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Record of Decision
Site 12 – Town Gut Landfill

Naval District Washington, Indian Head

Indian Head, Maryland

Naval Facilities Engineering Command Washington

Contract Number N62467-94-D-0888

Contract Task Order 0805

September 2004

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ACRONYMS AND ABBREVIATIONS

ARAR	Applicable or Relevant and Appropriate Requirement
BERA	baseline ecological risk assessment
BTAG	Biological Technical Assistance Group
CDI	chronic daily intake
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CNS	central nervous system
COC	chemical of concern
COPC	chemical of potential concern
CSF	cancer slope factor
CSM	Conceptual Site Model
DOD	Department of Defense
EE/CA	Engineering Evaluation/Cost Analysis
EPA	U.S. Environmental Protection Agency
EPC	exposure point concentration
ERA	ecological risk assessment
ESL	ecological screening level
FDA	Food and Drug Administration
FS	feasibility study
GIS	Geographic Information System
HEAST	Health Effects Assessment Summary Table
HI	hazard index
HQ	hazard quotient
IAS	Initial Assessment Study
IEUBK	Integrated Exposure Uptake Biokinetic (Model)
IHDIV-NSWC	Indian Head Division Naval Surface Warfare Center
IR	Installation Restoration
IRIS	Integrated Risk Information System
LOAEL	lowest observed adverse effects level
LUC	land use controls
MCL	Maximum Contaminant Level
MDE	Maryland Department of the Environment
msl	mean sea level
NCEA	National Center for Environmental Assessment
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NDW-IH	Naval District Washington, Indian Head

NEESA	Naval Energy and Environmental Support Activity
NEPA	National Environmental Policy Act
NMHSP&E	Netherlands Ministry of Housing, Spatial Planning, and Environment
NOAEL	no observed adverse effects level
NPL	National Priorities List
NPW	net present worth
O&M	operation and maintenance
ORNL	Oak Ridge National Laboratory
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
RAB	Restoration Advisory Board
RAGS	Risk Assessment Guidance for Superfund
RAO	remedial action objective
RBC	risk-based concentration
RCRA	Resource Conservation and Recovery Act
RDA	Recommended Daily Allowance
RfD	reference dose
RI	remedial investigation
ROD	Record of Decision
RME	reasonable maximum exposure
SARA	Superfund Amendments and Reauthorization Act
SF	slope factor
SVOC	semivolatile organic compound
TAL	Target Analyte List
TCL	Target Compound List
TRV	toxicity reference value
UCL	upper confidence limit
VOC	volatile organic compound

1.0 DECLARATION

1.1 SITE NAME AND LOCATION

Site 12 – Town Gut Landfill
Naval District Washington, Indian Head
Indian Head, Maryland
CERCLIS ID No. MD7170024684

1.2 STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedy for Site 12 – Town Gut Landfill at the Naval District Washington, Indian Head (NDW-IH)[1] in Indian Head, Maryland. The Selected Remedy was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA), and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record file for this site.

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

1.3 ASSESSMENT OF SITE

The remedial action selected in this Record of Decision (ROD) is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

1.4 DESCRIPTION OF SELECTED REMEDY

Site 12 is one of the Installation Restoration (IR) sites currently included in the facility's IR Program. Separate investigations and assessments are being conducted for these sites in accordance with CERCLA. Therefore, this ROD applies only to Site 12. The remedy calls for the design and implementation of response measures that will protect human health and the environment. The remedy addresses the landfill wastes, soil contamination, and shallow groundwater contamination.

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[1] On 1 October 2003, the installation management functions at Indian Head transferred from Indian Head Division, Naval Surface Warfare Center (IHDIV-NSWC) to NDW. References to this installation will now be Naval District Washington, Indian Head.

