FINAL

PROPOSED PLAN

HORSESHOE POND
Former Nansemond Ordnance Depot

Suffolk, Virginia

Prepared by:

U.S. Army Corps of Engineers
Baltimore District

June 2014

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1.0 INTRODUCTION

This **Proposed Plan** identifies the preferred alternative for the Horseshoe Pond ("the Site") at the Former Nansemond Ordnance Depot (FNOD). **Figure 1** shows the location of the Site.

The preferred alternative is removal of contaminated soil and debris, followed by disposal at an off-site solid waste landfill. This plan summarizes all the remedial alternatives evaluated and discusses the reasons for choosing the preferred alternative over the others.

The final remedy for the Site will be selected after reviewing and considering all information submitted during the 30-day public comment period. The preferred alternative presented in the Proposed Plan may be modified or another response action presented in the Proposed Plan may be selected, based on new information or public comments. The public is encouraged to review and comment on the Proposed Plan. This Proposed Plan was prepared using guidance provided in the *Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents* (USEPA, 1999).

The Proposed Plan is being issued by USACE as part of its public participation responsibilities under Section 300.430(f)(2) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP).

The Proposed Plan fulfills the public participation requirements of **Comprehensive Environmental Response, Compensation, and Liability Act** (CERCLA) Section 117(a). CERCLA specifies that a plan must be published outlining **remedial alternatives** evaluated for the Site and identifying the preferred alternative. The Proposed Plan summarizes information that can be found in greater detail in the Final **Remedial Investigation** (RI) Report (WESTON, 2011) and the Draft **Focused Feasibility Study** Report (WESTON, 2012). These documents are available in the **Administrative Record** at the North Suffolk Library in Suffolk, Virginia. The public is encouraged to review the Proposed Plan to gain a more comprehensive understanding of activities that have been conducted at the Site.

The purpose of the Proposed Plan is to:

- Summarize the Site history and the results of past Site investigations.
- Summarize remedial alternatives evaluated to best address contamination at the Site.
- Present the preferred alternative.

The Proposed Plan identifies the preferred alternative for the Site. Action is necessary at the Site because the ecological and human health risks associated with former Department of Defense (DoD) activities are at unacceptable levels.

« MARK YOUR CALENDAR »

PUBLIC COMMENT PERIOD:
30 June – 30 July 2014

USACE will accept written or oral comments on the Proposed Plan during a 30-day public comment period. Oral comments can be submitted during the public meeting. Written comments should be addressed to:

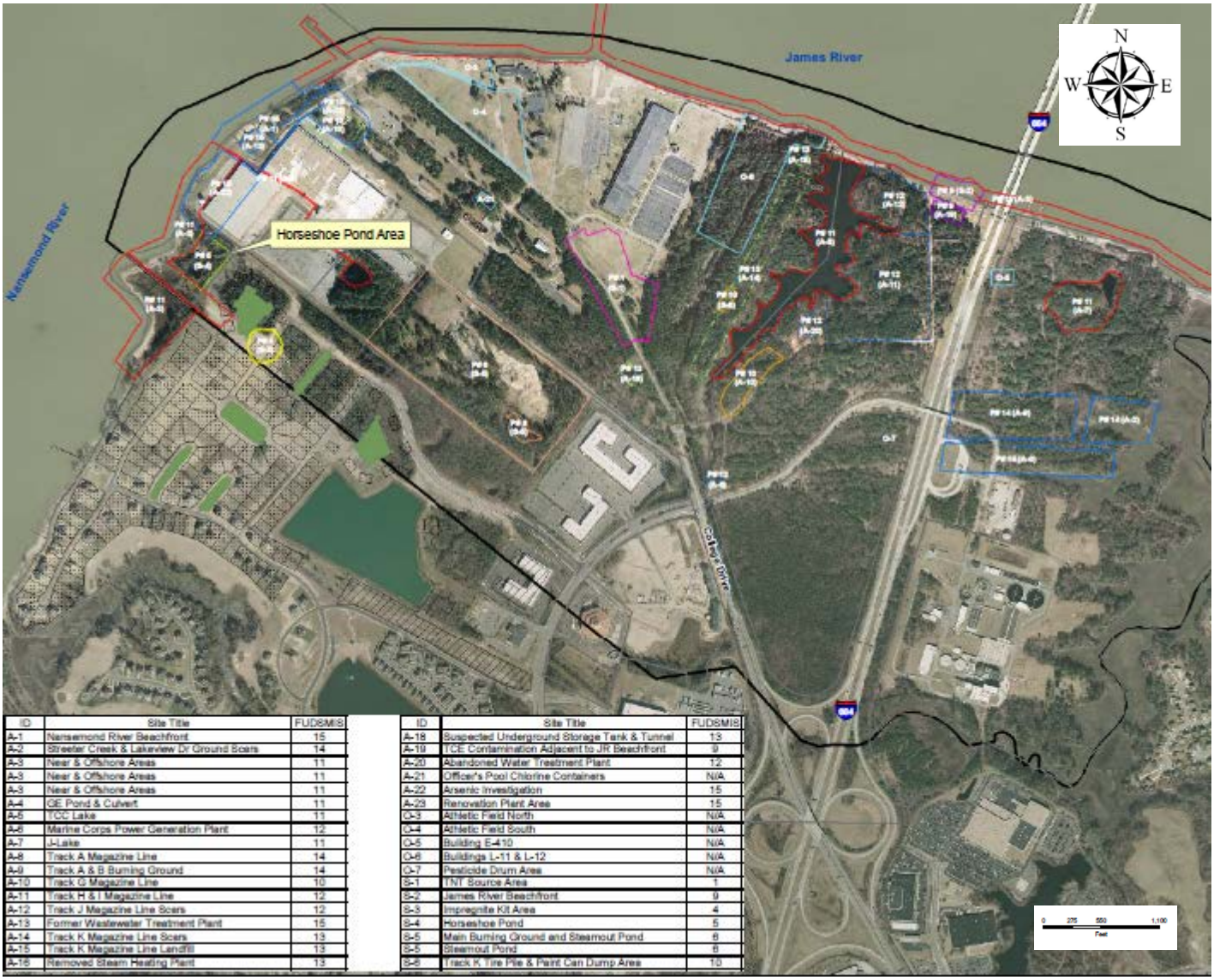
Mr. Sher Zaman, Project Manager
U.S. Army Corps of Engineers, Baltimore District
P.O. Box 1715
Baltimore, MD 21203-1715
email: sher.zaman@usace.army.mil

PUBLIC MEETING: 10 July 2014

A public meeting will be held to discuss the Proposed Plan for the FNOD Horseshoe Pond. The meeting will be held at the Hilton Garden Inn, 5921 Harbour View Boulevard, Suffolk, Virginia, from 6 p.m. to 8 p.m. Copies of the Proposed Plan and the presentation will be available at the meeting.

For more information on the Site, see the Administrative Record at the following location

North Suffolk Library
2000 Bennetts Creek Park Road
Suffolk, Virginia 23435
757-514-7150



ID	Site Title	FUDSMIS
A-1	Nansemond River Beachfront	15
A-2	Streeter Creek & Lakeview Dr Ground Scars	14
A-3	Near & Offshore Areas	11
A-3	Near & Offshore Areas	11
A-3	Near & Offshore Areas	11
A-4	QE Pond & Culvert	11
A-5	TCC Lake	11
A-6	Marine Corps Power Generation Plant	12
A-7	J-Lake	11
A-8	Track A Magazine Line	14
A-9	Track A & B Burning Ground	14
A-10	Track G Magazine Line	10
A-11	Track H & I Magazine Line	12
A-12	Track J Magazine Line Scars	12
A-13	Former Wastewater Treatment Plant	15
A-14	Track K Magazine Line Scars	13
A-15	Track K Magazine Line Landfill	13
A-16	Removed Steam Heating Plant	13

ID	Site Title	FUDSMIS
A-18	Suspected Underground Storage Tank & Tunnel	13
A-19	TCE Contamination Adjacent to JR Beachfront	9
A-20	Abandoned Water Treatment Plant	12
A-21	Officer's Pool Chlorine Containers	N/A
A-22	Arsenic Investigation	15
A-23	Renovation Plant Area	15
O-3	Athletic Field North	N/A
O-4	Athletic Field South	N/A
O-5	Building E-410	N/A
O-6	Buildings L-11 & L-12	N/A
O-7	Pesticide Drum Area	N/A
S-1	TNT Source Area	1
S-2	James River Beachfront	9
S-3	Impregnite Kit Area	4
S-4	Horseshoe Pond	5
S-5	Main Burning Ground and Steamout Pond	6
S-5	Steamout Pond	6
S-6	Track K Tire Pile & Paint Can Dump Area	10

Figure 1: Site Map

Figure 2 summarizes the process flow and public participation steps in achieving remedy selection (USEPA, 1999).

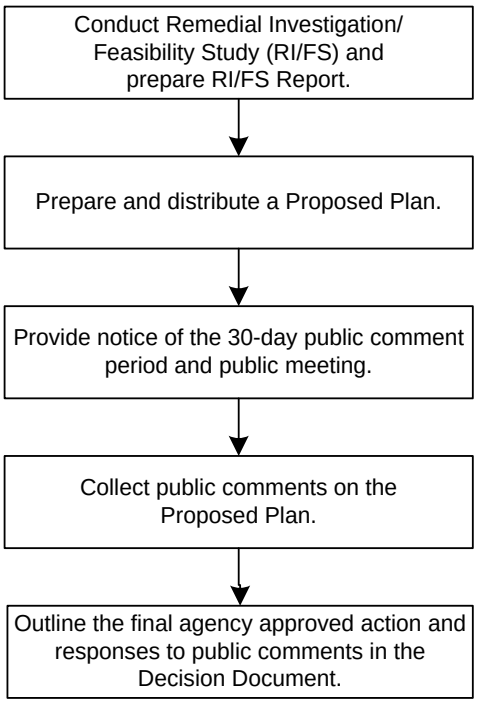


Figure 2: Public Participation Process

Responses to public comments on the FNOD Horseshoe Pond Proposed Plan will appear in a responsiveness summary section of the **Record of Decision** (ROD).

