28

Three rounds of surface water sampling were conducted over a 2-year period to assess temporal and seasonal variations of metals in water and to identify potential upgradient sources of metals contamination in Swale 4 (CH2M HILL, 2011). The results indicated that dissolved cadmium and dissolved zinc concentrations decreased since the NTCRA within and downgradient of the swale. The data further showed that the risk from cadmium had been mitigated by the NTCRA and that concentrations of zinc had decreased by approximately 97 percent compared to pre-NTCRA data, thereby effectively reducing the risk to ecological receptors from exposure to surface water at Site 28. Because the geologic cross-sections and potentiometric surface maps in the RI report indicated that a portion of the groundwater beneath the site contributes to the surface water in Swale 4, potential risks from zinc in the surface water are linked directly to the shallow groundwater contamination. Further information about the ecological risk evaluation conducted following the NTCRA is provided in Section 2.7 of this ROD.

#### Proposed Plan

A Proposed Plan was completed to present the remedial alternatives evaluated for addressing contaminated shallow groundwater at Site 28. The preferred alternative consisted of ICs to prohibit residential development at the site and any use of the shallow groundwater until the SRGs are met and the contaminants in groundwater are at levels that allow for unlimited use and unrestricted exposure and sampling to monitor arsenic and zinc concentrations in the shallow groundwater to verify that concentrations of these metals are decreasing. The preferred alternative was proposed to the public to address the shallow groundwater at Site 28, which also represents the source of the surface water in Swale 4. No further remedial action was recommended for surface soil, subsurface soil, sediment, and surface water in Mattawoman Creek adjacent to the site, based on the results of the RI and NTCRA.

### 2.2.3 Enforcement Activities

In September 1995, NSF-IH, including Site 28, was placed on the National Priorities List. The Federal Facilities Agreement, which was signed on December 9, 2000, provides for CERCLA-directed enforcement activities at the site. As a result, an RI, a BERA, an EE/CA, an NTCRA, an FFS, and a Proposed Plan have been completed for Site 28.

## 2.3 Community Participation

The NSF-IH Restoration Advisory Board is made up of representatives from the community, 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 IR Program activities.

In accordance with the requirements established in Sections 113 and 117(a) of CERCLA and the NCP at 40 CFR §300.430(f)(2), the RI report (CH2M HILL, 2005a), BERA work plan (CH2M HILL, 2005b), EE/CA (CH2M HILL, 2006b), and Proposed Plan for Site 28 (CH2M HILL, 2013) were made available to the public in

April 2005, September 2005, August 2007, and June 2013, 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 General Library |
|---|---|---|
| 4195 Indian Head Hwy.<br>Indian Head, MD 20640<br>(301) 743-5511<br>Hours: Mon–Fri 8:30 a.m. to 4:30 p.m. | 2 Garrett Ave.<br>La Plata, MD 20646<br>(301) 934-9001/(301) 870-3520<br>Hours: Mon–Thurs 9 a.m. to 8 p.m.<br>Fri and Sun 1–5 p.m.<br>Sat 9 a.m. to 5 p.m. | Building 620 (The Crossroads)<br>101 Strauss Ave.<br>Indian Head, MD 20640<br>(301) 744-4744<br>Hours: Mon–Fri 9 a.m. to 5:30 p.m.<br>Sat and Sun closed. |

The notice of the availability of the Proposed Plan was published in the *Maryland Independent* newspaper on July 26, 2013 (Appendix B). A public comment period was held from July 29, 2013, to August 28, 2013. In addition, a public meeting was held on August 21, 2013, 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 alternatives. Oral and written comments were received during the public comment period. A summary of the responses to comments is provided as Appendix C.

## 2.4 Scope and Role of Response Action

Site 28 is one of many sites in the IR Program that are part of the comprehensive environmental investigation and cleanup activities currently being performed at NSF-IH under the CERCLA program. The status of all the IR Program sites at NSF-IH can be found in the current version of the Site Management Plan, which is located in the Administrative Record. This ROD documents the final remedial action for surface soil, subsurface soil, sediment, and groundwater at Site 28 only and does not include or affect any other sites at the facility.

## 2.5 Site Characteristics

Site characteristics, nature and extent of contamination, and the human health and ecological risk assessments are presented in greater detail in the RI (CH2M HILL, 2005a), BERA (CH2M HILL, 2006a), and FFS (CH2M HILL, 2010) reports. They are summarized in the following sections.

### 2.5.1 Physical Setting

Site 28 is located on an area of land with a relatively steep slope towards Mattawoman Creek. The site elevation ranges from 47 feet above mean sea level along the dirt road, west of the site, to sea level at the shoreline of Mattawoman Creek. The dirt road is an abandoned rail bed. There is one swale (Swale 4) on Site 28 that is moderately to deeply incised; the surface water within this swale is fed mainly by groundwater discharge and subsequently discharges to Mattawoman Creek.

The soil in the northeast portion of Site 28 consists of highly plastic silty clay. The soil in the southern portion of the site consists of fine-grained sand and silty sand with trace clay. The soil on either side of the dirt road (old rail bed) contains fill and consists of fine to coarse sand and gravel. The entire site is underlain by dense, gray, highly plastic clay. The depth to the clay ranges from 4 to 26 feet bgs, depending on the topography of the surface. The depth to shallow groundwater, as determined from the monitoring wells installed at the site, ranges from about 12.7 feet bgs (at the dirt road) to about 1 foot bgs (downslope of the site). Based on the groundwater elevations, groundwater flows to the southeast, toward Mattawoman Creek, with a hydraulic gradient of approximately of 0.1 foot/foot (CH2M HILL, 2005a).

## 2.5.2 Conceptual Site Model

The conceptual site model (CSM) integrates information regarding the physical characteristics of the site, sources of contamination, contaminant mobility (fate and transport), and potentially exposed populations 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 source of contamination for Site 28 is the contaminated soil and sediment that were removed from the site as part of the 2008 NTCRA. The CSM for potential human receptors at Site 28 is shown on Figure 2-2.The CSM for potential ecological receptors is shown on Figure 2-3.

## 2.5.3 Nature and Extent of Contamination

The nature and extent of contamination in soil, groundwater, surface water, and sediment is described in detail in Section 4 of the RI report (CH2M HILL, 2005a) and is summarized below. The nature-and-extent discussion for groundwater also includes information (surface water data from Swale 4) collected following the completion of the RI and NTCRA at Site 28.

### Surface Soil

VOCs, SVOCs, and explosives were detected at low concentrations in several surface soil samples collected during the RI. Metals were detected in all surface soil samples. Arsenic, lead, and zinc (the risk drivers for the site) were found at all sample locations at concentrations ranging from 2.8 milligrams per kilogram (mg/kg) to 303 mg/kg, 10.7 mg/kg to 16,800 mg/kg, and 44.4 mg/kg to 71,900 mg/kg, respectively. Zinc concentrations were greatest around the former location of the zinc recovery furnace. For the most part, the concentrations of these metals exceeded their respective site-specific background concentrations.

### Subsurface Soil

As with surface soil, VOCs, SVOCs, and explosives were detected at low concentrations in several samples, and metals were detected in all samples. Arsenic concentrations (ranging from 0.76 mg/kg to 324 mg/kg), lead concentrations (ranging from 3.4 mg/kg to 16,600 mg/kg), and zinc concentrations (ranging from 7.3 mg/kg to 51,100 mg/kg) were greatest in and around the former location of the zinc recovery furnace. With very few exceptions, these metals also were detected in the site-specific background subsurface soil samples.

### Groundwater

Low concentrations of VOCs and SVOCs were detected in both DPT and monitoring well samples. A very low concentration of nitrobenzene (0.23 micrograms per liter [µg/L]) was detected in one DPT sample, and no explosives were detected in the monitoring well samples. The monitoring well samples had widespread metal detections in both total (unfiltered) and dissolved (filtered) metals samples. (Although filtered metals were collected at the DPT groundwater-sampling locations, the analytical results were used as a screening tool and not for risk assessment purposes.) Most metals concentrations, including the risk-driver arsenic (ranging from 12.1 µg/L to 347 µg/L for unfiltered arsenic and from 4.2 µg/L to 317 µg/L for filtered arsenic), in monitoring well groundwater were highest directly downgradient of the former zinc recovery furnace area.

### Surface Water

Neither VOCs nor SVOCs were detected in any of the surface water samples collected during the RI. Nitrobenzene was detected at 0.15 µg/L in one sample; no other explosives were detected. All four surface water samples collected had detections of total and dissolved metals. Concentration of the risk drivers total cadmium and zinc ranged from 4.7 to 7.4 µg/L and from 2,830 to 4,140 µg/L, respectively.

Surface water samples collected as part the post-NTCRA surface water monitoring at Site 28 showed that dissolved cadmium and dissolved zinc concentrations had decreased both within and downgradient of Swale 4. Dissolved cadmium concentrations detected over a two-year period ranged from 1.55 to 3.14 µg/L

(nondetect during the last round of sampling), and dissolved zinc concentrations ranged from 11.1 to 2,200 µg/L.

### Sediment

VOCs, SVOCs, and explosives were detected at low concentrations in several samples collected from the swales and Mattawoman Creek. Metals were detected in all sediment samples. Elevated levels of arsenic (up to 36 mg/kg), lead (up to 716 mg/kg), and zinc (up to 10,700 mg/kg) were detected in the sediment samples taken on the shore of Mattawoman Creek downgradient of the former zinc recovery furnace. Concentrations of most metals were significantly lower in the sediment collected offshore within Mattawoman Creek.

## 2.6 Current and Potential Future Land and Resource Uses

Site 28 is currently maintained as open space that is vegetated with grass. No future land use changes are projected for Site 28, and no other land use for this site is planned by the Navy. It is highly unlikely that Site 28 would be developed for residential use. However, hypothetical future residential use of the site, including groundwater use as a potentially potable resource, was evaluated in the risk assessment to determine if restrictions would be necessary at the site. Shallow groundwater beneath the site currently is not used for any beneficial uses and will not likely be used as a potable water supply in the future. The Navy has no plans to develop the groundwater resource in the future.

## 2.7 Summary of Site Risks

A risk assessment was conducted as part of the RI and in accordance with current EPA guidance to evaluate potential risks to human and ecological receptors exposed to environmental media at Site 28. A detailed discussion of the risk evaluation process and findings is presented in the RI report (CH2M HILL, 2005a) and the BERA report (CH2M HILL, 2006a).

The human health and ecological risk assessments were performed before the NTCRA was conducted in 2008. As noted earlier, the NTCRA removed the contaminated soil and sediment that presented potentially unacceptable human health and ecological risks at Site 28, as extensively delineated in the RI. Because the NTCRA removed the clearly delineated areas posing unacceptable human health and ecological risks in the soil and sediment, and the excavated area was restored with clean fill material and re-vegetated, no unacceptable risk for soil or sediment remains at Site 28 following the removal action. Therefore, the risk assessments described below present the pre-NTCRA conditions at Site 28 and overestimate the current site risks.

### 2.7.1 Human Health Risk Assessment

A baseline HHRA was conducted to evaluate potential human health risks associated with exposure to soil, groundwater, surface water, and sediment. In accordance with EPA human health risk assessment guidance, estimated risks were initially calculated using a reasonable maximum exposure (RME) scenario, which addresses the maximum human exposure reasonably expected to occur in a population. EPA guidance also allows evaluation based on a central tendency exposure (CTE), which essentially addresses average exposures, when RME scenarios are considered unacceptable. A CTE scenario is likely more representative of the actual risk to a majority of potential receptors.

The risk assessment characterized current and potential future human health risks based on potential receptor populations and exposure scenarios assuming that no remedial action would be implemented. The potential receptors evaluated in the risk assessment were as follows:

- For current uses—adult and adolescent trespassers (surface soil), utility workers (surface and subsurface soil), and adult and adolescent recreational users (surface water)

- For future uses—adult and child residents (surface and subsurface soil and groundwater), construction workers (surface and subsurface soil and groundwater), adult and adolescent trespassers (surface and subsurface soil), and adult and adolescent recreational users (surface water)

Future residential use was assumed for the human health assessment to evaluate unrestricted use of the site; however, future residential use of this site is unlikely. A CSM for potential human receptors at Site 28 is shown on Figure 2-2.

Exposure to sediment was not quantified in the HHRA conducted during the RI. Because of the steep grade of the shoreline, any sediment contacted by a receptor would be rinsed off the skin while exiting the creek to land or re-entering a boat. Therefore, exposure to the sediment adjacent to Site 28 is not a complete exposure pathway.

Section 6.3 of the RI report (CH2M HILL, 2005a) discusses the identification of COPCs and presents the list of COPCs for Site 28. Based on the initial screening of the site media, the COPCs for Site 28 were the following:

- Soil: benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, n-nitroso-di-n-propylamine, aluminum, antimony, arsenic, barium, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, thallium, vanadium, and zinc
- Groundwater: bis(2-ethylhexyl)phthalate, aluminum, antimony, arsenic, cadmium, chromium, iron, manganese, vanadium, and zinc
- Surface Water: arsenic and lead

The risk assessment tables are provided in Appendix G of the RI report. The Table 9 series summarizes the RME and CTE potential hazards and risks to each receptor. The Table 10 series shows only those pathways with total HIs greater than 1 or total carcinogenic risks greater than $1 \times 10^{-6}$ (that is, those pathways with potentially unacceptable risk).