The Selected Remedy for Site 12 is land use controls that restrict the use of land and shallow groundwater and monitoring. The Selected Remedy includes the following major components:

- Land use controls will be put in place to prohibit residential development, shallow groundwater use, and unauthorized excavation activities. This is necessary so that the soil cover installed under a previous non-time-critical removal action will not be damaged by future site activities.

- Shallow groundwater and surface water will be monitored to confirm that migration of contaminants from the site has not occurred.

1.5 STATUTORY DETERMINATIONS

The Selected Remedy is protective of human health and the environment, complies with federal and state requirements that are applicable or relevant and appropriate to the remedial action, is cost effective, and utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable.

The remedy does not satisfy the statutory preference for treatment as a principal element of the remedy. Based on the size and location of contents of the Town Gut Landfill, the Navy concluded that it was impractical to excavate and treat the landfilled waste and chemicals of concern in a cost-effective manner. The only unacceptable risks to human health were for the hypothetical future residential exposure scenario. The Navy's decision not to remove and treat the landfill waste, given the land-use assumptions, will not result in unacceptable human health or ecological risks.

Because this remedy resulted in hazardous substances, pollutants, or contaminants remaining on site above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within 5 years after initiation of remedial action to ensure that the remedy is, or will be, protective of human health and the environment.

1.6 ROD DATA CERTIFICATION CHECKLIST

The following information is included in the Decision Summary section of this ROD. Additional information can be found in the Administrative Record file for this site.

- Chemicals of concern (COCs) and their respective concentrations.

- Baseline risk represented by the COCs.

- Clean-up levels established for COCs and the basis for these levels.
- How source material constituting principal threats are addressed.
- Current and reasonably anticipated future land use assumptions and current and future beneficial uses of groundwater used in the baseline risk assessment and ROD.
- Potential land and groundwater use that will be available at the site because of the Selected Remedy.
- 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.
- Key factor(s) that led to selection of the remedy (i.e., how the Selected Remedy provides the best balance of tradeoffs with respect to the balancing and modifying criteria, highlighting criteria key to the decision).

1.7 AUTHORIZING SIGNATURES

T. L. Honey, CAPT
Deputy Commandant
Naval District Washington

29 Sept 04
Date

Abraham Ferdas, Director
Hazardous Site Cleanup Division
U.S. EPA Region 3

9/30/04
Date

2.0 DECISION SUMMARY

2.1 SITE NAME, LOCATION, AND DESCRIPTION

NDW-IH is located in northwestern Charles County, Maryland, approximately 25 miles southwest of Washington, DC (Figure 2-1). The NDW-IH is a military facility consisting of the main area on the Cornwallis Neck Peninsula and the Annex on Stump Neck. The main area 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. Stump Neck Annex is located across Mattawoman Creek. The Stump Neck Annex is not contiguous with the main area and is operated by a tenant. The EPA identification number is MD7170024684.

The Department of the Navy (Navy) is the lead agency for site activities at NDW-IH. EPA and MDE are the support agencies. Clean-up monies are provided by the Department of Defense.

Site 12 – Town Gut Landfill is located in the central portion of NDW-IH (Figure 2-2). Site 12 comprises approximately 4 acres of undeveloped land. The site is bisected by the Atkins Road Extension, which is oriented in a northwest-southeast direction, and a pond (Figure 2-3). The northern and southern portions of Site 12 are bounded by ponds that discharge to Mattawoman Creek.

2.2 SITE HISTORY AND ENFORCEMENT ACTIVITIES

2.2.1 Site History

Between 1968 and June 1980, the site was used by NDW-IH to dispose of landscaping waste, fill material, and rubble. Reportedly, material from outside the facility was also disposed at the site until 1972. Unauthorized dumping of trash may have occurred. Some of the unauthorized items reportedly disposed at Site 12 include paint, varnish, and other chemical waste.

Site 12 was estimated to contain approximately 70,000 cubic yards of mixed solid waste materials, primarily landscaping wastes, tree stumps, and construction debris. Naval Energy and Environmental Support Activity (NEESA) team interviews indicated that paint, varnish, and chemical wastes may also have been disposed at the site.