2.0 SITE BACKGROUND

2.1 History

FNOD is located in Suffolk, VA, at the confluence of the Nansemond and James Rivers. FNOD historically consisted of approximately 975 acres and was acquired by the Department of the Army between 1917 and 1928 by various deeds, easements, permits, and Declarations of Takings. FNOD was used primarily as an Army ammunition depot.

FNOD was constructed and commissioned the Pig Point Ordnance Depot between November 1917 and December 1918 to store munitions and ship them overseas. Principal operations included preparing ammunition and components for permanent storage, painting and marking shells and containers, segregating certain lots of ammunition, transferring powder charges from fiber to metal containers, salvaging munitions parts, and inspecting and disposing of unserviceable ammunition by defusing or burning.

On 9 August 1929, Pig Point Ordnance Depot was renamed Nansemond Ordnance Depot.

During World War II, while under the jurisdiction of the Ordnance Department, FNOD was instrumental in supporting operations at the Hampton Roads Port of Embarkation. This support included temporary storage and shipping ammunition overseas. Toward the end of the war, the purpose of FNOD was modified to function as an intermediate and distribution depot, in addition to its role in the reconditioning of ammunition. On 9 April 1945, FNOD was to be incorporated into the demobilization planning by the Ordnance Department. FNOD was transferred to the Department of the Navy on 15 November 1950, at which time it became known as the Marine Corps Supply Forwarding Annex. The Site was declared excess on 13 June 1960.

FNOD was deactivated in 1960 and conveyed to the Beasley Foundation, which operated a boys' military school at the Site until 1968. The foundation bequeathed most of the property to the Commonwealth of Virginia (Virginia Department of Community Colleges). Tidewater Community College Real Estate Foundation, Portsmouth Campus now occupies approximately 389 acres. Other occupants of FNOD include Ashley Bridgeway LLC, Bridgeway Limited Partnership, Continental Lakeview Associates, Continental-Harbour View Associates, Continental Bridgeway Associates, Suffolk Towers LLC, the City of Suffolk Economic Development Agency, Continental Tech Associates LLC, LMC Properties, Inc. (Lockheed Martin), River Stone Chop House LLC, Apple Eight Hospitality Ownership, the General Electric Company (GE), the Hampton Road Sanitation District, the Virginia Department of Transportation, and Dominion Land Management. A portion of the Site is also occupied by Interstate 664.

On 19 January 1999, USEPA proposed to add FNOD to the National Priorities List (64 Federal Register No. 27, 2950). On 22 July 1999, the USEPA placed FNOD on the National Priorities List for private sites (64 Federal Register No. 140, 39878). In the final determination, FNOD was listed as a Non-Federal Facility Superfund Site because the Federal Government does not currently own or operate any property at FNOD. The National Priorities List included several "Source Areas" requiring investigation at FNOD. The Site has been designated Source Area 4 (S-4).

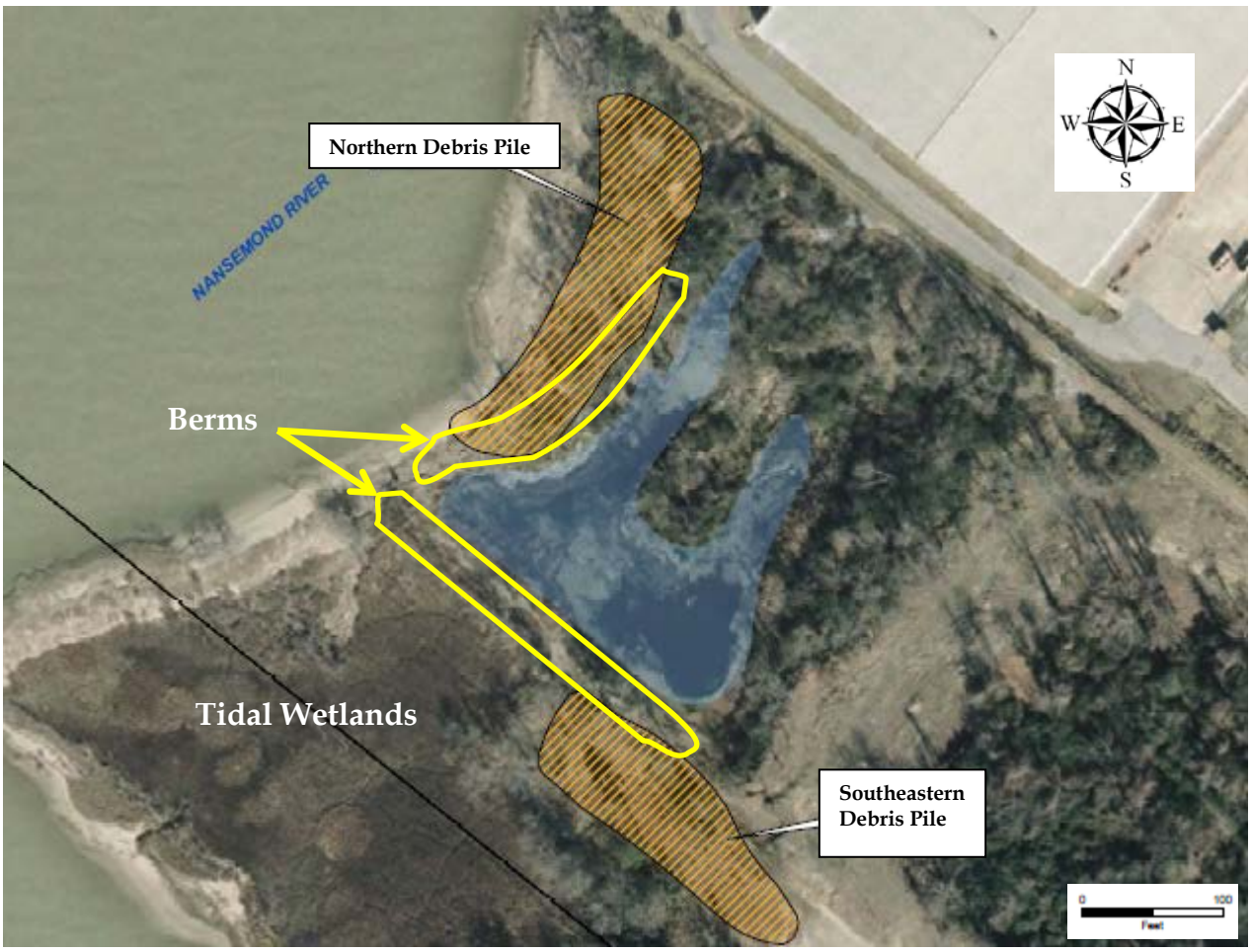


Figure 3: Site Layout

2.2 Physical Description

The 10-acre Site is located on the western boundary of FNOD on Dominion Land property southwest of the Ashley Capital-owned (former GE) facility. The man-made pond is surrounded by berms and steep banks. The pond was apparently used as an occasional waste disposal area over a period of approximately 10 years beginning in the late 1940s. Two areas adjacent to the berms surrounding the pond contain debris (e.g., laboratory glassware, film, metal, and brick) that is exposed at the ground surface. The area is mainly covered with trees and heavy brush. Based on a review of historical photographs, two potential contaminated areas ("source areas") were identified within the Site. The areas were subsequently located through **geophysical surveys** and test pits and identified as the northern debris pile and southeastern debris pile (see **Figure 3)**.

The northern debris pile is composed of surface debris, including glass bottles, construction debris, plastic bottles, miscellaneous metal scrap, and metal containers. In addition to the surface debris, large **metallic anomalies** were detected in this area of the Site, as described in the geophysical investigation results.

The southeastern debris pile is located southeast of the pond and consists of a portion of the earthen berm along the south side of the pond. The debris pile is composed of surface debris, including glass bottles, construction debris, plastic bottles, miscellaneous metal scrap, and metal containers. In addition to the surface debris, large metallic anomalies were detected along the southern side of the Site within the southeastern debris pile, as described in the geophysical investigation. The anomalies are most likely subsurface metal debris similar to the metal scrap and containers observed at the surface.

2.3 Remedial Investigation

In June 2011, WESTON® completed the Final Remedial Investigation (RI) report (document that summarizes the nature and extent of contamination) for the Site. A summary of the nature and extent of contamination, fate and transport, risk assessments, and conclusions and recommendations is presented in other sections of the Proposed Plan.

3.0 SITE CHARACTERISTICS

The Site name was designated because of the physical features of the 1.2-acre horseshoe-shaped pond. The pond is comprised of two parallel arms, each averaging approximately 50 feet by 200 feet, extending northeast from the center portion of the pond, which is approximately 100 feet by 300 feet. The pond has no surface water outlet and has an average depth of 2 to 3 feet.

A heavily wooded bluff comprises the area to the east of the pond. The area on the bluff is generally flat with elevations at approximately 20 feet above mean sea level . A steep slope is located between the bluff and the berm adjacent to the pond. Elevation changes in the area are from 20 feet above sea level to less than 10 feet above mean sea level at the berm. The RI indicated the following:

Soils

- Numerous **volatile organic compounds** (VOCs) were detected in Site soils and test pits. Chloroform was the only VOC detected above USEPA **regional screening levels**. The overall VOC results indicated that the debris contained within the two potential source areas (northern and southeastern debris piles), including the product found in the metallic containers in the southeastern debris pile, is the likely source for the VOCs.
- Numerous **semivolatile organic compounds** (SVOCs) were detected in the soil and debris soil samples collected at the Site. The highest concentrations are associated with soil borings HRP-SB16, HRP-SB17, and HRP-SB29 (see **Figure 4**) and with test pit location HRP-TP06. The three borings and the test pit are located on the western end of the Site. The SVOCs in this area appear related to the northern debris pile.
- Numerous pesticides and two polychlorinated biphenyls (PCBs) were detected in soil. Only three pesticides/PCBs were detected above regional screening levels, including Aroclor-1254, 4-4′-dichlorodiphenyltrichloroethane (4-4′-DDT), and dieldrin. The range of concentrations and detections are likely associated with area-wide use of these pesticides for pest control. Pesticides were detected throughout the Site at concentrations consistent with those detected within the debris pile areas, indicating that the debris piles are not the likely source for the pesticides.
- Explosive constituents, including trinitrotoluene, 2-amino-4,6-dinitrotoluene, 4-amino-2,6-dinitrotoluene, nitrobenzene, and tetryl, were detected in surface and subsurface soil samples from the Site. None of these constituents were found at levels that exceeded the regional screening levels for industrial or residential soils.
- Most **target analyte list** metals were detected in Site soils. Concentrations of 12 metals, including aluminum, antimony, arsenic, cadmium, cobalt, copper, iron, lead, manganese, mercury, thallium, and vanadium, exceeded regional screening levels. The highest concentrations of metals are associated with HRPSS04, HRPSS05, HRPSS06, HRP-TP04, HRP-TP05, and HRP-TP06, which are located to the west of the pond. The metals in this area appear related to the northern debris pile. Metals were also detected at elevated concentrations in the southeastern debris pile (HRP-TP01 and HRP-TP02) and an area west of the southeastern debris pile (samples HRPSB22 through HRPSB27), potentially due to runoff. Concentrations are significantly higher in surface soils compared to subsurface soils.