The HHRA concluded that under current site use conditions there are no unacceptable noncarcinogenic hazards or carcinogenic risks.

There would be potentially unacceptable risks to future residents if the site was used for future residential purposes and to future construction workers involved in excavation activities at the site.

Table 2-1 summarizes the results of the HHRA. The main risk drivers were the following:

- Soil: arsenic, zinc, and lead through ingestion and direct contact
- Shallow groundwater: arsenic through direct contact (although aluminum, cadmium, iron, manganese, and vanadium also contributed to risk, these metals were found to be consistent with site background concentrations)

An NTRCA was completed at Site 28 in 2008 to remove the contaminated soil and sediment identified by the HHRA and SERA. Extensive delineation of areas of soil associated with the potentially unacceptable risks and hazards were conducted during the RI, which ensured the NTCRA removed the soil to levels that would not result in any remaining unacceptable risks. Additionally, the excavated area was restored with clean fill material and re-vegetated (Shaw, 2009). The HHRA was not updated following the NTCRA; however, no potentially unacceptable risks from soil or sediment remain because the previously delineated areas of contaminated media (that is, areas posing potentially unacceptable human health risk) were removed from the site during the NTCRA. Although the concentrations of arsenic in groundwater have not been quantified following the NTCRA, these concentrations are expected to have decreased because the sources of contamination in the soil and sediment have been removed.

### 2.7.2 Ecological Risk Assessment

As part of the RI, the Navy conducted a SERA for surface soil at Site 28 (CH2M HILL, 2005a). Section 7.7.4.3 of the RI report provides a detailed description of the ecological risk characterization. The results of the

SERA indicated that unacceptable risks for ecological receptors were likely from COPCs in surface soil and possible from shoreline sediments as well. Therefore, a BERA was conducted to refine the risk estimates for the sediment along the immediate shoreline of Site 28 and to investigate potential risks in the offshore sediment of Mattawoman Creek. Because the NTCRA was planned for the site surface soil, this medium was not included in the BERA investigation.

The results of the BERA indicated that an unacceptable risk existed for benthic invertebrates along the shoreline in the northern portion of the site. The shoreline immediately upstream of this location was known to pose unacceptable risk based on previous toxicity testing related to an apatite treatment pilot study. The sediments along the shoreline in the central portion of the site posed low risk to benthic invertebrates. Initially identified in the SERA as a COPC, silver in the sediment along the vegetated bar across from Site 28 was determined to not pose an unacceptable risk to the benthic invertebrate community.

The results of the fish tissue chemical analysis revealed that, although lead and zinc were accumulating in fish at the site, neither metal posed an unacceptable risk to fish, and the levels of zinc in the fish were comparable to background levels.

The results of the bioaccumulation bioassays and associated risk estimates for aquatic omnivorous birds indicated that lead and zinc in the shoreline sediments at Site 28 posed a low risk to these receptors. The primary area of concern was in the vicinity of the shoreline in the northern portion of the site; however, contaminated sediment was later removed during the NTCRA.

The results of the fish tissue analysis and associated risk estimates for piscivorous birds and mammals indicated that lead, mercury, and zinc were not accumulating in fish at levels that would pose an unacceptable risk to these receptors.

A CSM for potential ecological receptors at Site 28 is shown on Figure 2-3. Table 2-2 summarizes the results of the BERA. The main risk drivers were various metals detected in site surface soil, swale surface water, and swale and shoreline sediment. However, the 2008 NTRCA removed the contaminated soil and sediment identified by the HHRA and SERA as posing an unacceptable risk, thus mitigating the potential risks from exposure to site surface soil and swale and shoreline sediment. The surface water data showed that the risk from cadmium had been mitigated by the NTCRA and that concentrations of zinc continue to decline, effectively reducing the overall ecological risk at Site 28. Because the groundwater beneath the site contributes to the surface water in Swale 4, the potential remaining risks from zinc in the surface water are linked directly to the shallow groundwater contamination.

Swale 4 provides limited aquatic habitat. Although zinc concentrations in the Swale 4 surface water exceeded ecological screening values approximately 2 years after the 2008 NTCRA, concentrations have decreased by approximately 97 percent from pre-removal levels. The maximum dissolved zinc concentration in Swale 4 surface water prior to the NTCRA was 4,420 μg/L. The maximum dissolved zinc concentration measured one year (2009) and 2 years (2010) after the NTCRA were 2,200 μg/L and 145 μg/L, respectively. Removal of the contaminant source with approximately 97 percent decrease in zinc concentrations over the ensuing 2-year period shows that zinc concentrations in Swale 4 surface water will continue to decline to levels that do not pose unacceptable risks to ecological receptors within a reasonable timeframe.

## 2.8 Remedial Action Objectives

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 28 groundwater were developed:

- Prevent unacceptable risks to human receptors from exposure to arsenic in shallow groundwater until groundwater conditions allow for unlimited use and unrestricted exposure

- Ensure concentrations of arsenic (the human health COC in shallow groundwater) and zinc (the ecological COC in shallow groundwater) decrease to meet site remediation goals (SRGs)
- Return the groundwater to beneficial use to the extent practicable

In the FFS, two remedial alternatives were developed to satisfy the RAOs. Arsenic was identified as the only human health COC in groundwater. The SRG for arsenic is 10 µg/L, which is the federal maximum contaminant level. In addition, zinc is the only ecological COC in groundwater. The SRG for zinc is calculated in accordance with the Criterion Continuous Concentration formula for zinc found in the National Recommended Water Quality Criteria (EPA, 2009); the numerical value for zinc is dependent on the hardness values measured at each sample location. Based on the hardness data measured for samples collected from Site 28 in 2010, the SRG range for dissolved zinc is 29 to 106 µg/L. The area of attainment is defined as the area over which the RAOs, and therefore the SRGs, are to be met. Figure 2-4 shows the area of attainment, which encompasses approximately 1.17 acres.

## 2.9 Summary Descriptions of Remedial Alternatives

Section 4.1 of the FFS provides a detailed description of each remedial alternative. A summary of the two alternatives is presented below.

- **Alternative 1—No Action**: This alternative is required by NCP §300.430(e)(3)(ii) to be evaluated as a baseline. Under this alternative, no remediation is planned.
- **Alternative 2—ICs and Groundwater Monitoring:** This alternative consists of:
  - Implement ICs to prohibit residential development of Site 28 and any use of the shallow groundwater (including use as a drinking water source) until the SRGs are met and the contaminants in groundwater are at levels that allow for unlimited use and unrestricted exposure.
  - Conduct sampling periodically to monitor arsenic and zinc concentrations in the groundwater to verify that concentrations of these metals are decreasing. It is expected that concentrations of these metals will continue to decrease to meet their respective SRGs within a reasonable timeframe (approximately 5 years) because the presumed source of the groundwater contamination (contaminated soil and sediment) was removed during the 2008 NTCRA.
  - Evaluate site conditions as part of statutory 5-year reviews until SRGs are met, and modify the long-term monitoring program as appropriate to address changes in groundwater quality.

  These components represent a conceptual approach to Alternative 2. The IC and groundwater sampling plans will be prepared within the context of land use control remedial design and work plan after the ROD has been signed.

## 2.10 Summary of Comparative Analysis of Alternatives

The NCP outlines the approach for comparing remedial alternatives at 40 CFR §300.430(f)(5)(i). Remedial alternatives are evaluated using nine evaluation criteria (including two threshold criteria which must be met; five balancing criteria that help determine which alternative provides the best combination of attributes; and two modifying criteria), to facilitate a comparison of the relative performance of the alternatives and provide a means to identify their advantages and disadvantages. The criteria are:

**Threshold:**

1. Overall protection of human health and the environment
2. Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)

**Balancing:**

1. Long-term effectiveness and permanence
2. Reduction of toxicity, mobility, and volume through treatment
3. Short-term effectiveness
4. Implementability
5. Cost

**Modifying:**

1. State acceptance
2. Community acceptance

The FFS provides a detailed analysis and evaluation of the remedial alternatives based on criteria 1 through 8. Criterion 9 was evaluated after receipt of the public's comments on the Proposed Plan during the 30-day comment period.

Alternative 1 is not protective of human health and the environment because, although the groundwater will most likely naturally attenuate to meet SRGs eventually, there is no restriction on current groundwater use to prevent human exposure to contaminants in groundwater. Therefore, Alternative 1 fails a threshold criterion and will not be discussed further in this analysis.

Alternative 2 is protective of human health and the environment because the groundwater is expected to meet SRGs over time. In addition, the groundwater at the site is not currently a potable resource, and IC measures to prohibit the groundwater use for potable water would be in place to minimize or eliminate potential exposures by future receptors. Alternative 2 would comply with the chemical-specific ARARs over time. Alternative 2 would meet all the location-specific and action-specific ARARs. Under Alternative 2, the magnitude of residual risks would diminish over time because of implementation of the 2008 NTCRA, which removed contaminated soil and other potential sources of groundwater contamination. Continued implementation of groundwater-use restrictions is expected to be adequate and reliable to prevent the potential exposures of future receptors to the shallow groundwater until SRGs are met. Alternative 2 would not provide any reduction in toxicity, mobility, or volume of the arsenic and zinc in groundwater through treatment. Under Alternative 2, there is very minimal impact on workers, the community, or the environment during implementation of the ICs and monitoring. Alternative 2 is technically and administratively implementable; however, it would entail a long-term allocation of administrative resources for continuous maintenance of the IC measures. Alternative 2 has a total cost of approximately $105,306, including capital and O&M costs.

The State of Maryland, through MDE, has been involved throughout the decision making process at Site 28 and supports Alternative 2. During the public comment period, the community did not provide any comments or voice any objections to the preferred alternative.

Table 2-3 presents the comparative analysis for the threshold and primary balancing criteria for the two remedial alternatives for the site. Section 4 of the FFS 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. Principle 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. A source material is one 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. There are no principal threats in any of the media at Site 28, and the contaminants onsite are not categorized as “highly toxic” or “highly mobile.”

# 2.12 Selected Remedy

The Selected Remedy for Site 28 is Alternative 2, ICs and sampling to monitor arsenic and zinc concentrations in the shallow groundwater. The area of attainment within Site 28 is shown in Figure 2-4.

# 2.13 Description of the Selected Remedy

The components of the remedy are the following:

- Implement ICs in the area of groundwater contamination depicted in Figure 2-4 to prohibit residential development at Site 28 and any use of shallow groundwater (including use as a drinking water source) until the SRGs are met and the contaminants in groundwater are at levels that allow for unlimited use and unrestricted exposure.
- Conduct periodic sampling to monitor arsenic and zinc concentrations in the groundwater to ensure concentrations of these metals are decreasing. It is expected that concentrations of these metals will continue to decrease to meet their respective SRGs because the presumed source of the groundwater contamination (contaminated soil and sediment) was removed during the 2008 NTCRA. In addition, the removal of the propellant grains (which contributed to an oxygen-deprived aquifer condition that mobilized metals such arsenic into the groundwater), will allow the geochemistry of the shallow groundwater at Site 28 to return to its natural aerobic setting and mitigate the mobilization of metals, such as arsenic, into the groundwater. Arsenic concentrations in groundwater are expected to continue to decrease to levels that do not pose unacceptable risks to human receptors. In addition, as shown by the 97 percent decrease in zinc concentrations in the Swale 4 surface water (from the groundwater seep) since the NTCRA, the concentrations of zinc are expected to continue to decline to levels that do not pose unacceptable risks to ecological receptors within a reasonable timeframe.

The site conditions will be evaluated as part of the five-year review process, and the Navy, with concurrence by EPA and MDE, may modify the long-term monitoring program as appropriate to address changes in groundwater quality. If groundwater contaminants do not decrease at a rate to achieve SRGs in a reasonable timeframe (estimated to be approximately 5 years), the Navy and EPA with concurrence from MDE will evaluate whether the long-term monitoring program should be extended or this ROD should be amended to provide for an active remedy to ensure that SRGs are attained.

After the ROD is signed, the Navy will prepare a Land Use Control Remedial Design to specify how the ICs will be implemented, monitored, and enforced and a long-term monitoring work plan to provide a detailed description of the shallow groundwater sampling plan, procedures for evaluation of the data, and decision rules for a groundwater monitoring exit strategy. The Navy will submit these documents to EPA and MDE for approval before implementing the Selected Remedy.

The Navy will be responsible for implementing, maintaining, periodically reporting on, and enforcing the ICs in accordance with this ROD and the land use control remedial design and remedial work plan. Although the Navy may transfer these responsibilities to another party by contract, property transfer agreement, or through other means, the Navy will remain ultimately responsible for the remedy integrity and will (1) perform CERCLA Section 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.

## 2.13.1 Summary of Estimated Remedy Costs

The estimated costs of the Selected Remedy are summarized in Table 2-4. The estimated total capital cost of the Selected Remedy is $27,500; the estimated 2012 total lifetime O&M cost is $81,200; and the estimated

total present-worth cost is $105,400 (as shown on Table 2-5). O&M activities are associated primarily with the completion of two sampling events to support one 5-year review.