Based on visual observations and examination of historical maps and aerial photographs, the landfill material appears to have been first dumped on the eastern side of the site in a topographically low area. Dumping then continued in a westward direction. It was estimated that the top of the waste was at that time 1 foot to 15 feet above the original ground surface. The total fill area was estimated to be

approximately 4 acres. The landfill was not closed in accordance with state solid waste management regulations.

2.2.2 Previous Investigations and Enforcement Activities

Site 12 has been under investigation since 1982, when a leachate sample was collected by NEESA during the Initial Assessment Study (IAS) of the NDW-IH facility (Hart, 1983). During the 1985 Confirmation Study (CH2M Hill, 1985), surface water and sediment samples were collected from the edge of the landfill. NDW-IH was placed on the National Priorities List (NPL) in September 1995.

A remedial investigation (RI) was performed at Site 12 in 1997. The investigation included a geophysical investigation, installation of soil borings and shallow groundwater monitoring wells, and collection and analysis of surface soil, shallow groundwater, surface water, and sediment samples.

Additional activities were performed in 1999 to fill data gaps as part of the feasibility study (FS) preparation process. Field activities included test pit excavation and wetland delineation.

An Engineering Evaluation/Cost Analysis (EE/CA) and Action Memorandum for a non-time-critical removal action were prepared in 2002 (Navy, 2002a and 2002b). A non-time-critical removal action that closed the landfill to the satisfaction of the state was then implemented. The removal action included the following major components:

- Large items of exposed waste and debris found along the shores of the ponds were excavated and removed for off-site disposal. Soil, sediment, and small objects were excavated to remove contaminated material from near the ponds and were consolidated under the cover of the site to assist with obtaining the proper grading for the site and to reduce the cost of bringing in additional fill material for this purpose. Wetland soil and vegetation disturbed during the removal action were replaced.

- An area of approximately 4.3 acres was covered with soil. Additional soil was placed as needed over the landfill so that all waste was covered with a minimum of 2-foot layer of soil. A type of vegetation that would discourage animals from burrowing into the landfill was planted on the soil cover.

Current site conditions following the removal action are shown on Figure 2-4.

2.3 COMMUNITY PARTICIPATION

This section describes how the public participation requirements of CERCLA and the NCP were met in the remedy selection process.

A Restoration Advisory Board (RAB) made up of community members and Navy, federal, and state officials meets several times a year. The RAB is designed to act as a focal point for the exchange of information between NDW-IH and the local community regarding restoration activities.

The RI Report, FS Report, Proposed Plan, and EE/CA for Site 12 – Town Gut Landfill at NDW-IH in Indian Head, Maryland, were made available to the public. The RI Report was made available in July 1999. The FS Report and the Proposed Plan were made available in January 2001. The EE/CA was made available in August 2002. These documents can be found in the Administrative Record file and the information repositories maintained at the NDW-IH General Library. The notice of the availability of the RI Report, FS Report, and Proposed Plan was published in the *Maryland Independent* on January 12, 2001 and the *La Plata – Indian Head Independent* on January 13, 2001. A public comment period on the Proposed Plan was held from January 16, 2001 to March 2, 2001. In addition, a public meeting was held on January 23, 2001 to present the Proposed Plan to a broader community audience than those that had already been involved at the site. At this meeting, representatives of the Navy, EPA, and MDE answered questions about problems at the site and the remedial alternatives. The Navy's responses to the comments received during this period are included in the Responsiveness Summary, which is a part of this ROD. The notice of the availability of the EE/CA was published in the *Maryland Independent* on August 9, 2002. A public comment period on the EE/CA was held from August 9 to September 8, 2002. No public comments were received.