Groundwater

- Only two VOCs, acetone and carbon disulfide, were detected in groundwater samples. Concentrations were lower than regional screening levels and VDEQ groundwater criteria. Based on the relatively low concentrations of VOCs detected in Site soils, impacts to groundwater quality from VOCs in soils from the two debris areas are unlikely.
- Two SVOCs, bis(2-ethylhexyl)phthalate and di-n-butylphthalate, were detected in Site groundwater. Bis(2-ethylhexyl)phthalate was detected in only one well (HRP-MW28, as shown on **Figure 5**) during a December 1999 sampling event. Bis(2-ethylhexyl)phthalate was detected at a concentration of 6 micrograms per liter (µg/L), which was slightly greater than the regional screening level for tap water of 4.8 µg/L. Concentrations of di-n-butylphthalate were lower than the regional screening level of 370 µg/L. Subsequent sampling of the groundwater showed no exceedances of bis(2 ethylhexyl)phthalate.
- The only pesticide detected in the groundwater samples was heptachlor. Heptachlor concentrations in HRP-MW21 exceeded both the regional screening level for tap water of 0.015 µg/L and the **maximum contaminant level** of 0.001 µg/L. HRP-MW21 is located more than 300 feet **upgradient** of the Site. Samples collected from HRP-MW29 and HRP-MW30 (**downgradient**) show no evidence of pesticides in groundwater.

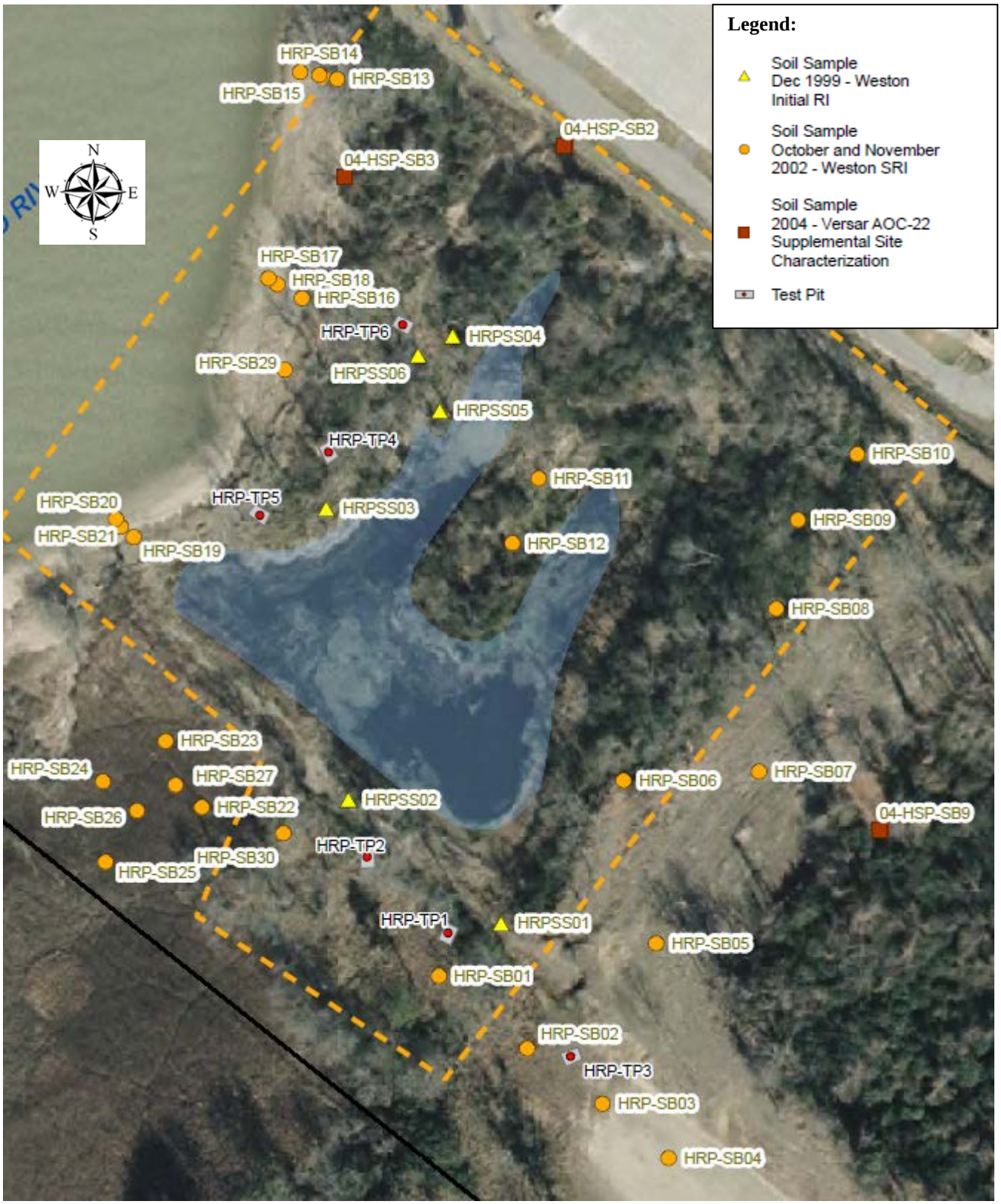


Figure 4: Soil Sampling Locations

Figure 5: Groundwater Sampling Locations

- No PCB or explosive constituents were detected in any of the groundwater samples.
- Numerous total metals were detected in groundwater at the Site. Concentrations of eight metals (antimony, arsenic, cadmium, cobalt, iron, manganese, nickel, and zinc) exceeded regional screening levels. Wells HRP-MW27 and HRP-MW30 appear minimally impacted by metals, with only total cobalt and total manganese concentrations above groundwater regional screening levels. Additional metals detected above regional screening levels were present in wells HRP-MW28 and HRP-MW29, with exceedances of criteria for total metals (antimony, arsenic, cobalt, iron, manganese, nickel, and zinc) and dissolved metals (cobalt and manganese) noted.

Principal Threat Waste

Principal threat wastes are those source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur. They include liquids and other highly mobile materials (e.g., solvents) or materials having high concentrations of toxic compounds. There are no wastes at the Horseshoe Pond that were considered to constitute principal threats. Concentrations of hazardous substances in the soil and subsurface soil of the Site are not greatly above reference dose levels that present an excess cancer risk near the acceptable risk range if exposure were to occur. Hazardous substances in Site soil are relatively immobile in air or ground water (i.e., non-liquid, low volatility, low leachability contaminants such as high

molecular weight compounds like various petroleum chemicals).

Surface Water

- VOCs, including 1,3,5-trimethylbenzene, acetone, carbon disulfide, chloromethane, toluene, and o-xylene, were detected in seven of nine surface water samples. Carbon disulfide, which was detected in six of nine samples, was the only VOC detected above the VDEQ surface water criteria. VOCs were detected in most surface water samples collected throughout the pond during the remedial investigation.
- Four SVOCs (bis(2-ethylhexyl)phthalate, di-n-butylphthalate, 4-methylphenol, and pentachlorophenol (PCP)) were detected in surface water samples at the Site. PCP was the only SVOC detected above VDEQ surface water criteria. It was detected in 1997 in one sample (HSL-SW-02, as noted on **Figure 6**) at a concentration of 44 µg/L. No specific distribution pattern was noted due to the infrequent and scattered detections.
- Four pesticides (gamma chlordane, delta-benzene hexachloride, 4,4'-dichlorodiphenyldichloroethane (DDD), and 4,4'-DDT) were detected in surface water samples at the Site. 4,4'-DDT was the only pesticide detected above the USEPA surface water screening level. Because of the infrequent and scattered detections, there is no discernible distribution pattern. The detection of trace levels of pesticides in the surface water at the Site may be a further indication that pesticides are a Site-wide surficial soils issue and not related to one single source area at FNOD. Past practices at FNOD likely included the use of pesticides.
- No PCBs or explosive constituents were detected in RI surface water samples for the Site.
- Metals were detected in moderate concentrations at the Site. The more notable concentrations of aluminum, barium, beryllium, cobalt, iron, and manganese were observed in three RI sampling locations. These locations (HRP-SW04, HRP-SW05, and HRP-SW06) are on the opposite side of the larger northern debris pile, but near the southeastern debris pile. Higher metals concentrations at these locations may be associated with the migration of sediment-laden stormwater from the southeastern debris pile.