### 2.13.2 Estimated Outcomes of Selected Remedy

The anticipated benefit of the Selected Remedy is the eventual and complete mitigation of human health and ecological risks in the shallow groundwater throughout the site. Through the IC mechanisms, NSF-IH can enforce restriction of future groundwater use. The site conditions will be evaluated and the long-term monitoring program will be modified as appropriate to address changes in groundwater quality. This remedy will be re-evaluated as part of the 5-year review process to ensure achievement of SRGs and to assess the need for continued implementation of groundwater monitoring and ICs. The groundwater at Site 28 is currently not used for any beneficial uses and will not likely be used as a potable water supply in the future. Table 2-5 summarizes the expected outcomes of the Selected Remedy.

## 2.14 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 states 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.

### 2.14.1 Protection of Human Health and the Environment

The Selected Remedy is considered protective of human health and the environment. Although contaminants would remain onsite, they would be prevented from entering potential exposure pathways by implementation of ICs.

### 2.14.2 Compliance with ARARs

The Selected Remedy will comply with the chemical-, location-, and action-specific ARARs identified in Table 2-6. Compliance would be met through eliminating the exposure pathways until contaminants in groundwater are reduced naturally to below SRGs. The land-use and water-use restrictions will be documented by periodic inspections and in the five-year reviews for the site until groundwater SRGs are achieved.

### 2.14.3 Long-Term Effectiveness and Permanence

The risks to potential human receptors from the shallow groundwater would be eliminated as long as the ICs are properly enforced. ICs will be enforced until evaluation of site conditions and long-term monitoring data demonstrate that the contaminants in groundwater are at levels that allow for unlimited use and unrestricted exposure. Therefore, the Selected Remedy fully satisfies the long-term effectiveness and permanence criterion.

### 2.14.4 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” (40 CFR §300.430(f)(1)(ii)(D)). This conclusion was reached by evaluating the overall effectiveness of the 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 it represents a reasonable value for the money to be spent.

### 2.14.5 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 practicable manner at Site 28. 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.

### 2.14.6 Preference for Treatment as a Principal Element

The Selected Remedy does not use treatment as a principal element because there is no principal threat waste at this site that requires treatment, and treatment of the groundwater would not be cost effective because treatment would be costly and unnecessary to satisfy the statutory criterion of long-term effectiveness and permanence. Concentrations of COCs are expected to decrease to below SRGs in a reasonable timeframe. To satisfy the requirement for the Selected Remedy to be cost effective, it cannot also satisfy the statutory preference for treatment as a principal element.

### 2.14.7 5-Year Review Requirement

Because this remedy will result in hazardous substances, pollutants, or contaminants remaining onsite above levels that allow for unlimited use and unrestricted exposure, pursuant to 40 CFR §300.430(f)(4)(ii), the Navy will conduct a statutory remedy review within 5 years after initiating the remedial action and every 5 years thereafter until site conditions allow for unlimited use and unrestricted exposure to ensure that the remedy continues to provide adequate protection of human health and the environment.

## 2.15 Documentation of Significant Changes

The Selected Remedy is the same alternative as the recommended alternative in the Proposed Plan that was presented at a public meeting on August 21, 2013.

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 August 28, 2013, 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 provides answers to major comments.

## 3.1 Stakeholder Comments and Lead Agency Responses

The 30-day public comment period for the Selected Remedy for Site 28 began on July 29, 2013, and ended on August 28, 2013. A public meeting was held on August 21, 2013, at the Indian Head Senior Center, 100 Cornwallis Square, Indian Head, Maryland, to accept oral and written comments on this decision. A summary of the oral and written comments received during the public comment period, and responses to those comments, are included as Appendix C.

## 3.2 Technical and Legal Issues

No technical or legal issues have been identified for Site 28 with respect to this ROD.

SECTION 4

# References


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SAIC (Science Applications International Corp.). 2001*. Sediment Toxicity Identification Evaluation Demonstration: Indian Head Naval Surface Warfare Center, Final Report*. Submitted to: Department of the Navy. October.

Shaw. 2009. *Final Closeout Report. Removal Action at Site 28, Naval Support Facility, Indian Head, Indian Head, Maryland.*

Tetra Tech NUS. 2004. *Final Mattawoman Creek Study Report.* Indian Head Division Naval Surface Warfare Center, Indian Head, Maryland. January 2004.

# Tables

TABLE 2-1

**HHRA Risk Characterization Results Summary**

*Site 28 Record of Decision*

*NSF-IH, Indian Head, Maryland*

| Receptor | Current Land Use | | Future Land Use | |
|---|---|---|---|---|
| | Carcinogenic Risk | Non-Carcinogenic Hazard | Carcinogenic Risk | Non-Carcinogenic Hazard |
| **Shallow Groundwater** | | | | |
| Construction Worker | NA | NA | Acceptable (CR = $5.3 \times 10^{-6}$) | Not Acceptable (HI = 2) |
| Adult Resident | NA | NA | Not Acceptable (CR = $7.8 \times 10^{-3}$) | Not Acceptable (HI =40) |
| Child Resident | NA | NA | | Not Acceptable (HI = 94) |
| **Surface Soil** | | | | |
| Adolescent Trespasser | Acceptable (CR = $1.2 \times 10^{-5}$) | Acceptable (HI = 0.42) | NA | NA |
| Adult Trespasser | Acceptable (CR = $2.6 \times 10^{-5}$) | Acceptable (HI = 0.34) | NA | NA |
| **Soil (Combined Surface and Subsurface Soil)** | | | | |
| Utility Worker | Acceptable (CR = $1.4 \times 10^{-5}$) | Acceptable (HI = 0.16) | NA | NA |
| Construction Worker | NA | NA | Acceptable (CR = $1.4 \times 10^{-5}$) | Not Acceptable (HI = 3.9) |
| Adolescent Trespasser | NA | NA | Acceptable (CR = $9.8 \times 10^{-6}$) | Acceptable (HI = 0.36) |
| Adult Trespasser | NA | NA | Acceptable (CR = $2.1 \times 10^{-5}$) | Acceptable (HI = 0.29) |
| Adult Resident | NA | NA | Not Acceptable (CR = $3.3 \times 10^{-4}$) | Not Acceptable (HI = 1.3) |
| Child Resident | NA | NA | | Not Acceptable (HI = 11) |
| **Surface Water** | | | | |
| Adolescent Recreational User | Acceptable (CR = $1.5 \times 10^{-7}$) | Acceptable (HI = 0.0025) | Acceptable (CR = $1.5 \times 10^{-7}$) | Acceptable (HI = 0.0025) |
| Adult Recreational User | Acceptable (CR = $2. \times 10^{-7}$) | Acceptable (HI = 0.0019) | Acceptable (CR = $2.9 \times 10^{-7}$) | Acceptable (HI = 0.0019) |

Notes:

HI - hazard index

CR - carcinogenic risk

NA - Not evaluated because it is not applicable, pathway incomplete

Acceptable - HI < 1 and/or target organ HI < 1 for non-carcinogenic hazard and carcinogenic risks within or below range of $1 \times 10^{-4}$ to $1 \times 10^{-6}$

Risk values are taken from the RME evaluation; numbers indicate the total risk from ingestion, dermal contact, and inhalation

Exposure to lead – average site-wide concentrations of lead in surface soil and combined surface and subsurface soil were below the residential lead soil screening level; therefore, site-wide lead concentrations were not further evaluated in the risk characterization. However, a lead 'hot-spot' area identified near Swale 3 was evaluated using adult lead model for non-residential adult receptors and Integrated Exposure Uptake Biokinetic model for adolescent and child receptors; findings indicated potential adverse effects associated with lead in soil to fetuses of expectant utility and construction workers and adult trespassers if exposed at the upper end of the estimated range of parameter values, and to future child residents.

The contaminated surface and subsurface soil, as identified by the risk assessment and delineated by remedial investigation sampling and analysis, was removed from the site during a non-time-critical removal action conducted after the risk assessment was completed; therefore, the calculated risks associated with exposure to surface and combined surface and subsurface soil have been mitigated.

TABLE 2-2

**Ecological Risk Characterization Results Summary**

*Site 28 Record of Decision*

*NSF-IH, Indian Head, Maryland*

| Receptor | Risk |
|---|---|
| **Surface Soil** | |
| Soil invertebrates and terrestrial plants | Unacceptable risk from antimony, cadmium, copper, lead, mercury, nickel, silver, and zinc - mitigated by the NTCRA |
| Herbivorous birds and mammals | Unacceptable risk from arsenic, cadmium, lead, and zinc - mitigated by the NTCRA |
| Insectivorous birds and mammals | Unacceptable risk from arsenic, cadmium, lead, mercury, and zinc - mitigated by the NTCRA |
| Carnivorous birds and mammals | Unacceptable risk from cadmium, lead, and zinc - mitigated by the NTCRA |
| **Swale Surface Water** | |
| Aquatic invertebrates and fish | Potentially unacceptable risk from cadmium and zinc - addressed through NTCRA; post-removal monitoring indicates decreasing zinc concentrations and cadmium below action limit |
| **Swale and Shoreline Sediment** | |
| Benthic invertebrates and aquatic plants | Unacceptable risk from arsenic, cadmium, copper, lead, and zinc - mitigated through NTCRA |
| Fishes | Acceptable |
| Herbivorous semi-aquatic mammals | Unacceptable risk from arsenic and zinc - mitigated through NTCRA |
| Omnivorous aquatic birds | Unacceptable risk from lead and zinc - mitigated through NTCRA |
| Insectivorous semi-aquatic birds | Unacceptable risk from cadmium, lead, and zinc - mitigated through NTCRA |
| Piscivorous (fish-eating) birds | Acceptable |
| Carnivorous semi-aquatic mammals | Acceptable |
| **Mattawoman Creek Sediment** | |
| Benthic invertebrates and aquatic plants | Acceptable |
| Piscivorous (fish-eating) birds | Acceptable |

Notes:

NTCRA - non time critical removal action

TABLE 2-3
**Comparative Analysis of Remedial Alternatives**
*Site 28 Record of Decision*
*NSF-IH, Indian Head, Maryland*

| Evaluation Criteria | Alternative 1<br>No Action | Alternative 2<br>Institutional Controls and Monitoring |
|---|---|---|
| Overall Protection of Human Health and the Environment | Not protective of human health and the environment | Protective of human health through ICs |
| Compliance With ARARs | Would comply with chemical-specific ARARs in the long-term; location- and action-specific ARARs are not relevant | Would comply with chemical- and location - specific ARARs in the long-term; action-specific ARARs are not relevant |
| Long-Term Effectiveness and Permanence | Provides poor long-term effectiveness, permanence, and reliability<br>The residual risks associated with arsenic and zinc in groundwater under this alternative would be reduced over time; however, no control to prevent future human exposures to arsenic in the shallow groundwater | Provides adequate long-term effectiveness and permanence<br><br>Sampling would be conducted to monitor arsenic and zinc concentrations in the groundwater to verify concentrations of these metals are decreasing. Concentrations of these metals are expected to continue to decrease to meet their respective SRGs, because the 2008 NTCRA removed the presumed source of the groundwater contamination (contaminated soil and sediment). Also, the removal of propellant grains (which contributed to an oxygen-deprived aquifer condition that mobilized metals such as arsenic into the groundwater), will allow the geochemistry of the shallow groundwater at Site 28 to return to its natural aerobic setting and mitigate the mobilization of metals, such as arsenic, into the groundwater. Arsenic concentrations in groundwater are expected to continue to decrease to levels that do not pose unacceptable risks to human receptors. In addition, as shown by the 97 percent decrease in zinc concentrations in the Swale 4 surface water (which is a groundwater seep) since the NTCRA, the concentrations of zinc are expected to continue to decline to levels that do not pose unacceptable risks to ecological receptors in a reasonable timeframe.<br><br>The site conditions would be evaluated and the long-term monitoring program would be modified as appropriate to address changes in shallow groundwater contaminant concentrations. This remedy would be re-evaluated as part of the 5-year review process, to assess the need for continued implementation of groundwater monitoring and ICs. |
| Reduction of Toxicity, Mobility, or Volume Through Treatment | Would not provide any reduction in toxicity, mobility, or volume of the arsenic or zinc in groundwater. | Would not provide any reduction in toxicity, mobility, or volume of arsenic or zinc in groundwater. |
| Short-Term Effectiveness | No impact to community, workers, and the environment because this alternative involves doing nothing; however, the RAO will not be achieved because this alternative will not minimize or eliminate the exposures to the shallow groundwater by potential future receptors | Very minimal impact to the community, workers, and the environment during implementation of ICs; RAOs will be achieved as concentrations of metals in groundwater continue to decrease and meet their respective SRGs |
| Implementability | Easily implemented | Easily implemented |
| Cost | $0 | **Capital: $27,500**<br>2012 Lifetime O&M Cost: $81,200<br>Total Present Worth Cost: $105,400 |

ICs - institutional controls
ARARs - applicable or relevant and appropriate requirement
NTCRA - non-time-critical removal action
RAO - remedial action objective
O&M - operation and maintenance
SRG - site remediation goal

TABLE 2-4
**Detailed Cost Estimate**
*Site 28 Record of Decision*
*NSF-IH, Indian Head, Maryland*

| REMEDIAL ALTERNATIVE 2 | LOCATION: | MEDIA: | Construction time: | None |
|---|---|---|---|---|
| | Site 28 | | Operation time: | 1 year |
| ICs and Groundwater Sampling | NSF-IH, Indian Head, Maryland | Groundwater | | |

**DESCRIPTION OF ALTERNATIVE:**

1) ICs to prohbit the use of groundwater as a drinking source until the SRGs are met and the contaminants in groundwater are at levels that allows for unlimited use and unrestricted exposure

2) Sampling to monitor arsenic and zinc concentrations in groundwater to ensure concentrations of these metals are decreasing

3) Evaluate site conditions as part of the 5-year review and modify the long-term monitoring program as apporpriate to address changes in groundwater quality and determine the need for continued implementation of Ics.