2.4 SCOPE AND ROLE OF REMEDIAL ACTION

Site 12 – Town Gut Landfill is one of the IR sites currently included in the facility's IR Program. The Selected Remedy is the final remedial action for Site 12 under CERCLA. The function of this remedy is to reduce risks to human health and the environment associated with exposure to buried wastes and contaminated soil and shallow groundwater.

A non-time-critical removal action that included a soil cover over the landfill has already been implemented. The FS developed remedial alternatives that addressed the risks identified in the RI Report. The alternatives were evaluated, and a Proposed Plan was prepared. Each of these documents was made available to the public for review and comment. The previous disagreement between the Department of Defense (DOD) and the EPA over post-ROD requirements with respect to institutional controls delayed the signing of the ROD. The Navy, EPA, and MDE were in agreement with the physical

portion of the preferred alternative identified in the Proposed Plan and that the ROD dispute over land use controls should not impede its accomplishment or protection of human health and the environment. Therefore, an EE/CA was prepared, an Action Memorandum was prepared for approval and signature, and the physical portion of the preferred alternative was executed in 2002 under the Navy removal action authority.

The potential exposure to contaminated soil and shallow groundwater under a hypothetical future residential exposure scenario constitutes the principal risk to human health. Potential exposure to contaminated soil constituted the principal risk to ecological receptors. The soil cover implemented under the 2002 removal action addressed this risk. Although the shallow groundwater is contaminated, the contamination is not affecting public drinking water supplies or adjacent surface water. The purpose of remedial action is to prevent current and future potential exposure to contaminated soil and shallow groundwater.

This is the only ROD contemplated for Site 12. Separate investigations and assessments are being conducted for the other IR sites at NDW-IH in accordance with CERCLA. Therefore, this ROD only applies to Site 12. Separate RODs or other CERCLA decision documents will be prepared for the other IR sites.

2.5 SITE CHARACTERISTICS

2.5.1 Physical Settings

The Town Gut Landfill, Site 12, covers an area of approximately 4 acres. Site features at the time of the RI/FS are shown on Figure 2-3. Current site conditions, after the 2002 removal action, are shown on Figure 2-4. There are no buildings, structures, or other development at the site. Ground surface elevations range from approximately sea level at the ponds to 25 feet above mean sea level (msl) at the highest portion of the site. The site is bisected by Atkins Road Extension, which is oriented in a northwest-southeast direction. A pond is adjacent to the western and southern sides of the northern portion of the site. Another pond is adjacent to the western and northern sides of the southern portion of the site. The ponds are connected via a 78-inch-diameter metal pipe located under Atkins Road Extension. Runoff from the site flows into these two ponds and eventually discharges to Mattawoman Creek. The water flow at the discharge (southern) end of the southernmost pond is controlled by a weir with a v-notch that inhibits influences on the pond by tidal changes in Mattawoman Creek and helps prevent sediment from entering the creek. Wetlands are located adjacent to the ponds.

Subsurface soil conditions at the site were investigated during the installation of six monitoring wells. Subsurface materials generally consist of silt, sand, and gravel (fill) overlying refuse material (wood,

plastic, cloth, concrete, and tar shingles) mixed with silt, sand, and gravel and interspersed with void spaces. Natural materials beneath the refuse consist of greenish-gray silt and gravel.

Large items of exposed waste and debris previously found along the shores of the ponds have been excavated and removed for off-site disposal. Soil, sediment, and small objects have been excavated to removal contaminated material from near the ponds and have been consolidated under the cover of the site to assist with obtaining the proper grading for the site and to reduce the cost of bringing in additional fill material for this purpose. Wetland soil and vegetation disturbed during removal activities have been replaced. An area of approximately 4 acres has been covered with soil. Additional soil has been placed as needed over the landfill so that all waste is now covered with a minimum 2-foot soil layer. A type of vegetation that would discourage animals from burrowing into the landfill has been placed on the soil cover.