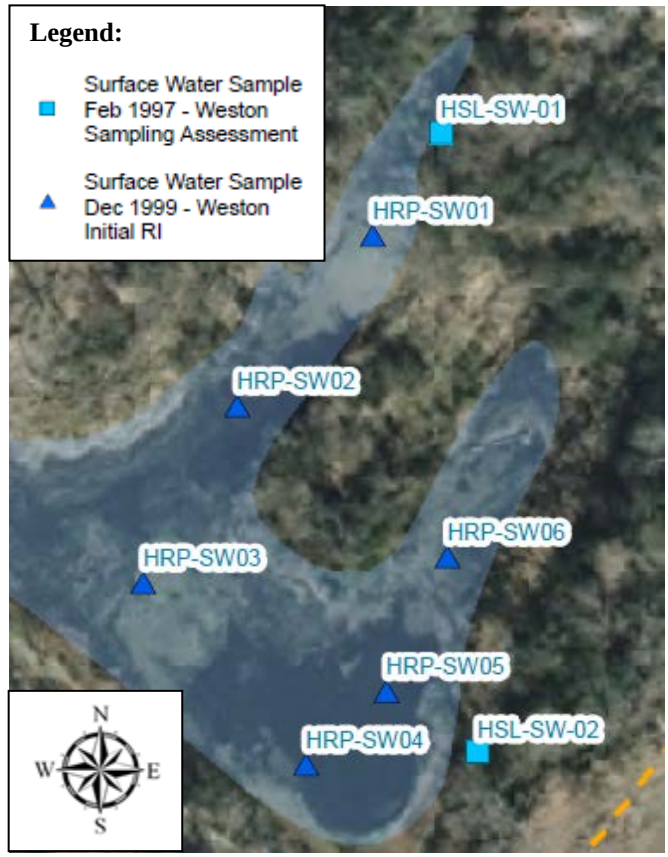


Figure 6: Surface Water Sampling Locations

Sediment

- VOCs detected in Site sediments included 1,3,5-trimethylbenzene, 2-butanone, acetone, bromomethane, carbon disulfide, carbon tetrachloride, chloroform, ethyl benzene, methylene chloride, P-isopropyl toluene, toluene, and trichloroethene. Carbon disulfide was the only VOC that exceeded the sediment screening levels. No specific distribution pattern was noted with scattered detections of low levels of VOCs throughout the pond area.
- **Polycyclic aromatic hydrocarbons** (PAHs) were detected in samples throughout the pond with the highest concentrations noted in the southern end of the pond based on the PAH concentrations in samples SD34, SD35, and SD36 (**Figure 7**). Several PAHs exceeded regional screening levels in these samples and in a few others throughout the pond. Impacts to sediments are likely related to runoff from both debris areas that surround the pond.

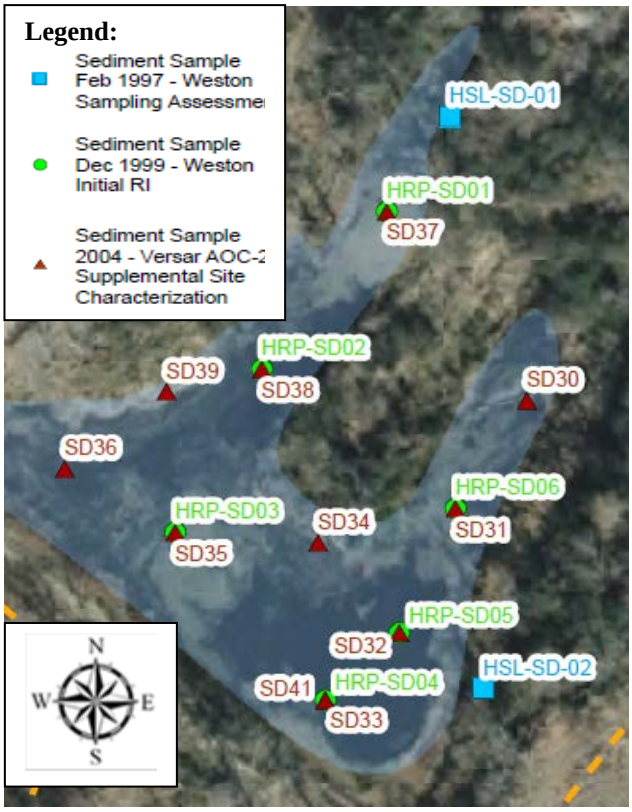


Figure 7: Sediment Sampling Locations

- Six pesticides, including aldrin, alpha-BHC, 4,4'-DDD, 4,4'- dichlorodiphenyldichloroethylene (DDE), 4,4'-DDT, and dieldrin, were detected above regional screening levels. Pesticides were detected in samples throughout the pond. The highest concentrations were noted in samples HRP-SD01, HRP-SD06, and SD37, which are located in different areas of the pond. Impacts to sediments are likely related to runoff from the soil area impacted by widespread historical pesticide application.
- No PCB or explosive constituents were detected in any of the RI sediment samples.
- Many metals were detected in Site sediments. Concentrations of 15 metals, including aluminum, antimony, arsenic, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, nickel, selenium, vanadium, and zinc, exceeded sediment regional screening levels. Numerous metals were detected throughout the pond with no discernible distribution pattern noted. Many metals exceeded sediment regional screening levels with impacts likely the result of runoff from the two debris areas that surround the pond.

4.0 SCOPE AND ROLE

FNOD was placed on the National Priorities List in July 1999. To manage cleanup efficiently, the work has been broken up into a number of different source areas and areas of concern. Currently, there are five Source Areas being investigated at FNOD. A sixth Source Area was deleted from the National Priorities List in March 2003. There are also 23 identified areas of concern that are also undergoing evaluation at the FNOD. Details of these investigations are presented in the Site Management Plan for FNOD, which is available in the Administrative Record file.

This proposed plan deals only with Source Area 4, the Horseshoe Pond. The proposed remedial action is intended to address all potential risks to human health and the environment posed by metals and polycyclic aromatic hydrocarbons in soils within two debris piles at the Horseshoe Pond, is intended to be the final remedy for the site, and does not include or affect any other site at FNOD.

5.0 SUMMARY OF SITE RISKS

The baseline human health risk assessment (BHHRA), screening-level ecological risk assessment (SLERA), and the baseline ecological risk assessment (BERA) estimate the risks at a Site if no action were taken. The assessments provide the basis for taking action and identify the contaminants and **exposure pathways** that need to be addressed by the **Remedial Action**. This section of the Proposed Plan summarizes the results of the BHHRA and BERA for the Site.

Baseline Human Health Risk Assessment

Chemicals of Potential Concern (COPCs)

The following were identified as COPCs (chemicals identified through the risk assessment process as the primary chemicals that may cause unacceptable risk) in soils at the Site, unless noted otherwise.

Aroclor 1254	Antimony
Benzo(a)anthracene	Arsenic
Benzo(a)pyrene	Cadmium (aggregate soil only)
Benzo(b)fluoranthene	Chromium
Benzo(k)fluoranthene	Cobalt
Carbazole	Copper
Chloroform (aggregate soil only)	Iron
Chrysene	Lead
4,4,-DDT (aggregate soil only)	Manganese
Dibenz(a,h)anthracene	Mercury (aggregate soil only)
Dieldrin	Thallium
Indeno(1,2,3-cd)pyrene	Vanadium
Aluminum	

The following were identified as COPCs in sediment.

Benzo(a)anthracene	4-Nitrophenol
Benzo(a)pyrene	P-Isopropyltoluene
Benzo(b)fluoranthene	Arsenic
Benzo(k)fluoranthene	Chromium
Chrysene	Cobalt
Dibenz(a,h)anthracene	Iron
di-n-Octyl phthalate	Thallium
Indeno(1,2,3-cd)pyrene	

The following were identified as COPCs in groundwater.

Bis(2-ethylhexyl)phthalate	Cobalt
Heptachlor	Iron
Antimony	Manganese
Arsenic	Nickel
Cadmium	Zinc
Chromium	

The following were identified as COPCs in surface water.

Pentachlorophenol	Lead
Arsenic	Manganese
Chromium	Mercury
Cobalt	

Land and Water Use

The Site is partially located within a designated Resource Protection Area . A Resource Protection Area is a subset of a Preservation Area and consists of "sensitive lands at or near the shoreline." The land is undeveloped, and development is subject to the VDEQ and Suffolk County evaluation of Resource Protection Area boundaries of the Chesapeake Bay Preservation Act. For the purpose of the BHHRA, the current land use for the Site was considered to be limited to the occasional trespasser/visitor because the Site is inaccessible and heavily wooded.

Future land use for the Site was assumed to be recreational, including the use of the pond for wading. No residential or industrial/commercial development is reasonably anticipated within the pond, the surrounding berms, or the tidal marsh and low lying areas, because the pond is near the Nansemond River, it has a wetlands designation, and use is restricted within the Resource Protection Area. If the Site were to be used as a recreational area in the future, it would need landscaping and periodic outdoor maintenance to improve access and appearance.

Groundwater at the Site is not used as a drinking water source; no drinking water wells are located within or downgradient of the Site. Although groundwater use is not reasonably anticipated in the future, the residential and industrial use of groundwater was evaluated.

Current use of the pond is limited to the occasional trespasser, if at all, on a seasonal basis. The potential for wading is very low due to murky water and poisonous snakes observed in the pond area. Exposed debris (e.g., glass, bricks, metal) litter the pond berm area and make access to the pond difficult.

The **exposure scenario** for the future recreational visitor includes wading in the pond. For the future recreational use scenario, it is assumed that the debris in the pond berms would be removed and the area would be landscaped to improve access. Swimming was not evaluated for the current situation or future land use because of the shallow water depth (2 to 3 ft), which is insufficient for swimming. Fishing was not evaluated for the Site because the water level is too low and intermittent to support fish of sufficient size to be caught and eaten. The findings of the Ecological Field Reconnaissance conducted 18-19 September 2001 found no fish in the pond.

Potentially Exposed Populations

Based on the current and potential future land and water uses, the environmental setting, and the types of Site activities, the following populations were identified for evaluation in the risk assessment:

- Current/future older (7-16 years old) child trespasser.
- Future adult maintenance workers.
- Future adult construction workers.
- Hypothetical future child and adult residents.

Exposure Pathways

Soil – COPCs in soil may be ingested and absorbed through the skin (i.e., current trespassers, future maintenance and construction workers, and hypothetical future residents). Dust released from the soil into the air could be inhaled by the current trespasser and future maintenance and construction workers and residents.

Sediment – COPCs in sediment may be ingested and absorbed through the skin by trespassers wading in the pond.

Surface Water – Swallowing and skin contact with pond water is possible for trespassers while wading in the pond.