4) Designate the AA as a "restricted use" area in the base geographic information system (GIS) database to prohibit the residential development of the site and any use of the shallow groundwater until SRGs are met.

5) Integrate requirements of the ICs into the Comprehensive Work Approval Process system for any future work at the site.

| Cost Component | Qty | Unit | Cost Source | 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** | | | | | | | | | | | **$25,000.00** |
| Draft and Final Site-Specific Land Use Control Plan | 1 | lump sum | Estimated from similar CH2M HILL project (Indian Head Site 21) | $10,000.00 | $10,000.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $10,000.00 |
| Draft and Final Work Plan in UFP-SAP format | 1 | lump sum | Estimated from similar CH2M HILL project (WNY Site 22) | $15,000.00 | $15,000.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $15,000.00 |
| **SUBTOTAL CAPITAL COST** | | | | | **$25,000.00** | | **$0.00** | | **$0.00** | **$0.00** | **$25,000.00** |
| Scope Contingency | 5% | | | | | | | | | | **$1,250.00** |
| Bid Contingency | 5% | | | | | | | | | | **$1,250.00** |
| **TOTAL CAPITAL COST** | | | | | | | | | | | **$27,500.00** |
| **PERIODIC ACTIVITIES - PER EVENT** | | | | | | | | | | | |
| **Sample Collection** | | | | | **$3,000.00** | | **$950.00** | | **$0.00** | | **$3,950.00** |
| Per Event by 2-person crew @ 10 hrs/day including travel; $75/hr | 20 | hrs | Estimated from Navy CLEAN P-grades | $150.00 | $3,000.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $3,000.00 |
| Sampling equipment and supplies (Peristaltic pump, tubing, filters, water level, PID, water quality meter, H&S, PPE, Shipping) | 1 | lump sum | Rates from Pine Invoice for PAX Site 39 & CH2M HILL FP Template | $0.00 | $0.00 | $800.00 | $800.00 | $0.00 | $0.00 | $0.00 | $800.00 |
| Rental Car (1 per Event; 2-day rental ) | 2 | days | Estimated from Enterprise Rates for CH2M HILL | $0.00 | $0.00 | $75.00 | $150.00 | $0.00 | $0.00 | $0.00 | $150.00 |
| **Data Management/Evaluation** | | | | | **$750.00** | | **$0.00** | | **$0.00** | | **$2,871.50** |
| Data Management by Chemist | 10 | hrs | CH2M HILL Chemist estimate | $75.00 | $750.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $750.00 |
| Critigen Support | 1 | lump sum | CH2M HILL Chemist estimate | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $600.00 | $600.00 |
| Laboratory Analysis - 10 locations | | | | | | | | | | | |
| Total Arsenic and Zinc - 13 samples including QA/QC per event (MS/MSD not included) | 13 | samples | CH2M HILL BOA Rate | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $403.00 | $403.00 |
| Dissolved Arsenic and Zinc - 13 samples including QA/QC per event (MS/MSD not included) | 13 | samples | CH2M HILL BOA Rate | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $403.00 | $403.00 |
| Hardness | 10 | samples | CH2M HILL BOA Rate | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $178.20 | $178.20 |
| pH | 10 | samples | CH2M HILL BOA Rate | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $107.70 | $107.70 |
| Dissolved Organic Carbon | 10 | samples | CH2M HILL BOA Rate | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 |
| Data Validation | | | | | | | | | | | |
| Total Arsenic and Zinc - 15 samples including QA/QC per event | 15 | samples | CH2M HILL BOA Rate | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $214.80 | $214.80 |
| Dissolved Arsenic and Zinc - 15 samples including QA/QC per event | 15 | samples | CH2M HILL BOA Rate | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $214.80 | $214.80 |
| Hardness | 10 | samples | CH2M HILL BOA Rate | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 |
| pH | 10 | samples | CH2M HILL BOA Rate | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 |
| Dissolved Organic Carbon | 10 | samples | CH2M HILL BOA Rate | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 |
| **Data Interpretation** | | | | | **$10,000.00** | | **$0.00** | | **$0.00** | | **$10,000.00** |
| Technical Memorandum | 1 | lump sum | Esimtate from similar CH2M HILL project (PAX Site 493) | $10,000.00 | $10,000.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $10,000.00 |
| **Five-Year Review** | | | | | **$20,000.00** | | **$0.00** | | **$0.00** | | **$20,000.00** |
| Draft and Final Report | 1 | lump sum | Esimtate from similar CH2M HILL project (PAX Site 39) | $20,000.00 | $20,000.00 | $0.00 | $0.00 | $0.00 | $0.00 | $0.00 | $20,000.00 |

TABLE 2-5

**Present Worth Calculation**

*Site 28 Record of Decision*

*NSF-IH, Indian Head, Maryland*

**PRESENT WORTH CALCULATION**

**REMEDIAL ALTERNATIVE 2 - Institutional Controls and Monitoring**

| | | | |
|---|---|---|---|
| Location: | Site 28, NSF-IH, Indian Head, Maryland | Construction time: | N/A |
| Media: | Shallow Groundwater | Operation time: | 1 year |
| | | Discount Rate: | 2.1% (2012 Nominal 5-yr) |
| | | Periodic Contingency: | Fixed-Price |

| Year | Real Cost Incurred | Cost Description | Cost Type | Discount Factor | Present Worth |
|---|---|---|---|---|---|
| 0 | $27,500 | Capital cost | Capital | 1.00 | $27,500 |
| 1 | $16,822 | Sampling Event and Technical Memorandum | Periodic | 1.02 | $16,476 |
| 2 | $0 | -- | Periodic | 1.04 | $0 |
| 3 | $16,822 | Sampling Event and Technical Memorandum | Periodic | 1.06 | $15,805 |
| 4 | $0 | -- | Periodic | 1.09 | $0 |
| 5 | $20,000 | Five Year Review | Periodic | 1.11 | $18,026 |
| **CAPITAL COST** | **$27,500** | | | | |
| **2012 Dollar LIFETIME O&M** | **$81,143** | | **Lifetime Present Worth O&M** | | **$77,806** |
| **TOTAL IMPLEMENTATION COST** | **$108,643** | | **TOTAL PRESENT WORTH** | | **$105,306** |

TABLE 2-6

**Expected Outcomes of the Selected Remedy**

*Site 28 Record of Decision*

*NSF-IH, Indian Head, Maryland*

| Risk | RAO | Remedy Component | Metric/Cleanup Level | Expected Outcome |
|---|---|---|---|---|
| Ingestion and dermal contact with arsenic in shallow groundwater<br><br>Ecological risk from zinc in shallow groundwater | To prevent unacceptable risk to human receptors from exposure to arsenic in the shallow groundwater .<br><br>Ensure concentrations of arsenic (the human health COC in shallow groundwater) and zinc (the ecological COC in shallow groundwater) decrease to meet SRGs<br><br>Return the groundwater to beneficial use to the extent practicable | Implement ICs by designating the contaminated area a "restricted use" area in the NSF-IH geographic information system database, prohibiting residential development of Site 28 and any use of the shallow groundwater (including use as a drinking water source) until the SRGs are met and the contaminants in groundwater are at levels that allow for unlimited use and unrestricted exposure. The requirements of the ICs will be integrated into the Comprehensive Work Approval Process system, and adherence to the ICs would be required for approval for any future work at the site.<br><br>Sample periodically to monitor arsenic and zinc concentrations in the groundwater to verify that concentrations of these metals are decreasing, and evaluate groundwater conditions during the statutory 5-year review to assess the need for continued implementation of ICs and groundwater sampling. | MCL for arsenic in groundwater (10 µg/L)<br><br>Criterion Continuous Concentration for zinc; the numerical cleanup value is dependent on the hardness value measured at each sample location. Based on the hardness data measured for samples collected from Site 28 in 2010, the SRG range for dissolved zinc is 29 to 106 µg/L | Current land use (open space) |

Notes:

RAO - remedial action objective

COC - contaminant of concern

IC - institutional controls

µg/L - microgram(s) per liter

MCL - maximum contaminant level

SRG - site remediation goal

TABLE 2-7

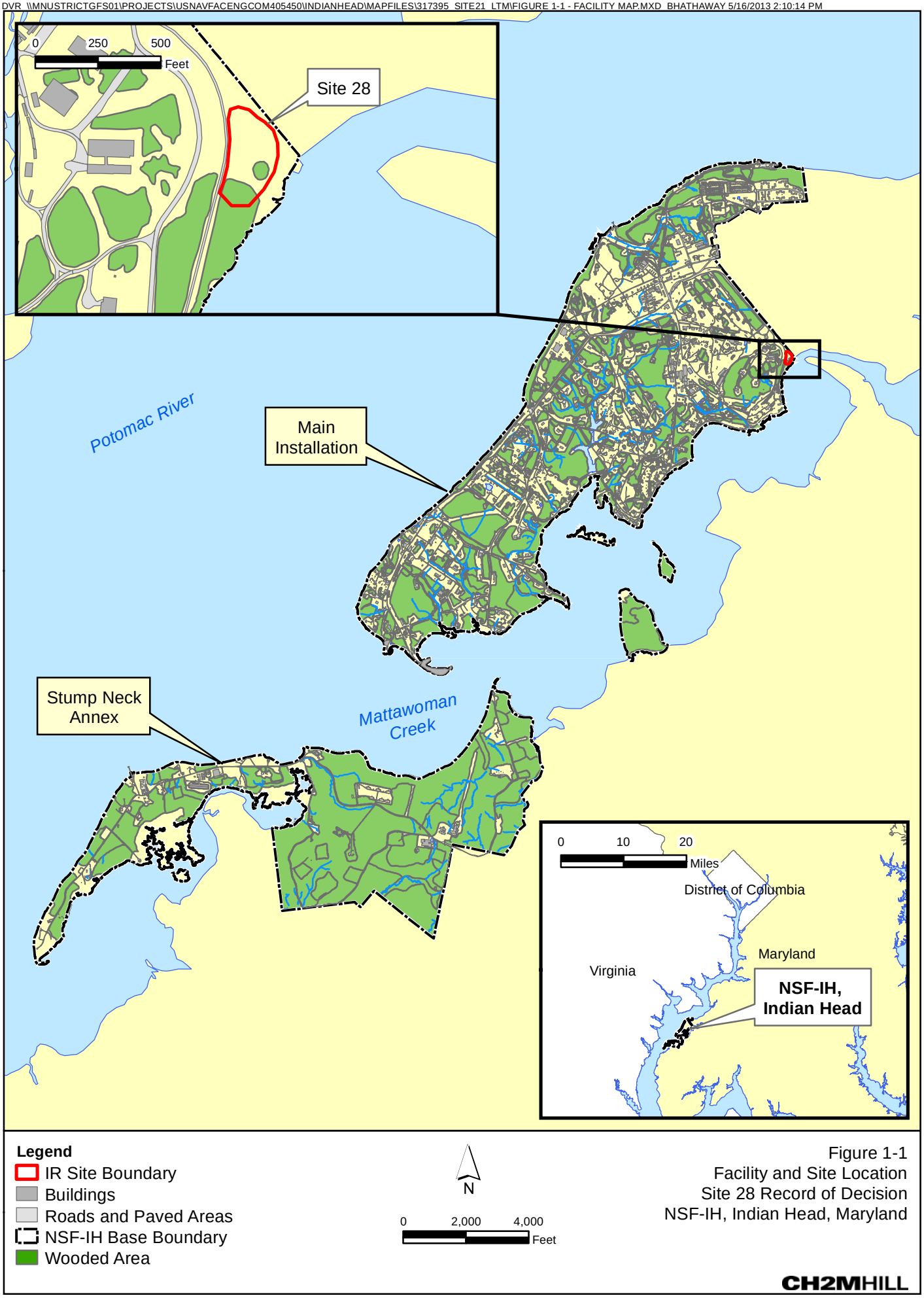
**Chemical-, Location-, and Action-Specific ARARs**