The shallow groundwater beneath the site occurs primarily under unconfined (water-table) conditions. The water-table aquifer consists primarily of refuse material mixed with silt, sand, and gravel (fill). Shallow groundwater flows toward and into the adjacent surface water (ponds). The groundwater is primarily recharged by downward migration of precipitation through the unsaturated zone to the water table. In addition, recharge of shallow groundwater may occur along the edges of the ponds during high water conditions. While depth to the water table is generally 1 foot to 4 feet below ground surface over most of the site, it is greater than 10 to 12 feet deep in a small portion. Groundwater from the shallow aquifer is not used as a potable water supply. Drinking water is obtained from a deeper aquifer (190 to 240 feet deep). There is no known hydrogeological connection or communication between the shallow water-table aquifer and the deeper aquifer used for drinking water.

There are no areas of archeological or historical importance at Site 12.

2.5.2 Conceptual Site Models

Figure 2-5 is the Conceptual Site Model (CSM) for human receptors, and Figure 2-6 is the CSM for ecological receptors. Each CSM graphically integrates information regarding the physical characteristics of the site, exposed populations, sources of contamination, and contaminant mobility (fate and transport) to identify potential 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 waste buried in or deposited at the landfill is the source of contamination. Human receptors under the current land use scenario (vacant land) and reasonable future land use scenario include the maintenance worker, full-time employee, and adolescent trespasser. An additional receptor under the

reasonable future use scenario is the construction worker. Hypothetical future residential use of the site was also evaluated for completeness and to determine whether land use controls would be needed. However, residential use of the site with use of shallow groundwater as a source of drinking water is not a reasonable future land use.

Current and potential future land and resource uses are discussed further in Section 2.6. Potential risks to human health are discussed further in Section 2.7.1.

The CSMs discussed above were developed for the risk assessments conducted before the removal action was implemented in 2002. The soil cover installed as part of the removal action has addressed the exposure routes associated with contaminated soil for the maintenance worker, full-time employee, adolescent trespasser, and ecological receptors.

2.5.3 Sampling Strategy

One leachate water sample was collected from a small runoff point along the bank of a stream during the IAS in 1982 (Hart, 1983). During the 1985 Confirmation Study, a surface water sample and a sediment sample were collected from the edge of the landfill in the same approximate area as the leachate water sample to confirm the IAS results (CH2MHill, 1985). The Confirmation Study concluded that Site 12 had no detectable impact on the concentration of metals in the adjacent ponds. However, the Confirmation Study also recommended additional monitoring.

After NDW-IH was listed on the NPL, a comprehensive RI was conducted in 1997 to fill data gaps and estimate risks to human health and the environment. During the RI, a geophysical survey was performed to estimate the suspected area of the landfill in the northern portion of the site. Five surface soil samples were collected for chemical analysis to determine whether this medium was contaminated. Soil borings were installed and converted into monitoring wells. Subsurface soil samples from the borings were collected for geological characterization only. No subsurface soil samples were subjected to chemical analysis. Six monitoring wells were installed and sampled to determine whether groundwater contamination was present in the shallow aquifer. Six surface water and sediment sample pairs were collected to determine whether contaminants are migrating from the landfill to the ponds. All samples were analyzed for Target Compound List (TCL) volatile organic compounds (VOCs), TCL semivolatile organic compounds (SVOCs), TCL pesticides/polychlorinated biphenyls (PCBs), Target Analyte List (TAL) metals, and cyanide. Soil and sediment samples were also analyzed for explosives. Sampling locations are shown on Figure 2-3.

Thirteen test pits were excavated as part of the FS field investigation in 1999 to better define the horizontal boundary of the landfill. No samples were collected from the test pits. Test pit locations and the extent of the landfill are shown on Figure 2-7.