Groundwater – The **aquifer** under the Site is not used as a drinking water source, nor is it likely to be used as such in the future; however, because there is no current prohibition against development and use of the groundwater, various exposures (e.g., drinking water and showering/bathing) for potential future residents were considered in the risk assessments. COPCs in groundwater may also be absorbed through the skin while showering and bathing by hypothetical future residents. VOCs released from groundwater into the air could be inhaled by the hypothetical future adult resident while showering.

Indoor Air – No COPCs with **vapor intrusion** potential were identified in the groundwater. Therefore, indoor air is an incomplete exposure pathway, and further evaluation was not necessary in the risk assessment.

Risk Characterization Summary

The following presents the results of the risk characterization.

- The cancer risk estimates and non-cancer health effects for the hypothetical future child (3.4E-04 and 35), adult (3.5E-04 and 12.7), and life-long (child plus adult) (6.3E-04) residents exceeded the high end of USEPA's **risk management range** of 1E-04 to 1E-06 cancer risk and the non-cancer hazard index management level of 1.0.
- The cancer risk estimates for the current/future older child trespasser slightly exceeded the high end of USEPA's risk management range of 1E-04 to 1E-06 having an incremental lifetime cancer risk of 1.5E-04. The non-cancer hazard index was 1.1 which is slightly greater than the hazard index management level of 1.0.
- The cancer risk estimates and non-cancer health effects for maintenance (4.1E-05 and 1.9) and construction (1.7E-06 and 1.9) workers were within USEPA's **risk management range** and slightly above the non-cancer hazard index management level of 1.0.
- Generally, the risk estimates for exposure to soil, sediment, surface water (pond), and groundwater showed unacceptable risks for noncancer illnesses and conditions.
- The future long-term resident had the highest cancer risks with exposure to soil, sediment, surface water, and groundwater. The future adult resident was second, and the future construction worker had the lowest cancer risk. For noncancer health effects, the future child resident had the highest risk, the future adult resident had the second highest risk, and the current/future older child trespasser had the lowest risk.

WHAT IS A HUMAN HEALTH RISK ASSESSMENT AND HOW IS IT CALCULATED?

A human health risk assessment estimates the baseline risk, an estimate of the likelihood of health problems occurring if no cleanup action is taken at a site. To estimate the baseline risk at a site, the following four-step process was performed:

Step 1: Analyze Contamination
Step 2: Estimate Exposure
Step 3: Assess Potential Health Dangers
Step 4: Characterize Site Risk

Step 1 considers the concentrations of contaminants found at a site as well as past scientific studies describing the effects these contaminants have had on people (or animals, when human studies are unavailable). Comparisons between site-specific concentrations and concentrations reported in past studies help to determine which contaminants are most likely to pose threats to human health.

Step 2 considers the different ways that people might be exposed to the contaminants identified in Step 1, the concentrations that people might be exposed to, and the potential frequency (how often) and length of exposure. Using this information, a "reasonable maximum exposure" scenario is calculated that portrays the highest level of human exposure that could reasonably be expected to occur.

Step 3 uses the information from Step 2 combined with information on the toxicity of each chemical to assess potential health risks. Two types of risk are considered: (1) cancer risk and (2) noncancer risk. The likelihood of any kind of cancer resulting from a contaminated site is generally expressed as an upper bound probability; for example, a "1 in 10,000 chance." In other words, for every 10,000 people who could be exposed, one extra cancer may occur as a result of exposure to site contaminants. An extra cancer case means that one more person could get cancer than normally would be expected from all other causes. For noncancer health effects, a "hazard index" Is calculated. The key concept here is that a "threshold level" (measured usually as a hazard index of less than 1) exists below which noncancer health effects are no longer predicted.

Step 4 determines whether site risks are great enough to cause health problems for people at or near the site. The results of the three previous steps are combined, evaluated, and summarized. The potential risks from the individual contaminants and exposure pathways are added and a total site risk is calculated.

COPCs that were identified for the Site and their potential impact on Site risk were as follows:

- PCP in surface water. For the older child trespasser, child resident, adult resident, and long-term resident, skin contact with surface water yielded PCP risks that exceed the USEPA management risk range. However, the pond is shallow and murky, and the assumption that people would wade in the water for 4 hours per event is highly unlikely. Additionally, PCP was not detected in soil, sediment, and groundwater. PCP was detected only in one historical sample collected by USEPA Region 3, and it is not a known contaminant at the Site.
- Arsenic in soil, sediment, and surface water. All arsenic risks via the soil, sediment, and surface water pathways were in the mid-range of the USEPA management risk range.
- Arsenic in groundwater. Arsenic risks for the child, adult, and long-term resident were within the USEPA risk management range. Arsenic was detected in only one of five groundwater samples. These samples had concentrations below the federal maximum contaminant level for arsenic.
- Benzo(a)pyrene in soil. Soil PAHs contributed risks in the low to mid range for the older child trespasser, child, adult, and long-term resident and maintenance worker. The risks for benzo(a)pyrene and other PAHs in soil may have been overestimated due to biodegradation over time.
- Cobalt in groundwater. Cobalt posed an unacceptable risk to child and adult residents if a home were to be built on the current property.
- Iron and manganese in groundwater. Iron and manganese posed an unacceptable risk to the child and adult residents if a home were to be built on the current property.
- Chloroform in soil. Inhaling chloroform via soils/dust posed unacceptable cancer risks for the child, adult, and long-term resident, and maintenance worker. However, cancer risks are likely to be overestimated given the current review of toxicity studies and the low frequency of detection (3%) of chloroform at the Site.

Human Health Risk Summary

Soil

Four compounds, including arsenic, benzo(a)pyrene, benzo(b)fluoranthene, and chloroform have cancer risks exceeding 1E-06 with cumulative risk greater than 1E-04 for the future residential scenario. Because chloroform cancer risks were in the lower end of the risk management range, the inhalation unit risk for chloroform is highly overestimated as studied by USEPA (ILSI, 1996; Butterworth et al., 1998), and chloroform was detected infrequently at the Site (in 3% of samples), chloroform cancer risk is likely to be overstated and was not included in further assessment.

Thallium exceeded the non-cancer health effects **hazard quotient** of 1.0.

Groundwater

Arsenic cancer risk exceeded 1E-06 while non-cancer risk for three compounds (cobalt, iron, and manganese) exceeded an hazard quotient of 1; however, because total and dissolved arsenic was detected below its maximum contaminant level in all samples, dissolved manganese and cobalt exceeded their regional screening level in only one sample, and no dissolved iron exceeded its regional screening level, no further action is warranted for groundwater.

Surface Water

Two compounds, arsenic and PCP, had a cancer risk that exceeded 1E-06. Because of the infrequent detection of PCP (only one detect in surface water in a historical EPA sample) and the lack of PCP detects in other media and because arsenic risk is on the lower end of the EPA cancer risk management goal range, no further action is warranted for surface water.

Sediment

Arsenic and benzo(a)pyrene were the only human health COPCs with cancer risks that exceeded 1E-06, but they were on the lower end of the EPA management risk range (1E-06 to 1E-04) as their cancer risks were 3E-06 and 2E-06, respectively; therefore, no additional action is warranted for sediment.

As noted above, potential future residential exposure to soils is the only identified population/exposure pathway identified with risk above either the USEPA risk management range or non-cancer health effects level.

A summary of the risks associated with soils and the identified COCs is presented in Table 1 below.

Receptor	Exposure Route	Cancer Risk	COCs with Cancer Risks $>10^{-5}$	Exposure Route	Hazard Index	COCs with HI > 1
Future Resident Adult	Ingestion Skin contact	4.5×10^{-5}	None	NA	NA	NA
Future Resident Child	Ingestion Skin contact	2.0×10^{-4}	Arsenic Benzo(a)pyrene	Ingestion Dermal	4.5	Thallium
Future Resident Child/Adult	Ingestion Skin contact	2.0×10^{-4}	Arsenic Benzo(a)pyrene Benzo(b)fluoranthene	NA	NA	NA

Table 1 – Human Health Risk Summary

Screening-Level Ecological Risk Assessment (SLERA)

The SLERA consists of the first two steps of the ecological risk assessment process. The objectives of the SLERA were to identify complete ecological exposure pathways and the potential for ecological risks at the Site that may require further investigation.

The SLERA indicated that contaminants present in soil, sediment, and surface water may pose ecological risks at the Site. As a result, further investigation in a baseline ecological risk assessment was necessary.

The SLERA provided a foundation on which to proceed further with the ecological risk assessment process.

Baseline Ecological Risk Assessment

A baseline ecological risk assessment (BERA) was completed for the Site.. The objective of the BERA investigation was to determine whether contaminated soils, surface water, and sediments at the Site pose ecological risks requiring further action. Results of the investigation indicated there is no evidence of unacceptable risks to plants and animals from **chemicals of potential ecological concern** (COPECs) in the sediment and surface water at the Site. Similarly, no unacceptable ecological risks to small mammals were evident from within the berm areas. However, the BERA indicated potential ecological risks exist to insectivorous (insect-eating) birds (American robins used as the example for this group) eating soil invertebrates (e.g., worms) from within the berm areas, primarily as a result of metals, DDT, and PAH contamination in soils.

Assessment Endpoints

- Protection of benthic invertebrate (animals without a backbone).
- Protection of amphibian communities (salamanders and frogs).
- Protection of worm-eating birds (e.g., American robin).
- Protection of small mammals that forage on invertebrates and plant matter along the forest floor.
- Protection of secondary consumers (e.g., herons, hawks, mink) in water-based and land-based environments that may consume amphibians or small mammals as part or all of their diet.

Exposure Pathways

The following complete exposure pathways were evaluated for the Horseshoe Pond:

In the pond:

- COPECs in Surface Water and Sediment => Benthic Macroinvertebrates
- COPECs in Surface Water and Sediment => Amphibians (e.g., frogs) => Carnivorous Mammals (e.g., mink or raccoon), Carnivorous Birds (e.g., herons).