*Site 28 Record of Decision*

*NSF-IH, Indian Head, Maryland*

| Chemical-Specific ARARs | | | | | |
|---|---|---|---|---|---|
| **Media** | **Requirement** | **Prerequisite** | **Citation** | **Applicability Determination** | **Comments** |
| **Safe Drinking Water Act** | | | | | |
| Groundwater | Sets limits on the concentrations of chemicals that may be present in sources or potential sources of drinking water. | Exceedance of concentration limit in groundwater | 40 CFR 141.62(b)(16) | Relevant and Appropriate | The remediation goal for arsenic in groundwater is 10 µg/L |
| µg/L - microgram(s) per liter<br>No Maryland Chemical-Specific ARARs apply. | | | | | |
| **Location-Specific ARARs** | | | | | |
| **Location** | **Requirement** | **Prerequisite** | **Citation** | **Applicability Determination** | **Comments** |
| **Migratory Bird Treaty Act** | | | | | |
| Migratory bird area | Protects almost all species of native birds in the United States from unregulated "taking". | Presence of migratory birds. | *Migratory Bird Treaty Act, 16 USC 703* | Applicable | The site is located in the Atlantic Migratory Flyway. If migratory birds, or their nests or eggs, are identified at the site, operations will not destroy the birds, nests, or eggs. |
| No Maryland Location-Specific ARARs apply. | | | | | |
| **Action-Specific ARARs** | | | | | |
| **Action** | **Requirement** | **Prerequisite** | **Citation** | **Applicability Determination** | **Comments** |
| **Maryland Well Construction Standards** | | | | | |
| Maintenance of groundwater monitoring wells | Specifications for well maintenance including maintaining wells to protect the groundwater resource, maintaining access to the well port such that foreign materials may not enter the well, and maintaining the identification tag. | Maintenance of a monitoring well network. | COMAR 26.04.04.10 A, C, E. | Applicable | Requirements for maintaining the monitoring well network will be incorporated into long-term monitoring plans. |
| No Federal Action-Specific ARARs apply. | | | | | |

# Figures




**Legend**

- IR Site Boundary
- Buildings
- Roads and Paved Areas
- NSF-IH Base Boundary
- Wooded Area

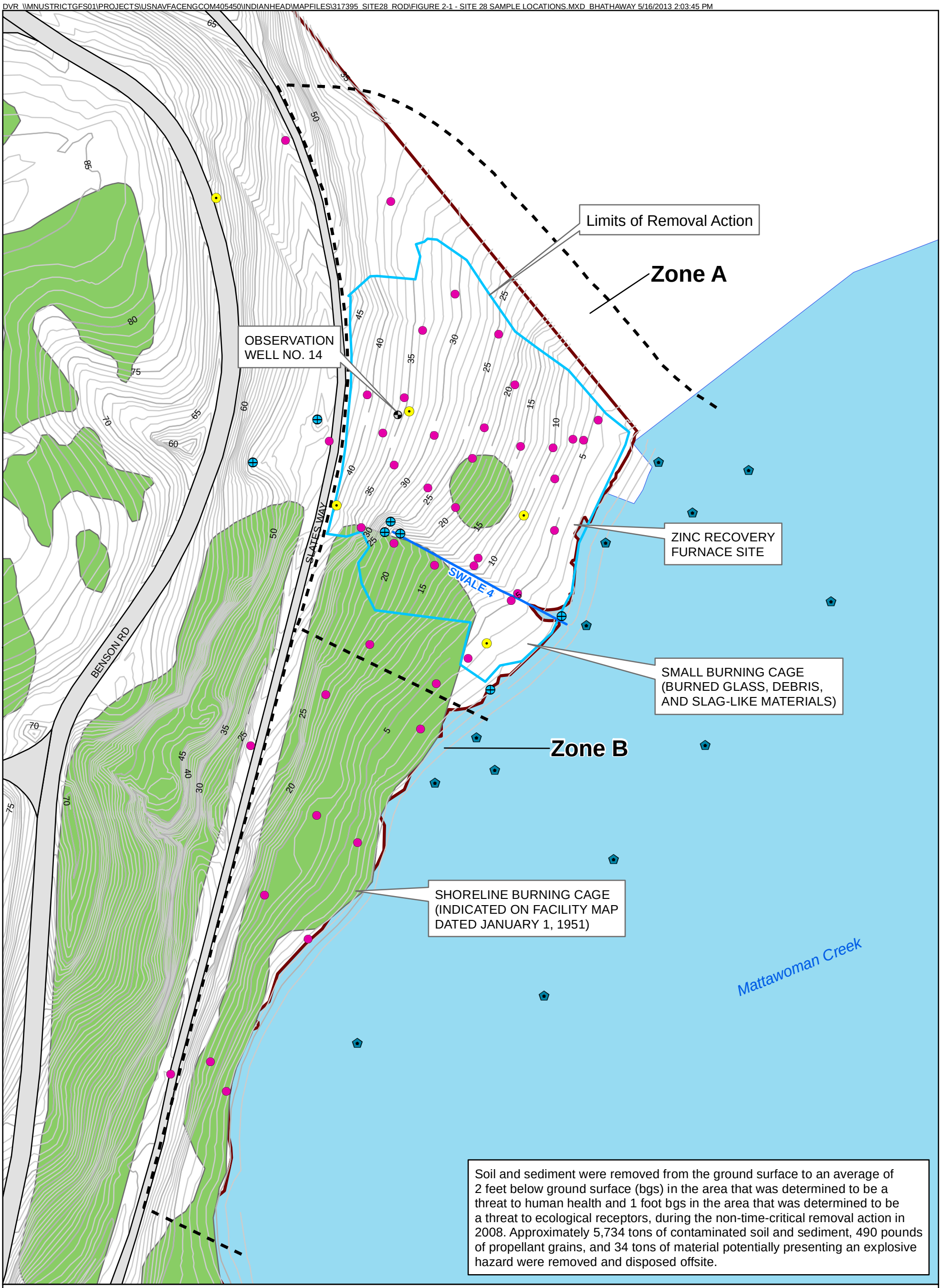
N

0 2,000 4,000 Feet

Figure 1-1
Facility and Site Location
Site 28 Record of Decision
NSF-IH, Indian Head, Maryland

CH2MHILL

DVR \\MNUSTRICTGFS01\PROJECTS\USNAVFACENGCOM405450\INDIANHEAD\MAPFILES\317395_SITE28_ROD\FIGURE 2-1 - SITE 28 SAMPLE LOCATIONS.MXD BHATHAWAY 5/16/2013 2:03:45 PM




Soil and sediment were removed from the ground surface to an average of 2 feet below ground surface (bgs) in the area that was determined to be a threat to human health and 1 foot bgs in the area that was determined to be a threat to ecological receptors, during the non-time-critical removal action in 2008. Approximately 5,734 tons of contaminated soil and sediment, 490 pounds of propellant grains, and 34 tons of material potentially presenting an explosive hazard were removed and disposed offsite.

**Legend**

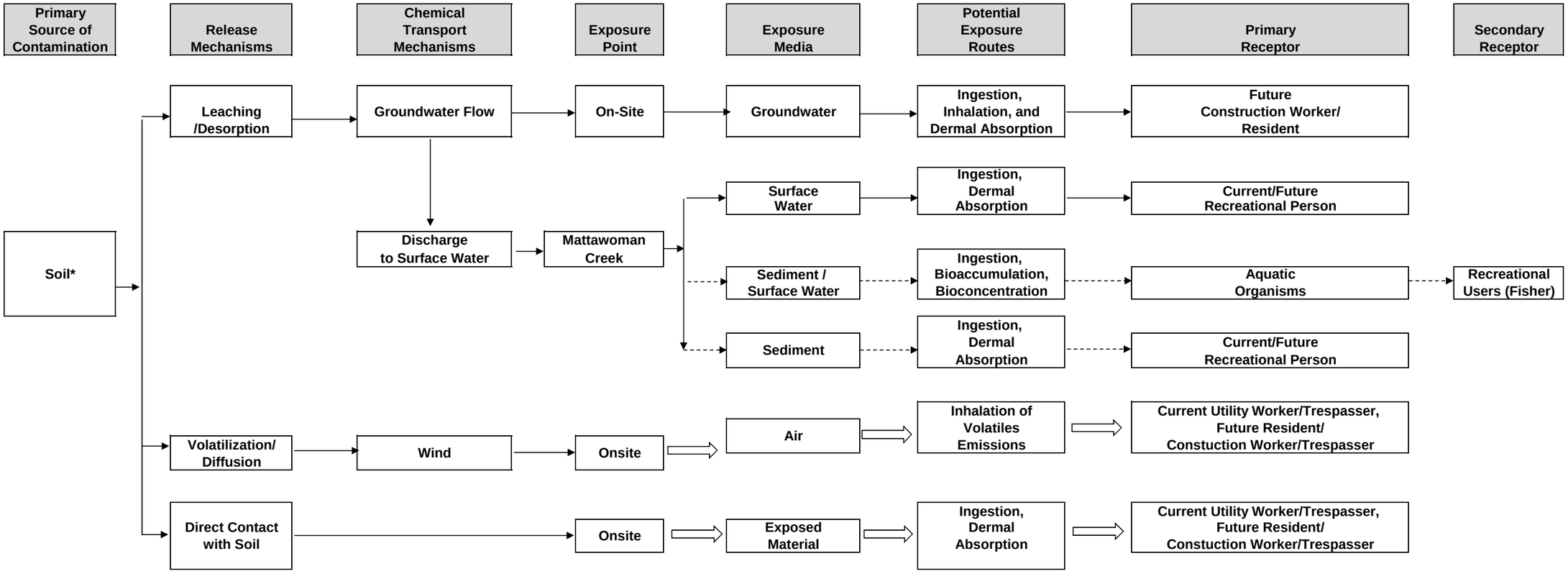
- Mattawoman Creek Sediment Sample Location
- DPT Sample Location
- Monitoring Well Location
- Approximate Observation Well Location
- Surface Water Sample Location
- Swale 4
- Post Excavation Contours (5 ft)
- Post Excavation Contours (1 ft)
- Zone Boundary
- Water Bodies
- Buildings
- Road Area
- Wooded Area
- Installation Boundary

N

0 45 90 Feet

Figure 2-1
Site Layout and Sample Locations
Site 28 Record of Decision
NSF-IH, Indian Head, Maryland

CH2MHILL




* Current scenario is for surface soil and future scenarios are for soil (surface and subsurface soil combined).

Figure 2-2
Conceptual Site Model for Potential Human Receptors
Site 28 Record of Decision
NSF-IH, Indian Head, Maryland

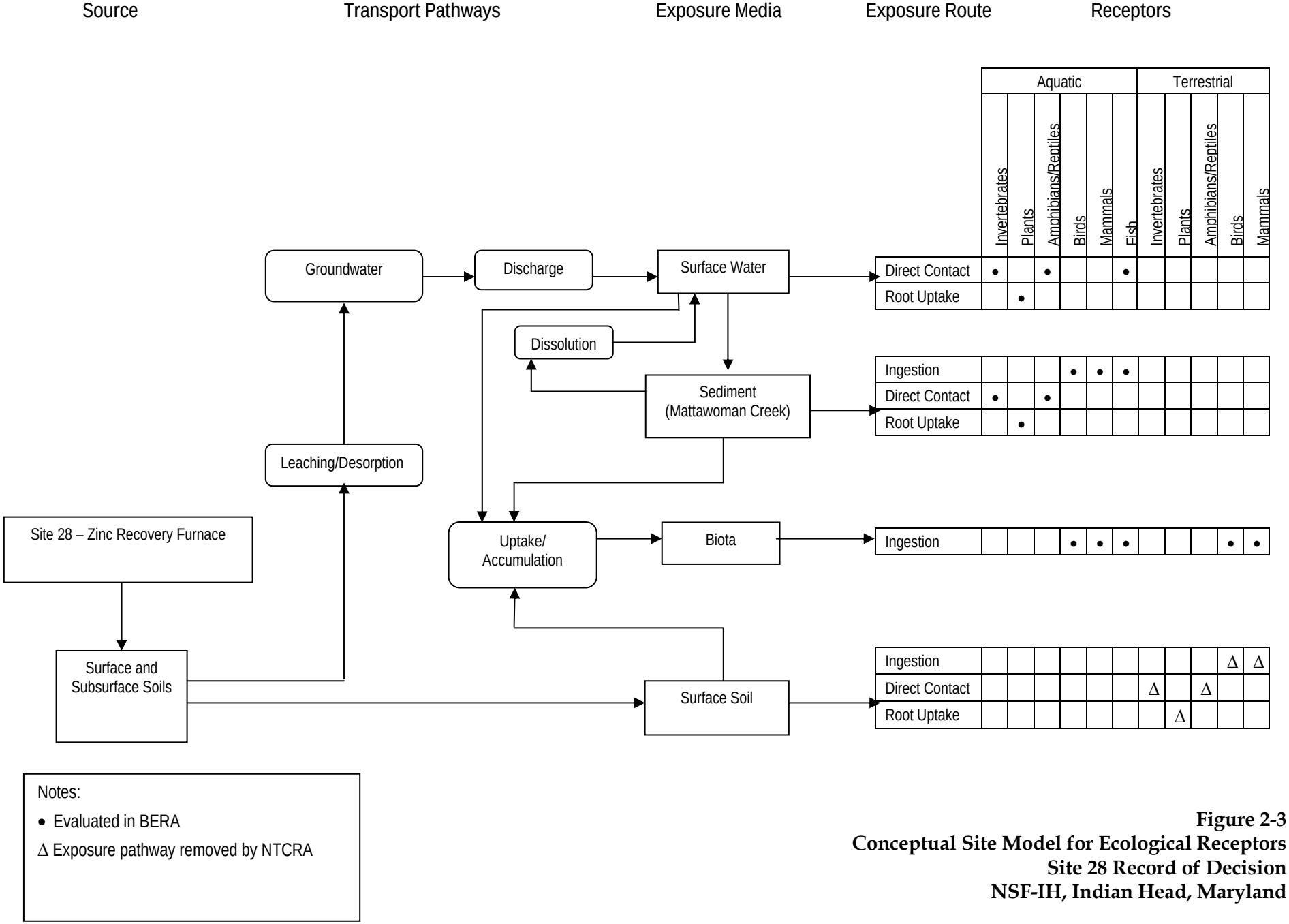



**Figure 2-3**
**Conceptual Site Model for Ecological Receptors**
**Site 28 Record of Decision**
**NSF-IH, Indian Head, Maryland**