2.5.4 Nature and Extent of Contamination

Based on the results of the geophysical survey, soil borings, and test pits, the landfill covers an area of approximately 4 acres. Landfilled material was encountered just below the ground surface at one location and as deep as 8 feet at another location. Generally, the depth to the landfill material ranged from approximately 1 to 2 feet below the ground surface. The FS estimated that the volume of landfilled waste is approximately 70,000 cubic yards. No hazardous wastes, as defined by the Resource Conservation and Recovery Act (RCRA), were identified during investigations at the site; however, five rusted drums of hazardous waste that were encountered during the 2002 removal action were removed and properly disposed off site.

COCs have been identified based on the analytical data, risk drivers from the human health and ecological risk assessments (discussed in Section 2.7), and exceedances of regulatory standards and criteria. The concentrations of the COCs are provided in Table 2-1. The COCs (risk drivers) for soil based on protection of human health for the hypothetical future resident are arsenic and iron. The concentrations of arsenic and iron were similar in all soil samples. No COCs were identified for the other human receptors evaluated. Additional soil COCs based on protection of ecological receptors are Aroclor 1254 (a PCB), mercury, and silver. Aroclor 1254 was only detected in one sample (S12SS05). PCBs and arsenic are classified as carcinogens. Iron, mercury, and silver are classified as non-carcinogens. PCBs and metals are relatively immobile in the environment. This sample also had the highest concentrations of mercury and silver. The concentrations of the soil COCs and the soil sampling locations are shown on Figure 2-8. Additional chemicals that were detected in soil but did not result in unacceptable risks include polynuclear aromatic hydrocarbons (PAHs), pesticides, and other metals. The concentrations and locations of these detections are also shown on Figure 2-8.

None of the soil concentrations exceeded EPA screening levels for migration of soil contaminants to groundwater (EPA, 1996).

The COCs (risk drivers) for shallow groundwater based on protection of human health (hypothetical future resident) are cis-1,2-dichloroethene, vinyl chloride, arsenic, iron, and manganese. No groundwater COCs were identified for the other human receptors evaluated. Additional COCs for shallow groundwater, based on exceedances of federal and state Maximum Contaminant Levels (MCLs), are trichloroethene and lead. Trichloroethene, vinyl chloride, arsenic, and lead are classified as carcinogens. Cis-1,2-dichloroethene, iron, and manganese are classified as non-carcinogens. VOCs are relatively

mobile in the environment. Metals are relatively immobile in the environment. There is no discernable plume of the organic COCs evident from the data. The organic COCs were only detected at one location (S12PW01). The concentrations of the shallow groundwater COCs are shown on Figure 2-9. Additional chemicals that were infrequently detected in shallow groundwater but did not result in unacceptable risks include PAHs, pesticides, and other metals. The concentrations and locations of these detections are also shown on Figure 2-9.

No COCs have been identified for surface water or sediment.

2.5.5 Summary

Soil COCs include PCBs and metals. Shallow groundwater COCs include VOCs and metals. Arsenic is the only metal detected that is classified as a carcinogen. Trichloroethene, vinyl chloride, and PCBs are also classified as carcinogens. VOCs are soluble in water and have a low capacity for retention by soil organic carbon. Therefore, VOCs are more likely to be detected in shallow groundwater than in soil. PCBs are less soluble and are more likely to be retained in the soil. It appears that some migration of metals from soil to shallow groundwater has occurred at the site.

Human and ecological receptors may come into direct contact with soil affected by the release of chemicals from the source area (landfill). The receptors may be exposed via ingestion of a small amount of soil or via dermal absorption of certain contaminants from the soil. Domestic use of shallow groundwater and direct contact by hypothetical future residents were evaluated in the baseline risk assessment. Shallow groundwater is not currently used as a potable water supply and is not anticipated to be used in the future. However, it is possible that an excavation (for construction, utility maintenance, etc.) could be deep enough to encounter shallow groundwater. In such an instance, workers could be exposed to the shallow groundwater via dermal contact.