In upland forested areas along berms and surrounding the pond:

- COPECs in Soil => Soil Invertebrates => Small Mammals (e.g., shrews) => Raptors (e.g., red-tailed hawk), Carnivorous Mammals (e.g., Red fox)
- COPECs in Soil => Soil Invertebrates => Birds (e.g., American robins) => Raptors (e.g., red-tailed hawk)
- COPECs in Soil => Terrestrial Plants => Herbivores (e.g., meadow vole)

Risk Characterization

Results of the risk characterization is summarized as follows:

- No hazard quotients exceed 1.0 for the five of the six higher receptors evaluated. There are, therefore, no apparent ecological risks to the aquatic habitat receptors (mink, raccoon or great blue heron) or the forested habitat receptors (red fox and red-tailed hawk) from the contamination detected in frogs or small mammals collected at the Horseshoe Pond.
- A number of hazard quotients (for metals and polycyclic aromatic hydrocarbons) above 1.0 were noted for the American robin models using both the **95% upper confidence limit** COPEC concentration as well as the mean COPEC concentration.

Additional specific results of the BERA investigation are summarized below.

- Tests conducted using midge larvae indicated that there were no significant impacts of the sediment to survival of small sediment-dwelling animals in the pond.
- **Hazard quotients** (HQ) modeling for sediment indicated no evidence of ecological risks to herons, mink, or raccoon from consumption of frogs at the Site.
- Histopathology (microscopic exam of tissue) results of the small mammals collected at the Site did not indicate any significant impact to liver tissue when compared to the Streeter Creek reference area. In addition, HQ studies based on small mammal tissue

results indicated no ecological risks to red-tailed hawk or mink consuming these small mammals.

- On the basis of the screening evaluation of Site soils and groundwater levels for a number of organic and inorganic substances, there is no reason to believe that there is a groundwater risk.
- HQ modeling of the American robin using site-specific concentrations of detected chemicals in soil (for both the mean and 95% upper confidence level and **bioconcentration factors** to model earthworm tissue concentrations indicated potential risks from a number of SVOCs, pesticides, and metals in soils at the Site.

Based on the results of the BERA risk calculations, the only identified receptor potentially at risk the Site was the insectivorous bird (modeling using the American robin).

It is the current judgment of the USACE and EPA that the preferred alternative identified in this Proposed Plan, or one of the other active measures considered in the Proposed Plan, is necessary to protect public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

WHAT IS AN ECOLOGICAL RISK ASSESSMENT AND HOW IS IT CALCULATED?

An ecological risk assessment evaluates the potential adverse effects human activities have on the plants and animals that make up ecosystems. The ecological risk assessment process follows a phased approach similar to the human health risk assessment. The risk assessment results are used to help determine what measures, if any, are necessary to protect plants and animals.

Ecological risk assessment includes three steps:

Step 1: Problem Formulation
Step 2: Risk Analysis
Step 3: Risk Characterization

Step 1 problem formulation includes the following:

- Compiling and reviewing existing information on the site habitat, plants, and animals that are present.
- Evaluating how plants and animals may be exposed to chemicals at the Site.
- Identifying and evaluating area(s) where site-related chemicals may be found.
- Evaluating potential movement of chemicals in the environment.
- Evaluating routes of exposure (for example, ingestion).
- Identifying receptors (plants and animals that could be exposed).
- Identifying exposure media (soil, air, water).
- Developing how the risk will be measured for all complete pathways (determining the risk where plants and/or animals can be exposed to chemicals).

In **Step 2**, the potential exposures to plants and animals are estimated and the concentrations of chemicals at which adverse effects may occur are evaluated through the calculation of the hazard quotient, which is the ratio of the concentration of a chemical detected at a site to the concentration of the chemical at which no negative effects are expected.

In **Step 3**, all of the information identified in the first two steps is used to estimate the risk to plants and animals. Also included is an evaluation of the uncertainties (potential degree of error) that are associated with the predicted risk evaluation and their effects on the conclusions that have been made.

The three principal components of an ERA are implemented within the framework of an 8-step, 3-tiered process as follows:

1. Screening-Level ERA (Steps 1-2; Tier 1) – The SLERA conducts an assessment of ecological risk using the three components described above and very conservative assumptions (such as using maximum chemical concentrations).

2. Baseline ERA (Steps 3-7; Tier 2) – If potential risks are identified in the SLERA, a BERA is typically conducted. The BERA is a re-iteration of the three components described above but uses more site-specific and realistic exposure assumptions, as well as additional methods not included in the SLERA, such as consideration of background concentrations. The BERA may also include the collection of site-specific data (such as measuring the concentrations of chemicals in the tissues of organisms, such as fish) to address key risk issues identified in the SLERA.

3. Risk Management (Step 8; Tier 3) – Step 8 develops recommendations on ways to address any unacceptable ecological risks that are identified in the BERA and may also include other activities such as evaluating remedial alternatives.

6.0 REMEDIAL ACTION OBJECTIVES

Remedial Action Objectives

Based on the human health and ecological COCs and the exposure pathways and receptors at the Site, the following **remedial action objectives** were developed:

- Reduce exposure via ingestion, direct contact, and inhalation of Site soil containing COC concentrations that present a cancer risk estimate of 1E-04 (each COC's target risk goal is 1E-05) or noncarcinogenic adverse health effects resulting in an HQ of 1.
- Reduce ecological risk for soil COCs to an HQ of less than 1.
- Reduce migration of COCs present within surface soil toward the sediment and surface water of the pond and Nansemond River.

Preliminary Remediation Goals

Numerical preliminary remediation goals representing contaminant levels protective of human health and the environment were calculated for the COCs based on the receptor groups and exposure pathways. The risk-based

preliminary remediation goals were derived for COCs and receptor groups identified as a concern for the Site.

Final cleanup levels will be determined when the remedy is selected. The final cleanup levels will be documented in the ROD. A comparison of the human health-based and ecological-based preliminary remediation goals is presented in the following table, and the final selected preliminary remediation goals (lowest of the human health and ecological goals) for the Site are noted.

Site-Specific Preliminary Remediation Goals			
Soil COC	**Human Health PRGs (mg/kg)**	**Ecological PRGs (mg/kg)**	**Final PRGs (mg/kg)**
Aluminum	---	11,000	11,000 (1)
Arsenic	9.4	---	9.4 (1)
Benzo(a)anthracene	---	0.229	0.229 (2)
Benzo(a)pyrene	0.066	0.542	0.066 (1)
Benzo(b)fluoranthene	0.639	0.508	0.508 (1)
Benzo(k)fluoranthene	---	0.365	0.365 (2)
Chrysene	---	0.27	0.27 (1)
DDT	---	0.034	0.034 (2)
DDE	---	0.005	0.005 (2)
DDD	---	0.005	0.005 (2)
Naphthalene	---	0.210	0.210 (2)
Phenanthrene	---	0.149	0.149 (2)
Pyrene	---	0.415	0.415 (2)
Thallium	0.76	0.46	0.46 (1)
Zinc	---	34.0	34.0 (2)

mg/kg – milligram per kilogram.
Preliminary remediation goal (PRG) Selection Rationale:
1. Based on Background Toxicity Value
2. Based on Ecological Risk for American Robin Exposure

* Details on the preliminary remediation goals are provided in Section 2 of the Focused Feasibility Study Report.

7.0 SUMMARY OF REMEDIAL ALTERNATIVES

The following five remedial alternatives were identified for further analysis:

- Alternative No. 1 – No Action
- Alternative No. 2 – Land Use Controls
- Alternative No. 3 – Soil Cover Installation
- Alternative No. 4 – Debris and Soil Removal and Off-Site Disposal
- Alternative No. 5 – Soil and Limited Debris Removal and Off-Site Disposal

Alternative Descriptions

A brief description of each alternative is provided below.

ALTERNATIVE NO. 1 – NO ACTION

Under Alternative 1, no further efforts or resources would be expended at the Site. No action would be implemented to address the existing contamination in the Site soils. Remedial action objectives would not be met after implementation and are not expected to be met in the future.

ALTERNATIVE NO. 2 – LAND USE CONTROLS

Alternative 2 includes the following elements:

- Implementation of land use controls, including deed restrictions or environmental easements.
- Fencing to prevent trespassers from entering the Site and potentially being exposed to COCs in Site soils.
- Signs warning about the environmental hazards.
- Long-term monitoring of chemicals in soils to see if preliminary remediation goals are met.
- Implementation of land use controls within 3 months with long-term monitoring of site soils every five years to determine if chemical concentrations have changed through natural processes.
- **Present net worth** costs for implementation: estimated at $515,000 (capital costs of $231,000 and operation and maintenance costs of $284,000 including $8,000 for each 5-year review).

ALTERNATIVE NO. 3 – SOIL COVER INSTALLATION

Alternative 3 includes the following elements:

- Installation of a 2-foot thick soil cap for the two debris piles and contaminated soil areas to limit potential contact with soils that contain contaminants above preliminary remediation goals.
- Dust controls during construction activities.
- Installation of erosion controls during construction activities.
- Ground cover restoration.
- Implementation of access restrictions (fencing) to prevent trespassers from entering the Site and potentially being exposed to COCs in Site soils.
- Signs to alert trespassers about the environmental risk.
- Brochures/fact sheets, newspaper articles, and interviews for public notification.
- Restrictions in deeds or environmental covenants that prohibit wading in pond, disturbing the soil caps, etc..

- Information packages to public officials and emergency management agencies.
- Present net worth costs for implementation: estimated at $1,865,000 (capital costs of $1,632,000 and Operation & Maintenance costs of $233,000 including $8,000 for each 5-year review).

ALTERNATIVE NO. 4 – DEBRIS AND SOIL REMOVAL AND OFF-SITE DISPOSAL

Alternative 4 includes the following elements:

- Excavation of debris and contaminated soils that contain contaminant concentrations above preliminary remediation goals.
- Dust controls during construction activities.
- Installation of erosion controls during construction activities.
- Off-site disposal of excavated soils at a local landfill.
- Post-excavation confirmation soil sampling to document compliance with preliminary remediation goals.
- Backfill of the excavated areas with clean fill material.
- Ground cover restoration.
- Brochures/fact sheets, newspaper articles, and interviews for public notification.
- Present net worth costs for implementation: estimated at $2,150,000 (capital costs of $2,135,000 and Operation & Maintenance costs of $15,000).