DVR \\MNUSTRICTGFS01\PROJECTS\USNAVFACENGCOM405450\INDIANHEAD\MAPFILES\317395_SITE28_ROD\FIGURE 2-4 - AREA OF ATTAINMENT.MXD BHATHAWAY 5/16/2013 2:06:35 PM

IS28MM01
IS28MW05
IS28MM02
IS28MM03
IS28MM07
IS28MM06
IS28MW04
IS28MM05
IS28MM14
IS28MM16
IS28MM27
IS28MM28

Area of Attainment
(1.17 acres)

| IS28MW03 | |
|---|---|
| Total Arsenic | 12.1 µg/L |
| Dissolved Arsenic | 4.2 µg/L |

| IS28GW23 | |
|---|---|
| Dissolved Arsenic | 19.7 µg/L |

| IS28GW11 | |
|---|---|
| Dissolved Arsenic | 142 µg/L |

| IS28GW20 | |
|---|---|
| Dissolved Arsenic | 213 µg/L |

| IS28MW02 | |
|---|---|
| Total Arsenic | 135 µg/L |
| Dissolved Arsenic | 93.5 µg/L |

| IS28GW42 | |
|---|---|
| Dissolved Arsenic | 10.4 µg/L |

| IS28MW01 | |
|---|---|
| Total Arsenic | 347 µg/L |
| Dissolved Arsenic | 317 µg/L |

SWALE 4

Mattawoman Creek

µg/l - micrograms per liter
Note: The Area of Attainment is the area in which arsenic concentrations in groundwater exceed the site remediation goal of 10 µg/l. Institutional controls will be implemented and enforced in this area until the site remedial goal is met.

**Legend**

- Monitoring Well Location
- DPT Groundwater Sample Location
- Groundwater Flow Direction
- Post Excavation Contours (5 ft)
- Post Excavation Contours (1 ft)
- Road Area
- Wooded Area
- Installation Boundary
- Water Bodies

N

0 37.5 75
Feet

Figure 2-4
Area of Attainment
Site 28 Record of Decision
NSF-IH, Indian Head, Maryland

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# Appendix A
# MDE Concurrence Letter

MARYLAND DEPARTMENT OF THE ENVIRONMENT
1800 Washington Boulevard • Baltimore MD 21230
MDE 410-537-3000 • 1-800-633-6101 • www.mde.maryland.gov

Martin O'Malley
Governor

Anthony G. Brown
Lieutenant Governor

Robert M. Summers, Ph.D.
Secretary

March 24, 2014

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

Re: Final Record of Decision, Site 28 – Original Burning Ground at Naval Support Facility, Indian Head, January 2014

Dear Mr. Rail:

As the original Final Record of Decision for Site 28 – Original Burning Ground was to be printed in November 2013, the Federal Facilities Division (FFD) of the Maryland Department of the Environment's Land Restoration Program issued a concurrence letter dated November 28, 2013. Due to issues regarding legal review at the Environmental Protection Agency, the final version of this document was delayed until January 2014.

Thererfore, at the request of the Navy, the FFD is sending this letter to confirm that the State still concurs with the selected remedy for Site 28.

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

Sincerely,

Curtis DeTore
Geological Supervisor
Federal Facilities Division

CD:cd

cc: Mr. Dennis Orenshaw
Mr. Horacio Tablada
Mr. James Carroll

MARYLAND DEPARTMENT OF THE ENVIRONMENT
1800 Washington Boulevard • Baltimore MD 21230
MDE 410-537-3000 • 1-800-633-6101• www.mde.state.md.us

Martin O'Malley
Governor

Anthony G. Brown
Lieutenant Governor

Robert M. Summers, Ph.D.
Secretary

November 21, 2013

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

RE: Final Record of Decision, Site 28 – Original Burning Ground at Naval Support Facility, Indian Head, November 2013

Dear Mr. Rail:

The Federal Facilities Division (FFD) of the Maryland Department of the Environment's Land Restoration Program has completed its review of the above referenced document. This Record of Decision documents the Navy's selected remedy for Site 28 – Original Burning Ground, which is located on the Main Area of the Naval Support Facility Indian Head. The selected remedy is entitled, "Institutional Controls and Groundwater Monitoring". The remedy consists of the following elements: (1) implementation of institutional controls to prohibit residential use and any use of shallow groundwater; (2) periodic groundwater sampling (frequency to be determined at a later date) until contaminant concentrations are below site remediation goals (SRGs); and (3) five-year reviews until SRG's have been met. The selected remedy is based upon the human health and ecological risk assessments performed during the Remedial Investigation. The remedy selected by the Navy is in compliance with the Comprehensive Environmental Response, Compensation and Liability Act.

On August 21, 2013, the Navy held a public meeting to present the findings in the Proposed Plan (PP). Several questions were asked during the public meeting and multiple comments were received during the public comment period. No changes were made to the PP as a result of these comments. Based upon the acceptable level of protection to human health and the environment provided by the remedy, the FFD concurs with the Navy's selected remedy for Site 28.

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

Sincerely,

Curtis DeTore
Geological Supervisor
Federal Facilities Division

CD:cd
cc: Mr. Dennis Orenshaw
Mr. Horacio Tablada
Mr. James Carroll

# Appendix B
# Public Notice and Proof of Publication

panic mode. I freaked out," said.
Lake said, adding that her On Tuesday, she was using kfitzpatrick@somdnews.com

**NAVAL SUPPORT ACTIVITY SOUTH POTOMAC**
**Invites PUBLIC COMMENT**
**on the PROPOSED REMEDIAL ACTION PLANS for**
**SITE 28-ORIGINAL BURNING GROUND, SITE 38-RUM POINT LANDFILL, and UXO 32-SCRAP YARD**
**under the INSTALLATION RESTORATION PROGRAM**

In accordance with the requirements of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980, Naval Support Activity South Potomac invites public comment on the proposed remedial action plans at Installation Restoration Site 28-Original Burning Ground, Site 38-Rum Point Landfill, and UXO 32-Scrap Yard on Naval Support Facility Indian Head, Maryland. The proposed remedial actions are presented in separate Feasibility Study reports for each site. Public comment begins on **July 29, 2013**, and ends on **August 28, 2013**. Therefore, all comments must be postmarked no later than August 28, 2013.

A public meeting poster session will be held on **August 21, 2013, from 5:00 p.m. to 6:00 p.m.** at the Indian Head Senior Center, 100 Cornwallis Square, Indian Head, MD, 20640, to discuss the proposed remedial actions. To request a copy of the proposed plans for the Sites 28, 38, or UXO 32 remedial actions, please visit one of the locations shown below or contact Mr. Joe Rail of the Naval Facility Engineering Command Washington at (202) 685-3105.

The proposed action for **Site 28** is institutional controls to prohibit residential development at Site 28 and any use of the shallow groundwater (including use as a drinking water source) until the contaminants in groundwater are at levels that allow for unlimited use and unrestricted exposure, and groundwater monitoring.

The proposed action for **Site 38** is excavation and offsite disposal of landfill waste and impacted soil, site restoration, and groundwater monitoring.

The proposed action for **UXO 32** is land use controls restricting the site to industrial usage. Groundwater associated with UXO 32 will be addressed in a separate, future proposed remedial action plan.

Additional information on the Navy Installation Restoration Program and relevant environmental documents for Sites 28, 38, and UXO 32 can be found in the Information Repository at the following locations:

| Indian Head Town Hall | Charles County Public Library | Naval Support Facility Indian Head General Library |
|---|---|---|
| 4195 Indian Head Hwy. | 2 Garrett Ave. | Building 620 (The Crossroads) |
| Indian Head, MD 20640 | La Plata, MD 20646-5959 | 4163 N. Jackson Rd. |
| (301) 743-5511 | (301) 934-9001 * (301) 870-3520 | Indian Head, MD 20640-5117 |
| Hours: Mon-Fri 8:30 a.m. to 4:30 p.m. | Hours: Mon-Thurs 9 a.m. to 8 p.m. | (301) 744-4747 |
| | Fri 1-5 p.m. | |
| | Sat 9 a.m. to 5 p.m. | Hours: Mon-Fri 9:30 a.m. to 5 p.m. |

Written comments should be mailed (postmarked) by the closing date of **August 28, 2013** to:

Naval Support Activity South Potomac
Attn: Public Affairs Officer, Code 00P
6509 Sampson Road
Dahlgren, VA 22448-5108
(540) 653-8153

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# Appendix C
# Responses to Public Comments on the Site 28 Proposed Plan

**APPENDIX C**

# Responses to Public Comments on the Site 28 Proposed Plan

The 30-day public comment period for the Selected Remedy for Site 28 began on July 29, 2013, and ended on August 28, 2013. A public meeting was held on August 21, 2013, at the Indian Head Senior Center, 100 Cornwallis Square, Indian Head, Maryland, to accept oral and written comments on this decision. Several questions were raised during the open discussion at the August 21, 2013 public meeting on the Final Site 28 Proposed Plan; these are paraphrased below along with the Navy, EPA, and MDE's consolidated response in italics. In addition, several other questions and comments were received during the public comment period. These comments are presented below as received, and include Navy, EPA, and MDE's consolidated response in italics.

## Comments during Public Meeting - Received on August 21, 2013

1. Have we sampled or monitored the USGS well in the deeper aquifer within Site 28? If not, why?

   ***Response:*** *No, the Navy has not sampled or monitored Well 14 for several reasons. Well 14 was installed in 1918 to a depth of 430 ft. This well was initially used as a potable well, but it became a USGS observation well in 1988. Well 14 is installed in a deep aquifer (Patapsco), which is located below a confining clay layer. This means that the clay layer has very low permeability that prevents the movement of contaminants from Site 28, which were found in the shallow aquifer, to lower portions of the formation. Based on the presence of this confining clay layer, evaluation of the results of the various investigation activities at Site 28, and the conceptual site model, it was determined that contamination was not expected to migrate from the shallow aquifer at Site 28 to deeper aquifers, such as the Patapsco; therefore, it was not necessary to install deeper wells at the site, and similarly, it was not necessary to sample USGS Well 14.*

   *Potable water wells, which are not located within or downgradient of the boundary of Site 28, but are installed in the deeper aquifers (Patapsco and Patuxent) at other locations on the main installation and Stump Neck, are sampled as part of the potable water monitoring program performed by the facility for facility customers. You can find out more information about these wells in the annual Consumer Confidence Report for Naval Support Activity South Potomac, Naval Support Facility Indian Head, Maryland, under Maryland Public Water System IDs 0080058 and 1080039. Maryland also performed a Source Water Assessment (see http://www.mde.maryland.gov/programs/water/ water_supply/ source_water_assessment_program/pages/programs/waterprograms/water_supply/sourcewaterassessment/factsheet.aspx).*

   *For additional information on facility water quality, please contact Ms. Kathy Frey of the Environmental Program Office via Mr. Gary Wagner of Public Affairs at (540) 653-1475.*

2. Was sampling completed outside of Area A and outside of the fence? Did we sample outside of the base to ensure that contamination was not migrating to the Mattawoman Creek?