Human receptors for the current land use (vacant land) and reasonable future use scenario include the maintenance worker, full-time employee, and adolescent trespasser. An additional receptor for the reasonable future land use (e.g., vacant land, minor construction, limited development) is the construction worker. Hypothetical future residential use was also evaluated to determine whether land use controls would be needed. Current and potential future land and resource uses are discussed further in Section 2.6. Potential risks to human health are discussed further in Section 2.7.1.

Ecological receptors that could be affected are terrestrial animals and plants that contact contaminants in surface soil. These contaminants could also enter the food chain. The risks to potential ecological receptors are discussed in Section 2.7.2.

2.6 CURRENT AND POTENTIAL FUTURE LAND AND RESOURCE USES

This section of the ROD discusses the current and reasonably anticipated future land uses and current and potential beneficial groundwater uses at Site 12. This section forms the basis for reasonable exposure assessment assumptions and risk characterization conclusions.

Site 12 is a vacant unused area at this time. Reasonable potential future land uses include vacant land, minor construction, and limited development. There are no plans for residential development of the site. Shallow groundwater beneath the site and the ponds adjacent to the site are not used for any purpose. The shallow unconfined groundwater at the site is not hydraulically connected to deeper aquifers that are the principal sources of water for domestic use at NDW-IH.

It is unlikely that the site area would be developed for residential use. The fact that the site has been landfilled is also a limiting factor for future development. However, hypothetical future residential use of the site was evaluated in the risk assessment to determine whether land use controls are needed.

2.7 SUMMARY OF SITE RISKS

This section presents the results of the risk assessments completed as part of the RI before the removal action was implemented in 2002. The removal action mitigated potential risks to human health and ecological receptors associated with exposure to soil contaminants. The soil cover component of the removal action removed exposure pathways associated with soil.

2.7.1 Summary of Human Health Risk Assessment

The baseline risk assessment estimates the risks that the site poses if no action were taken. It provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action. This section of the ROD summarizes the results of the baseline risk assessment for Site 12. The primary focus of this summary is on those exposure pathways and chemicals found to pose actual or potential threats to human health. The risk assessment in the RI Report contains an evaluation of all chemicals of potential concern (COPCs) and exposure pathways, including those that do not pose unacceptable risks to human health. COPCs are those chemicals that are identified as a potential threat to human health or the environment and are evaluated further in the baseline risk assessment. COCs are a subset of the COPCs that are identified in the RI/FS as needing to be addressed by the response action proposed in the ROD.

2.7.1.1 Identification of Chemicals of Concern

Table 2-1 presents the COCs and exposure point concentrations for each of the COCs detected in soil and shallow groundwater. COCs either result in an unacceptable risk or exceed a regulatory standard. The exposure point concentration is the concentration that was used to estimate the exposure and risk from each COC. The table includes the concentration range for each COC in soil and shallow groundwater, the frequency of detection, the exposure point concentration, and how the exposure point concentration was derived. Generally, the 95 percent upper confidence limit (UCL) on the arithmetic mean concentration for a chemical is used as the exposure point concentration. However, for sites with limited amounts of data, such as Site 12, the highest concentration (maximum value) is commonly used as a default exposure point concentration in the risk assessment.

Soil COCs based on unacceptable risks to human health are arsenic and iron. Each of these metals was detected in all soil samples collected at the site.

Shallow groundwater COCs based on unacceptable risks to human health are cis-1,2-dichloroethene, vinyl chloride, arsenic, iron, and manganese. Additional COCs based on exceedances of federal and state MCLs are trichloroethene and lead. The metals were the most frequently detected COCs. The organics were only detected in one shallow groundwater sample.

2.7.1.2 Exposure Assessment

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

The compilation of contaminant sources, likely exposure pathways, and receptors at Site 12 is depicted in the CSM (Figure 2-5). Potential receptors for Site 12 include the following: current and future maintenance workers, current and future full-time employees, current and future adolescent trespassers, future construction workers, and hypothetical future residents. While worker exposure may occur under current or future land use scenarios, maintenance activities are not routinely scheduled for the site, which is a vacant unused lot at this time. Future residential use is not a reasonably anticipated land use, but was evaluated to identify if unrestricted land use could be permitted.