ALTERNATIVE NO. 5 – SOIL AND LIMITED DEBRIS REMOVAL AND OFF-SITE DISPOSAL

Alternative 5 includes the following elements:

- Excavation of limited debris (only that debris with the potential for additional contaminant releases) and contaminated soils that contain contaminant concentrations above preliminary remediation goals.
- Dust controls during construction activities.
- Installation of erosion controls during construction activities.
- Off-site disposal of excavated soils in a local landfill.
- Post-excavation confirmation soil sampling to document compliance with preliminary remediation goals.
- Backfill of the excavated areas with clean fill material.
- Ground cover restoration.
- Brochures/fact sheets, newspaper articles, and interviews for public notification.
- Present net worth costs for implementation: estimated at $1,173,000 (capital costs of $1,158,000 and Operation & Maintenance costs of $15,000).

8.0 EVALUATION OF REMEDIAL ALTERNATIVES

Nine criteria are used to evaluate the different remedial alternatives individually and against each other in order to select a remedy. This section of the Proposed Plan evaluates each alternative against the nine criteria, noting how it compares to the other options under consideration. The nine evaluation criteria are discussed below. The "Detailed Analysis of Alternatives" is presented in the focused feasibility study.

THRESHOLD CRITERIA

- **Overall Protectiveness of Human Health and the Environment** determines whether an alternative eliminates, reduces, or controls threats to public health and the environment through institutional controls, engineering controls, or treatment.
- **Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)** evaluates whether the alternative meets Federal and State environmental statutes, regulations, and other requirements that pertain to the Site, or whether a waiver is justified.

BALANCING CRITERIA

- **Long-term Effectiveness and Permanence** considers the ability of an alternative to maintain protection of human health and the environment over time.
- **Reduction of Toxicity, Mobility, or Volume of Contaminants through Treatment** evaluates an alternative's use of treatment to reduce the harmful effects of principal contaminants, their ability to move in the environment, and the amount of contamination present.
- **Short-term Effectiveness** considers the length of time needed to implement an alternative and the risks the alternative poses to workers, residents, and the environment during implementation.
- **Implementability** considers the technical and administrative feasibility of implementing the alternative, including factors such as the relative availability of goods and services.
- **Cost** includes estimated capital and annual operations and maintenance costs, as well as present worth cost. Present worth cost is the total cost of an alternative over time in terms of today's dollar value. Cost estimates are expected to be accurate within a range of +50 to -30 percent.

MODIFYING CRITERIA

- **State/Support Agency Acceptance** considers whether the State/Support agency(ies) concurs with, opposes, or has no comment on the preferred alternative based on review of the remedial investigation, focused feasibility study, and Proposed Plan.
- **Community Acceptance** assesses the general public response to the Proposed Plan. Comments received on the Proposed Plan are an important indicator of community acceptance.

Overall Protection of Human Health and Environment

Alternatives 3, 4, and 5 are preferable and would provide protection of human health and the environment from the short-term and long-term risks because the contaminated soils above the preliminary remediation goals would be removed or contained. Both Alternatives 4 and 5 include removal of soils with concentrations above preliminary remediation goals. The only difference is that Alternative 5 does not include removal of debris that does not have the potential to further contaminate soil, sediment or water if left on-site. In Alternative 3, COCs above preliminary remediation goals would remain on-site, and routine inspection and maintenance would be required to ensure that the soil cover remains intact. Alternative 1 would not protect human health and the environment. Alternative 2 would control potential human health risk through land use controls; however, it would not reduce risk to ecological receptors because the contaminated soils would remain in-place and available for ecological receptor contact.

Compliance with ARARs

No chemical-specific ARARs were identified for the Site. Several other ARARs were identified including, for example, certain Federal and/or State hazardous waste, surface water management, erosion control, and air pollution control requirements, among others. Alternatives 1 and 2 would not comply with some ARARs, such as those related to surface water management and its impact on adjacent wetlands and waterways, because there would be the potential for continued surface runoff from the debris pile areas to the adjacent wetlands and surface waters. Alternatives 3, 4, and 5 would comply with all ARARs including, among others, use of dust control (i.e., controlling particulate matter, which will help protect air quality) during construction activities, and sediment and erosion control practices to reduce the potential for runoff to adjacent waterways and wetlands during construction activities.

Long-Term Effectiveness and Permanence

Alternatives 3, 4, and 5 would provide the greatest long-term effectiveness because the risk to human health and the environment would be reduced to acceptable levels provided that the soil cover for Alternative 3 is inspected and maintained. Because contaminated soils would remain on-site, Alternative 3 would be less effective in the long-term and a less permanent remedy than Alternatives 4 and 5. In Alternative 3, contaminants above preliminary remediation goals would remain on-site and the integrity of the soil cover could be compromised by burrowing mammals or natural forces such as erosion. Alternatives 4 and 5 have the same level of permanence. The only difference between the two alternatives is that Alternative 5 does not include removal of debris that does not have the potential to further contaminate soil, sediment or water if left on-site. Alternative 2 would be a less permanent and effective remedy in the long-term because it leaves waste in place and must be perpetually monitored and enforced to ensure that people are not exposed to waste left in place. It would not be effective for addressing ecological risk. Alternative 2 would not prevent ecological receptors from potentially contacting contaminated soils.

Reduction of Toxicity, Mobility, or Volume of Hazardous Substances Through Treatment

None of the alternatives employ treatment to reduce toxicity, mobility or volume of hazardous substances; therefore, none of the alternatives satisfy the preference for treatment as a principal element. Selection of Alternatives 4 and 5 would not meet this preference but would be expected to be acceptable because these alternatives eliminate the unacceptable human health and ecological risks at the Site. No treatment would be conducted for the excavated contaminated soils because concentrations are at levels that can be accepted at a local solid waste landfill without treatment as opposed to shipment out-of-state to a facility for chemical treatment of soils prior to reuse or disposal.

Short-Term Effectiveness

Since Alternative 1 involves no action, it could be implemented immediately while it would take approximately 3 months (after approval of the Land Use Control remedial design) to implement Alternative 2 and approximately 6 months for Alternatives 3, 4, and 5. Alternative 1 is the most preferable under this criterion, as it would not have short-term impacts. Alternative 2, which includes only the installation of fencing and signs and long-term monitoring, has fewer short-term impacts than all alternatives except Alternative 1 because of fewer invasive Site activities. Alternatives 3, 4, and 5 are

less preferable because they would have minor short-term impacts during implementation, but these impacts would be addressed by using standard work practices, safety measures, and dust control measures. Compared to Alternative 3, Alternatives 4 and 5 would involve additional truck traffic and its associated traffic hazards because additional truck traffic is anticipated to haul excavated soil off-site and to transport clean fill for backfilling activities. Alternative 4 would involve more truck traffic and increased risk compared to Alternative 5 because of the greater volume of debris to be excavated and removed and the greater amount of clean fill required for backfilling activities. The increased truck traffic would not be concentrated in a manner that would significantly impact local traffic patterns. Alternatives 4 and 5 would have greater short-term worker risk because they involve excavation of contaminated soils, whereas Alternative 3 involves only the capping of those soils.

Implementability

All of the alternatives are implementable. However, Alternatives 3, 4, and 5 are less implementable than Alternatives 1 and 2 because they require more difficult and complex construction-related activities and operations. Alternative 1 is the easiest to implement because it requires no action. Alternative 2 is the most implementable of the alternatives that include an action because it involves only land use controls and fence installation (assuming the current land owner is agreeable), whereas Alternatives 3, 4, and 5 require heavy equipment construction activities. There is little difference in the implementability of Alternatives 3, 4, and 5. The only difference is the excavation of soils and transport to an off-site landfill for Alternatives 4 and 5, but these activities are highly implementable.

Cost

Alternative 1 involves no action; therefore, no cost is associated with this alternative. Alternative 2 is the least costly of the available alternatives with a present net worth of $515,000. Alternative 5 has the next lowest cost with a present net worth of approximately $1,173,000 followed by Alternative 3 at $1,856,000. The present net worth of Alternative 4 is estimated at $2,150,000, which is the highest cost.

State and Community Acceptance

State acceptance will be fully addressed in the ROD after all public comments are received. Community acceptance will be assessed during the Proposed Plan comment period and associated public meeting, and information about community acceptance will be incorporated into the ROD.

9.0 PREFERRED ALTERNATIVE

The preferred alternative for the Site is Alternative 5 – Limited Debris and Soil Removal with Off-site Disposal.

Alternative 5 is the most cost-effective because it is lower in cost than the other alternatives that meet the remedial action objectives, reduces risk through removal of soils with contaminant concentrations greater than the preliminary remediation goals, and provides off-site disposal. Thus, Alternative 5 is identified as the preferred alternative.

Alternative 5 is preferred over other alternatives because it will achieve substantial and long-term risk reduction for human health and the environment through removal and off-site disposal of debris and soil contamination where constituents exceed preliminary remediation goals. Alternative 5 is expected to allow the property to be used for its current and reasonably anticipated future land use (undeveloped property). The remediation area is presented on **Figure 8**.