   ***Response:*** *Soil and groundwater sampling showed that the lateral and vertical extent of contamination was within Navy property boundaries. Soil and groundwater sampling were not conducted outside of the Navy property boundary, because the analytical results from the soil and groundwater samples collected within the Site 28 boundary (inside the fence) were adequate to characterize the nature and extent of contamination at Site 28. Consequently, Navy, MDE and EPA agreed that expanding the sampling effort outside of Navy property was not necessary.*

*Sediment and surface water sampling were conducted along the shoreline of Mattawoman Creek and within Swale 4 (which is within the site boundary but discharges to Mattawoman Creek), to determine if contamination was migrating offsite to Mattawoman Creek. Sediment samples also were collected from within Mattawoman Creek to support the ecological risk assessment and determine the nature and extent and potential off-site migration of chemicals into Mattawoman Creek.*

*Human health risk assessments showed that there were no unacceptable human health risks from exposure to sediment or surface water along the shoreline of Mattawoman Creek and within Swale 4. The ecological risk assessment found unacceptable risks to ecological receptors from exposure to the sediment along the shoreline of Mattawoman Creek and within the surface water of Swale 4. However, it found no unacceptable risk to ecological receptors from exposure to sediment within Mattawoman Creek.*

*The sediment posing unacceptable ecological risks along the shoreline of Mattawoman Creek was later removed from the site (see "Limits of Removal Action" in Figure 2 of the Proposed Plan) and disposed offsite as part of the 2008 non time critical removal action (NTCRA), resulting in no remaining unacceptable ecological risk from exposure to sediment. While potentially unacceptable ecological risk remains for the surface water within Swale 4, sampling results following the NTCRA show that concentrations of cadmium (one of the risk-driving metals) is now within acceptable levels, and concentrations of zinc (another risk-driving metal) have declined by approximately 97% compared to pre-NTCRA data, effectively reducing the overall ecological risk from the site. Based on the contaminant reduction already observed at the site following the NTCRA, it is expected that zinc concentrations will continue to decline to meet the site remediation goals (SRGs) within a reasonable timeframe (estimated to be five years).*

3. How are we planning to treat residual concentrations of arsenic and zinc in groundwater?

***Response:** There is currently no plan to treat arsenic and zinc in the shallow groundwater at the site. The NTCRA conducted in 2008 removed the source of the groundwater contamination—contaminated soil and sediment and propellant grains—and restored the excavated area with clean fill material. Based on the successful completion of the removal action, the geochemistry of the shallow groundwater at Site 28 is expected to return to its natural aerobic setting, and arsenic and zinc are expected to decrease to meet the SRGs within five years.*

*Groundwater sampling will be conducted periodically prior to the 5-year review to confirm that these concentrations are decreasing. A 5-year review is required to ensure that the remedy remains protective of human health and the environment. The details of the sampling program, including sampling frequency and data evaluation, will be proposed by the Navy following the finalization of the Record of Decision (ROD) for the site and presented in a work plan that will be reviewed and approved by the EPA and MDE. The Navy and the regulators will use the data collected during these sampling events to re-evaluate the remedy as part of the 5-year review process to assess the need for continued implementation of institutional controls (ICs) and groundwater monitoring at the site, and to decide the sampling frequency and analysis going forward, if needed. If groundwater contaminants do not decrease at a rate to achieve SRGs in a reasonable timeframe, the Navy and EPA with concurrence from MDE will evaluate whether the long-term monitoring program should be extended or the ROD should be amended to provide for an active remedy to ensure that SRGs are met.*

It was mentioned that we expect contaminant of concern concentrations to attenuate to acceptable levels in a reasonable amount of time. How do we establish what is a "reasonable amount of time?"

***Response:** Following the 2008 NTCRA, concentrations of metals have decreased in the surface water in Swale 4 (which represents the shallow groundwater at the site, based on hydrogeologic cross-sections and potentiometric surface maps for the site). Concentrations of cadmium have already decreased to acceptable risk levels, and concentrations of zinc decreased by approximately 97% compared to pre-NTCRA data in the two years following the NTCRA. These decreases in surface water contaminant concentrations suggest that the arsenic concentrations in the groundwater will also decrease because the*

*source of contamination has been removed. In consultation with EPA and MDE, the Navy has concluded that the site is expected to meet SRGs within the next 5 years.*

*EPA requires that if an action is taken at a site, the site will have to undergo a 5-year review. As noted in the response to Comment #3 above, sampling will be performed for Site 28 to confirm that the concentrations of contaminants are decreasing, and the remedy will be re-evaluated as part of the 5-year review.*

4. The proposed plan mentions sampling every 5 years as part of a 5-Year Review process. Can monitoring occur more frequently than every 5 years? Are there any examples where contamination has been shown to decrease to acceptable levels in a 5-year timeframe or less at other sites?

   ***Response:*** *Yes, groundwater monitoring at Site 28 will occur more frequently than every 5 years. The details of the sampling program, such as sampling frequency, data evaluation, and decision rules for an exit strategy will be developed and agreed to by the Navy and regulators following the finalization of the ROD, and will be documented in a monitoring plan. The Navy and regulators will use the data collected as part of the groundwater monitoring activities to re-evaluate the remedy as part of the 5-year review process to assess the need for continued implementation of ICs and groundwater monitoring at the site, and to decide the sampling frequency and analysis going forward, if needed.*

   *Yes, there are examples where contamination has been shown to decrease to acceptable levels in less than 5 years. Following the NTCRA, sampling of water in Swale 4 showed that concentrations of zinc decreased by 97% and cadmium decreased below the action level in a period of 2 years. This is because the sources of the contamination, contaminated soil and sediment and propellant grains, were removed from the site, which in turn mitigated the migration of contaminants from these media to the site groundwater and surface water in Swale 4.*

5. Did you measure the flow rate of water from Site 28 into the Mattawoman Creek?

   ***Response:*** *No, the flow rate of water from Site 28 into the Mattawoman Creek has not been measured. A remedial investigation was completed, which characterized the nature and extent of contamination. Measuring the flow rate of water was not necessary for that investigation.*

6. What was the cost of cleanup at Site 28 and how much money has the Navy spent at the site?

   ***Response:*** *Approximately $3 million has been spent on Site 28 to date. Completed work includes the NTCRA completed in 2008, as well as a Remedial Investigation, Baseline Ecological Risk Assessment, Feasibility Study, Proposed Plan, and ROD (which is in progress). Additional work anticipated for the site includes a long-term monitoring plan, groundwater monitoring, and implementation of land use controls at an estimated cost of $110,000.*

*7.* What has been done concerning other contaminant runoff from the base particularly along the old railroad tracks?

   ***Response:*** *The Site 28 remedy is only intended to address contaminants associated with the site. A total of 56 Installation Restoration sites have been identified for investigation and potential cleanup at NSF-IH and contamination from those sites is also being addressed on a site-specific basis. To date, there has been no railroad bed contamination identified at those sites. A list of all sites can be found in the Final 2012 Environmental Restoration Site Management Plan (NAVFAC, 2012), located in the Administrative Record. The link is* http://go.usa.gov/DyQF. *The Site Management Plan contains the location, description, contaminants of concern, and cleanup status of each site. For questions about stormwater runoff generally and along the railroad tracks please contact Mr. Gary Wagner of Public Affairs at (540) 653-1475.*

## Written Comments from ARARAT (dated 8/27/13) - Received on September 4, 2013

Following are comments on the above Plan which presents the remedial alternatives evaluated and recommended to address shallow groundwater contamination at Site 28, Original Burning Ground at NSF-IH.

1. The plan sites the number of soil samples that have been conducted over the years including sediment samples collected from Mattawoman Creek in the vicinity of Site 28. In 2003 samples were collected from surface soil, subsurface soil, groundwater, surface water, and sediment samples from Zone A and Zone B.

   In 2006 an Engineering Evaluation/Cost Analysis was prepared for what is referred to as a "Non-Time-Critical Removal Action."(NTCRA). This action they felt would remove the potential source for contaminants in the soil, groundwater, sediment, and surface water at the site. Soil and sediment removal with offsite disposal was selected because the removal of soil and sediment at and adjacent to the site and offsite disposal would decrease lead and zinc concentrations in these media to acceptable levels, thereby reducing risks to human health and ecological receptors.

   The Plan states that as a result of the 5,734 tons of contaminated soil and sediment that were removed and disposed of offsite the NTCRA clearly removed the delineated extent of contaminated soil and sediment that was the source of the unacceptable human health and ecological risks. The excavated area was restored with clean fill material and re-vegetated. We are told that based on these actions, unacceptable human health and ecological risks from exposure to soil and sediment were eliminated at the site.

   In order to accept this proposal we would like to know the results of the samples that were taken. We note that the removal action does not include residual areas of Zone A some of which are outside the NSF-IH boundaries. Did we contact the town of Indian Head to obtain access to those community or privately owned areas close to the Installation Boundary where the soils and/or groundwater may be contaminated? As stated in the opening, however, Introduction of the Proposed Plan recommends no further remedial action based on the NTCRA performed at Site 28 in 2008.

   ***Response:*** *The limits of the removal area were clearly defined, both laterally and vertically, by the extensive delineation achieved through the RI sampling. RI sampling showed that contamination was fully contained within the limits of Navy property. Therefore, the Navy, EPA, and MDE decided that on and off-site confirmation sampling following the excavation was not required. The results of the RI samples are summarized in the Proposed Plan, but the complete data tables can be found in the RI Report and the Focused Feasibility Study Report, which are in the Administrative Record. The link is* http://go.usa.gov/DyQF.

   *The removal action does not include the portion of Zone A outside the site boundary and outside of Navy property, and the Navy did not contact the town of Indian Head to obtain access to those community or privately owned areas, because the lateral and vertical extents of contamination are within the site on the Navy property. Please see response to Comment #2 from "Comments during Public Meeting" above.*

   *The Proposed Plan recommends no further remedial action based on the NTCRA performed at Site 28 in 2008 for surface soil, subsurface soil, sediment, and surface water in Mattawoman Creek adjacent to the site because the NTCRA removed the clearly delineated extent of contaminated soil and sediment that was the source of the unacceptable human health and ecological risks; the excavated area was restored with clean fill material and re-vegetated. The Proposed Plan, however, recommends ICs to prohibit use of the shallow groundwater as a drinking water source until groundwater conditions do not pose an unacceptable risk to human health or the environment and periodic sampling to monitor contaminant concentrations in shallow groundwater.*

2. Now we come to the main objectives of the current Proposed Plan that recommends Institutional Controls (ICs) to prohibit use of shallow groundwater as a drinking water source until groundwater conditions do not pose an unacceptable risk to human health or the environment. Please indicate the type of institutional controls that will be used. What organizational unit would be responsible for implementing and enforcing these restrictions?

   ***Response:*** *As noted in the Proposed Plan, the ICs will be implemented in the Area of Attainment (Figure 3 of the Proposed Plan) where residual groundwater contamination is still present. The Navy will designate the Area of Attainment as a "restricted use" area in the base's geographic information system database. This is to prohibit residential development and any use of the shallow groundwater until the SRGs are met. In addition, the requirements of the ICs would be integrated into the Navy's Comprehensive Work Approval Process (CWAP) system to provide a warning to workers that there is potential for encountering contaminated groundwater in the Area of Attainment, and appropriate health and safety measures must be taken.*

   *The Navy will be responsible for implementing and enforcing these restrictions through the CWAP process and a Land Use Control Remedial Design Plan. Following signing of the ROD, the Navy will prepare and submit to MDE and EPA a Land Use Control Remedial Design plan for the IC component of the Selected Remedy in accordance with the ROD. This plan will document the objectives of the ICs, and the implementation and maintenance actions.*

3. We note that there is an observation well that was installed in 1918 to a depth of 430 feet and is used by the U.S. Geological Survey as an observation well. Since this well is in the limits of removal action have we had the water and the well tested for its level of contamination if any? Is the well access secure?

   ***Response:*** *Please response to Comment #1 in "Comments during Public Meeting" above. The well access is not specifically secured; however, it is within the facility fence line.*

4. Under the Evaluation of Remedial Alternatives I agree with the selection of Alternative 2 since it is considered protective of human health and the environment because the groundwater is expected to meet the Site Remediation Goal (SRG). I am concerned, however, that the Area of Attainment is the same as the property boundary on the northeast side. Water, soil, etc. do not always conform to political boundaries. I suggest several additional DPT Groundwater Sample Locations be entered next to the property (Navy side of fence) boundary for at least 100 feet beginning at Mattawoman Creek. If any of the DPT's are more Arsenic than 10 milligrams per liter we will need to ask the Town of Indian Head, who I believe owns the property adjoining the fenced area near the Mattawoman, to permit the Navy to do additional DPT's. I suggest that additional DPT's should be added at fifty foot intervals until the DPT's drop to 10 milligrams per liter or less. Institutional controls should be implemented and enforced in the extended area until the site remedial goal is met.

   ***Response:*** *The Area of Attainment is based on analytical data (not a property boundary) and is defined as the area where the SRGs are exceeded for arsenic and zinc in groundwater. The Area of Attainment boundary is based on review of all groundwater data that were available during the Focused Feasibility Study. The boundary line is an isoconcentration line (line of equal concentration) that equals to 10 micrograms per liter (µg/L), which is the SRG for arsenic. The lines are close together, but the Area of Attainment boundary is within the property boundary on the northeast.*

   *In response to the suggestion regarding additional groundwater sampling, please see response to Comment # 2 in "Comments during Public Meeting" above.*

   Note: The map on page 3 indicates that the boundary for Zone A extends into private property and/or the property that is owned by the Town of Indian Head. The Town of Indian Head is one of only three incorporated Towns in Charles County. Since you have already identified the boundary of Zone A I think it would be in the Navy's best interest to have a representative of the Navy meet with either the Town

Mayor or someone he appoints to brief the Town on the status of Site 28 and what assistance the Town can provide for the Navy to meet its objectives with respect to Site 28.

***Response:*** *The RI delineated the lateral and vertical extents of soil contamination, which were then addressed during the NTCRA. Based on hydrogeologic cross-sections and potentiometric surface maps in the RI report, shallow groundwater flows towards the Mattawoman Creek (flow is from northwest to southeast) not toward the Town property (northeast). Therefore, it is extremely unlikely that contamination is migrating towards the Town property.*

5. The references to Groundwater in the report and in the Glossary of Terms seems to refer primarily to shallow wells. It seems to be generally assumed that there is no risk of contamination in the aquifers since they are confined and protected by the ground around them. It has been my understanding that aquifers do not all function the same. They can vary in type and thickness of soil separating them and one aquifer can bleed into another –either up or down. My comments here are not meant to apply to Site 28 only but to our evaluation of other of the IRP's at NSF-IH.

   ***Response:*** *During the Site 28 RI, samples were collected from the clay layer beneath Site 28 and analyzed by a laboratory for hydraulic conductivity properties. The results of the laboratory testing showed that the clay layer had very low permeability, which would prevent the movement of contaminants from Site 28 (found in the shallow aquifer) to lower portions of the formation (such as the Patapsco aquifer). Based on the presence of this confining clay layer, evaluation of the results of the various investigation activities at Site 28, and the conceptual site model, it was determined that contamination was not expected to migrate from the shallow aquifer at Site 28 to deeper aquifers; therefore, it was not necessary to install deeper wells at the site, and similarly, it was not necessary to sample the deep USGS Well 14 located on Site 28.*

   I do not know the number of wells on the base that are in a confined aquifer (either Patapsco or Patuxent) and some are for domestic use. I would assume those wells that are used for drinking and domestic use are tested monthly. Does the testing of these wells from time to time focus on testing for contamination of IRP sites in the area of the well? I think we should recognize that simply because it is a so called confined well does not mean it is safe from contamination. If monitoring is not done with our domestic wells in the area of the IRP I suggest it be considered.

   ***Response:*** *There are six wells on Naval Support Facility Indian Head (including the main installation and Stump Neck): three wells are drilled to the Patuxent aquifer, and three wells are drilled to the Patapsco aquifer. None of the wells are located within the boundary of Site 28. You can find out more information about these wells, including water quality data, in the annual Consumer Confidence Report for Naval Support Activity South Potomac, Naval Support Facility Indian Head, Maryland, under Maryland Public Water System IDs 0080058 and 1080039.*

## Written Comments from Mr. Jim Long, Mattawoman Watershed Society (dated 9/4/13) - Received on September 5, 2013

**Site 28: Original Burning Ground**

Site summary: This site lies on the northern shore of the Mattawoman estuary just within the NSF perimeter fence and adjacent to Mattingly Park. The Proposed Plan follows an extensive soil removal project completed in 2008. Presently, the chief problem is reported to be shallow groundwater that retains high but declining levels of arsenic. It is stated that dissolved arsenic was exacerbated by biogeochemical processes related to propellant contaminants that have since been removed. High levels of zinc are also present in the groundwater. The plan proposes to use Institutional Controls to prevent use of contaminated groundwater, and to continue monitoring to verify expectations that elevated metal levels will continue to decline after the soil removal from the site in 2008.

Comments:

1. The map of Figure 2 shows Zone A extending beyond the fence, which seems prudent. However, no sampling sites are indicated beyond the fence. No discussion is provided to justify the absence of sampling where the public is most likely to come into contact with potential contaminants. Should such sampling be provided as an assurance?

   ***Response:*** *Please see the response to Comment # 2 in "Comments during Public Meeting" above.*

2. The Proposed Plan appears to be seriously incomplete in assuring the public that groundwater that may be reaching Mattawoman, or that bottom sediments in Mattawoman adjacent to the site, pose no ecological or human risk. On p. 4 (Sediment Toxicity Identification Evaluation Demonstration), a large zinc concentration of 25,000 g/L is noted for pore water within a bottom-sediment core in October 2000. On p. 5 (Sediment, under Remedial Investigation), it is stated that "[d]etected concentrations of most metals were significantly lower in the sediment collected offshore within Mattawoman Creek" when compared to shoreline levels of 10,700 mg/kg. No date is given. What does "most metals" mean? Evidently some metals were not significantly lower, though of course absolute concentrations for different metals must be assessed against the level posing a risk. Evidently Post-NTCRA monitoring (p. 6) did not include bottom sediments. We note that bottom feeding fish (e.g. catfish, an omnivore) frequent the area, and are routinely caught by anglers using the Mattingly Park fishing piers. Is there a need for retesting bottom sediments? For testing fish tissues? If not, why not?

   ***Response:*** *No, additional testing and/or sediment sampling is not needed. Although groundwater is reaching the Mattawoman Creek (groundwater flow at the site is northwest to southeast toward Mattawoman Creek), the human health and ecological risk assessments performed as part of the Mattawoman Creek Study (TTNUS, 2004) and the RI (CH2M HILL, 2005) found no unacceptable risk from human exposure to the surface water and sediment along the shoreline of Mattawoman Creek, and no unacceptable risk to ecological receptors from bottom sediment within Mattawoman Creek. The contaminated soil and sediment posing unacceptable human health and/or ecological risk within Site 28 and along the shoreline of Mattawoman Creek were removed from the site and disposed offsite as part of the 2008 NTCRA (see "Limits of Removal Action" in Figure 2 of the Proposed Plan).*

   *As noted in the Proposed Plan, potential human health risks from exposure to sediment were evaluated in the Final Mattawoman Creek Study Report (Tetra Tech NUS, 2004). In this study, it was concluded that potential risks to current and future construction workers and adult and adolescent recreational users were within acceptable levels. The RI report did not further evaluate sediment data for human health risks, based on the findings of the 2004 report and a determination that exposure to sediment adjacent to Site 28 was not a complete exposure pathway (due to the steep grade of the shoreline, any sediment contacted by a receptor would be rinsed off the skin while exiting the creek to land or re-entering a boat).*

   *For this site, "most metals" can be defined as those that have risk-driving concentrations (i.e. arsenic, lead, and zinc.) The Sediment Toxicity Identification Evaluation Demonstration sampling conducted in 2000 found a pore water concentration of 25,000 micrograms per liter (not grams per liter as noted in the comment) for zinc. The complete analytical data tables for the sediment collected as part of the RI (including the shoreline levels of 10,700 mg/kg referenced in the comment) can be found in Table 4-5 of the RI report. Although concentrations of arsenic, lead, and zinc were lower offshore than on site, there were some metals that were found in higher concentrations in the Mattawoman Creek sediment. However, as noted previously, these offshore metals concentrations were not found to pose unacceptable risks.*

   *The shoreline zinc concentration of 10,700 mg/kg was found in sample IS28SD05, which was located within limits of the NTCRA that extended out into the near shore sediments to an elevation of 2 feet below mean sea level; sediment from this location was removed and disposed offsite during the removal action, and the area was restored with clean fill material and re-vegetated. In addition, sampling performed prior*

*to the NTCRA to support the ecological risk assessments for Site 28 showed that elevated metal concentrations and ecological risk were limited to the immediate shoreline and near shore sediments that were addressed by the NTCRA (and did not extend further out into the Mattawoman Creek); therefore, sampling of bottom sediments following the NTCRA was not warranted.*

*Also, fish tissue samples were collected to support the baseline ecological risk assessment for Site 28. The fish tissue concentrations from fish collected along the shoreline of Site 28 were comparable to fish tissue concentrations from reference areas collected in the Mattawoman Creek Study. Therefore, ingestion of fish caught adjacent to Site 28 would not result in risks above those associated with ingestion of fish caught from reference areas. Because of the extensive sampling and contaminant delineation conducted as part of the RI, which defined the limits of the removal action, the Navy, EPA, and MDE decided that confirmation sampling following the excavation was not required.*

3. It appears that a tacit assumption has been made that no connection exists between the contaminated shallow groundwater on the site and deeper aquifers. However, confining clay layers are evidently penetrated by the 430-foot-deep USGS well on the site. It would seem sensible to test the water from this USGS water for the presence of contaminants.

***Response:*** *As described in the responses to comment # 1 in "Comments during Public Meeting" above and comment # 5 in "Written Comments from ARARAT" above, the clay layer underlying Site 28 was shown by laboratory testing to have very low permeability, which would prevent the movement of contaminants from Site 28 (found in the shallow aquifer) to lower portions of the formation (such as the Patapsco aquifer). The presence of a well that penetrates this clay layer does not itself contribute to contaminant migration from the shallow to deeper aquifers.*

*Well 14 was installed in 1918 to a depth of 430 ft. This well was initially used as a potable well, but it became a USGS observation well in 1988. Well 14 is installed in a deep aquifer (Patapsco), which is located below the confining clay layer at Site 28. During the RI, the Navy considered whether Well 14 should be sampled as part of site investigation activities. Based on several lines of evidence, the Navy concluded that it was not necessary to sample this well:*

- *Well 14 was observed to be in good physical condition; the surface casing was intact and surrounded by a sizable concrete pad. The riser, a "stickup" type riser completed approximately 3 feet above ground surface, was capped and locked. Visual inspection of the well showed no indication that the surface seal had been compromised.*
- *During the RI, Well 14 was under an ongoing study by the USGS, and was sampled periodically between May 1952 and October 1989 for water quality parameters such as dissolved oxygen, sodium, chloride, etc. Water samples were also periodically analyzed for other criteria, including zinc. Zinc was not detected in the water samples collected from Well 14 in 1957, 1959, and 1961 (the last three years in which samples were analyzed for this parameter).*
- *Well 12, which is located approximately 1000 feet west of Well 14, is screened in the same deep aquifer as Well 14 (Patapsco) and was still used as a potable water production well at the time of the Site 28 RI. As such, Well 12 was regularly tested for a variety of chemical constituents. Analysis of a water sample collected from Well 12 in November 2001 (during the work planning phase for the Site 28 RI) indicated zinc levels in the Patapsco aquifer groundwater were less than 10 µg/L. This is lower than the current Site 28 site remediation goal for zinc, which ranges from 29 to 106 µg/L (based on the hardness levels measured at the sample location).*

*Because of the depth of Well 14 below the confining clay layer at Site 28, and the absence of site-related contamination in the Patapsco aquifer (based on the Well 12 sampling), Well 14 was not proposed to be sampled during the Site 28 RI.*

*Based on the presence of the confining clay layer, evaluation of the results of the various investigation activities at Site 28 (including the RI), and the conceptual site model, it was concluded that contamination was not expected to migrate from the shallow aquifer at Site 28 to deeper aquifers; therefore, it was determined not to be necessary to install deeper wells at the site, and similarly, it was not necessary to sample USGS Well 14. It should also be noted that Well 14 is located outside the Area of Attainment (Figure 3 of the Proposed Plan) where residual groundwater contamination is still present at Site 28.*

In the Preferred Remedial Alternative, and elsewhere, no rationale is given for the expectation that five-years will be sufficient for oxidizing conditions to immobilize arsenic (and zinc?) dissolved in the groundwater. We agree that five-years seems "a reasonable time frame" to meet the Site Remediation Goal, but no evidence is presented to justify the expectation. It is presumably based on testing after the removal of contaminated soils, but (at least as described), the reduction may simply reflect the removal of the source rather than a change in biogeochemistry.

***Response:*** *Please see response to comment # 4 in "Comments during Public Meeting" above. The 5-year timeframe for site groundwater to meet SRGs for arsenic and zinc is based on the removal of the source of contamination during the 2008 NTCRA and the rate of contaminant concentration decreases observed for site groundwater following the NTCRA. In just the two years following the NTCRA, concentrations of metals have decreased in the surface water in Swale 4 (which represents the shallow groundwater at the site, based on hydrogeologic cross-sections and potentiometric surface maps for the site): concentrations of cadmium decreased within that timeframe to acceptable risk levels, and concentrations of zinc decreased by approximately 97% compared to pre-NTCRA data.*

*While concentrations of arsenic have not been measured following the NTCRA, it is expected that concentrations of this metal in groundwater will decrease similarly. As described in the Site 28 Groundwater Focused Feasibility Study (CH2M HILL, 2010), the elevated arsenic concentrations at Site 28 were likely caused by a reducing, or oxygen-deprived, condition in the shallow aquifer. This is supported by field data collected during the RI, which showed reducing conditions in the monitoring wells that had the highest arsenic concentrations at the site. The presence of the propellant grains in Site 28 soil likely drove the shallow groundwater into a reducing condition, due to the high organic content in the propellant grains. The presence of these organic compounds increased both biological and chemical oxygen demand in the subsurface, changing the geochemical condition into an oxygen-deprived condition that subsequently caused the mobilization of metals, such as arsenic, in the shallow groundwater. Because the 2008 NTCRA removed the sources of groundwater contamination (both the contaminated soil and sediment and the propellant grains), the geochemistry of the shallow groundwater at Site 28 is expected to return to its natural aerobic setting, which would mitigate the mobilization of metals, such as arsenic.*

*EPA and MDE concur with the Navy's conclusion.*

4. In the same section, no scale at all is given to the reasonable time frame for zinc concentrations to reach levels that pose no unacceptable risk to ecological receptors.

***Response:*** *Please see response to comment # 4 in "Comments during Public Meeting" above.*