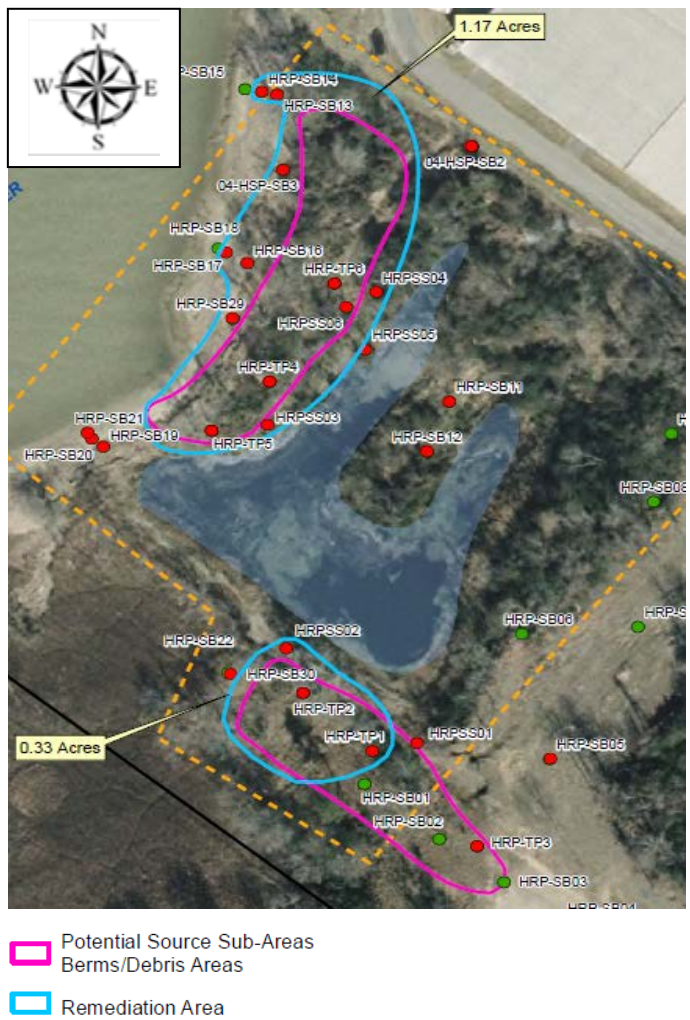


Figure 8: Remediation Area

Based on information currently available, it is believed that the preferred alternative meets the threshold criteria and provides the best balance of tradeoffs among the other alternatives. The preferred alternative is expected to satisfy the following statutory requirements of CERCLA §121(b): 1) be protective of human health and the environment; 2) comply with ARARs; 3) be cost-effective; 4) utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and 5) satisfy the preference for treatment as a principal element (or justify not meeting the preference).

The preferred alternative does not meet the preference for treatment as a principal element because the low concentrations of hazardous substances in Site soil pose a relatively low, long-term threat that can be reliably contained in a solid waste landfill without treatment.

The preferred alternative may change in response to public comment or new information.

10.0 COMMUNITY PARTICIPATION

Public input is important to the decision-making process. Nearby residents and other interested parties are encouraged to use the comment period for questions and concerns about the preferred alternative for the Site. The public comments will be summarized and responded to in a responsiveness summary, which will become part of the official ROD.

« AVAILABLE INFORMATION »

Final technical documents, including the Remedial Investigation and Focused Feasibility Study Reports and other relevant technical reports for the Horseshoe Pond, are available to the public at the following location:

Administrative Record:
North Suffolk Library
2000 Bennetts Creek Park Road
Suffolk, Virginia 23435
757-514-7150

10.1 How to Submit Comments

The Public Comment Period for the Horseshoe Pond Proposed Plan offers the public an opportunity to provide input to the process of evaluating remedial alternatives for the Site. The Public Comment Period will begin on 30 June 2014 and end on 30 July 2014. A public meeting will be held on 10 July 2014. The meeting will provide an additional opportunity for the public to submit comments regarding the Proposed Plan. Comments may be written or submitted orally at the meeting. All interested parties are encouraged to attend the meeting to learn more about the alternatives proposed for the Site.

To submit written comments during the Public Comment Period or to obtain further information, please contact the following representative:

Mr. Sher Zaman
Project Manager
U.S. Army Corps of Engineers, Baltimore District
P.O. Box 1715
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Written comments on the Horseshoe Pond Proposed Plan must be postmarked no later than 30 July 2014.

10.2 Community Acceptance

Community acceptance of the preferred alternative will be evaluated after the public comment period ends.

10.3 Record of Decision

Following the public comment period, a ROD will be issued. The ROD will detail the remedial action selected for the Site. It will also include responses to comments received during the public comment period.

« PUBLIC MEETING NOTICE »

Date: 10 July 2014
Time: 6:00 pm to 8:00 pm
Place: Hilton Garden Inn
5921 Harbour View Boulevard
Suffolk, VA

GLOSSARY OF TERMS

Administrative Record	The body of documents that "forms the basis" for the selection of a particular response at a site. Documents that are included are relevant documents that were relied upon in selecting the response action as well as relevant documents that were considered but were ultimately rejected. This file is to be available for public review and a copy maintained near the Site. The Horseshoe Pond Administrative Record file is maintained at the North Suffolk Library.
Applicable or Relevant and Appropriate Requirement (ARARs)	Cleanup standards, standards of control, and other substantive requirements, criteria or limitations promulgated under Federal environmental or State environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site or that address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site. Action-specific ARARs: Action-specific limitations on "actions" associated with a remedial action. Chemical-specific ARARs: Chemical-specific standards established for specific chemicals found on the Site. Location-specific ARARs: Location-specific restrictions based on the location of the Site.
Aquifer	An underground layer of rock and sand that contains water.
Bioconcentration Factor	The ratio of a substance's concentration in tissue versus its concentration in water.
Biodegradation	The breakdown of chemicals by bacteria or other biological means.
Chemicals of Concern	Chemicals identified through the risk assessment process as the primary chemicals that may cause unacceptable human health and/or ecological risk.
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)	A Federal law enacted in 1980 and amended in 1986 by the Superfund Amendments and Reauthorization Act (SARA), which concerns investigation and response actions regarding hazardous substances, pollutants, and contaminants.
Chemicals of Potential Ecological Concern	Chemicals identified through the risk assessment process as the primary chemicals that may cause unacceptable ecological risk.
Downgradient	The direction that groundwater flows; similar to "downstream" for surface water.
Exposure Pathway	The route a chemical takes from its source (where it began) to its end point (where it ends), and how people and animals can come into contact with (or get exposed to) the chemical.
Exposure Scenario	Situations (e.g., trespassing, living in a home [residential], digging, eating, burrowing, etc.) that results in exposure to chemicals by humans or animals.
Geophysical Survey	The use of specialized instruments on the ground surface to detect features below the ground such as buried materials. The instruments are sensors.

Hazard Quotient	The ratio of the concentration of a chemical detected at a site to the concentration of the chemical at which no negative effects are expected.
Maximum Contaminant Levels	The maximum concentration of a chemical in drinking water allowed by law.
Metallic Anomaly	Sensor readings during a geophysical survey that are different from readings expected or standard for subsurface soils and that indicate metal objects are present below the ground surface.
Polycyclic Aromatic Hydrocarbons	Chemicals primarily associated with petroleum, coal, and tar. These chemicals can also be created by burning.
Present Net Worth	What a series of cash flows in the future would be worth today.
Proposed Plan	Plan that identifies the alternative that best meets the requirements of CERCLA and the National Oil and Hazardous Substances and Pollution Contingency Plan (NCP. The purpose of the proposed plan is to supplement the RI/FS and provide the public with a reasonable opportunity to comment on the preferred alternative for remedial action, as well as alternative plans under consideration, and to participate in the selection of remedial action at a site.
Record of Decision (ROD)	A public document that describes the remedy selected for a site, the basis for the choice of that remedy, and provides responses to public comments. The ROD is created from information generated during the remedial investigation/feasibility study.
Regional Screening Levels	Regional Screening Levels - Risk-based contaminant concentrations developed by the USEPA against which site data are compared to determine if negative effects on human health may be occurring.
Remedial Action	Those actions consistent with permanent remedy taken instead of or in addition to removal actions in the event of a release or threatened release of a hazardous substance into the environment, to prevent or minimize the release of hazardous substances so that they do not migrate to cause substantial danger to present or future public health, welfare or the environment.
Remedial Alternative	Combination of various technologies (e.g., removal, containment, treatment) identified for a site cleanup.
Remedial Action Objective	Objectives established for remedial actions to guide the development of alternatives and to focus the comparison of acceptable remedial action alternatives, if warranted. Remedial action objectives also assist in clarifying the goal of minimizing risk and achieving an acceptable level of protection for human health and the environment.
Risk Management Range	The range established by USEPA as being between 1x 10-4 (one in 10,000) and 1 x 10-6 (one in 1,000,000) and representing what are generally considered acceptable levels of chemicals. This is also the range at which a risk management decision is needed, including evaluating site-specific information to determine if remedial action is needed.
Semivolatile Organic Compounds	Organic compounds that evaporate slowly under normal atmospheric conditions and are typical components of petroleum and cleaning products.
Target Analyte List	List of 23 metals included in laboratory analysis.

95th Upper Confidence Limit	The upper boundary (or limit) of a confidence interval of the population mean expressed as a value that, when calculated for randomly drawn subsets, equals or exceeds the true population mean 95% of the time.
Upgradient	Of or pertaining to the place(s) from which ground water originated or traveled through before reaching a given point in an aquifer.
Vadose Zone	The unsaturated zone between the land surface and the top of the groundwater zone.
Vapor Intrusion	Process by which chemicals in soil or groundwater migrate to indoor air above a contaminated site.
Volatile Organic Compounds (VOCs)	Organic chemical compounds whose composition makes it possible for them to evaporate under normal atmospheric conditions of temperature and pressure. VOCs are typically components of petroleum and cleaning products.

LIST OF ACRONYMS

ARAR	Applicable or Relevant and Appropriate Requirement
BERA	baseline ecological risk assessment
BHHRA	baseline human health risk assessment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	chemical of concern
COPEC	chemical of potential ecological concern
4,4′-DDD	4,4'-dichlorodiphenyldichloroethane
4,4′-DDE	4,4'-dichlorodiphenyldichloroethylene
4,4′-DDT	4,4'-dichlorodiphenyltrichloroethane
DoD	U.S. Department of Defense
FNOD	Former Nansemond Ordnance Depot
GE	General Electric Company
HQ	hazard quotient
µg/L	micrograms per liter
mg/kg	milligrams per kilogram
MW	monitoring well
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCP	pentachlorophenol
RCRA	Resource Conservation and Recovery Act
ROD	record of decision
SLERA	screening level ecological risk assessment
SVOC	semivolatile organic compound
USACE	U.S. Army Corps of Engineers
USEPA	U. S. Environmental Protection Agency
VDEQ	Virginia Department of Environmental Quality
VOC	volatile organic compound
WESTON®	Weston Solutions, Inc.

REFERENCES

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WESTON (Weston Solutions, Inc.). 2011. *Final Remedial Investigation, Horseshoe Pond, FNOD, Virginia.* June 2011.

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