Maintenance workers, full-time employees, and construction workers may be exposed to surface soil and sediment during the course of their normal activities. Potential exposure pathways for maintenance workers, full-time employees, and construction workers include incidental ingestion of soil, dermal contact with soil, incidental ingestion of sediment, and dermal contact with sediment. Construction workers may also be exposed to shallow groundwater during excavation activities. Potential exposure pathways for construction workers exposed to shallow groundwater include dermal contact and inhalation of organics volatilizing from the groundwater.

Adolescent trespassers may be exposed to surface soil, surface water, and pond sediment while trespassing across the site. Potential exposure pathways for adolescent trespassers include incidental ingestion of surface soil, dermal contact with surface soil, incidental ingestion of surface water, dermal contact with surface water, incidental ingestion of sediment, dermal contact with sediment, and ingestion of fish.

Hypothetical future residents were evaluated in the risk assessment to determine whether land use controls are needed. Given that the current land use for Site 12 is military and future land use is expected to be military, industrial, or commercial, it is unlikely that this area would be developed for residential use. The fact that the site has been landfilled is also a limiting factor for future development. It was assumed that hypothetical future on-site residents may be exposed to soil and shallow groundwater is used as a potable water supply. It was also assumed that the hypothetical future resident would be exposed to surface water and sediment during recreational activities. Potential exposure pathways for hypothetical future residents include incidental ingestion of soil, dermal contact with soil, ingestion of shallow groundwater, dermal contact with shallow groundwater, inhalation of volatiles from shallow groundwater, incidental ingestion of surface water, dermal contact with surface water, incidental ingestion of sediment, dermal contact with sediment, and ingestion of fish.

A summary of the potentially significant receptor groups and exposure pathways for Site 12 is provided in Table 2-2. Major assumptions about exposure frequency (days/year), exposure duration (years), and other exposure factors (e.g., body surface area for dermal exposure, ingestion rates) that were included in the exposure assessment can be found in the RI Report (TtNUS, 1999).

2.7.1.3 Toxicity Assessment

Table 2-3 provides carcinogenic risk information for the COCs in both soil and shallow groundwater. At this time, cancer slope factors (CSFs) are not available for the dermal route of exposure. The dermal slope factors used in the assessment were extrapolated from oral values. An adjustment factor is applied that is dependent upon how well the chemical is absorbed via the oral route. Adjustments are particularly

important for chemicals with less than 50 percent absorption via the ingestion route. However, an adjustment was only necessary for arsenic (95 percent absorption). The oral values were used as the dermal CSF for trichloroethene and vinyl chloride (100 percent absorption). Cis-1,2-dichloroethene, iron, and manganese are not classifiable as human carcinogens, and there are no cancer toxicity data available. Although lead is classified as a probable human carcinogen, there is insufficient toxicity information to support the development of oral, dermal, and inhalation cancer slope factors.

Table 2-4 provides noncarcinogenic risk information for the COCs in both soil and shallow groundwater. Five of the COCs (cis-1,2-dichloroethene, trichloroethene, arsenic, iron, and manganese) have toxicity data indicating their potential for adverse noncarcinogenic effects in humans. The chronic toxicity data available for oral exposures have been used to develop oral reference doses (RfDs). The available toxicity data indicate that arsenic primarily affects the skin, iron primarily affects the lung and digestive system, and lead and manganese primarily affect the central nervous system (CNS). Oral RfDs are not available for lead and vinyl chloride. As was the case for carcinogenic data, dermal RfDs can be extrapolated from oral values by applying an adjustment factor as appropriate. However, an adjustment was only necessary for arsenic (95 percent absorption). No adjustment was needed for the other COCs (100 percent absorption), and the oral values were used as the dermal RfDs for these contaminants. At this time, inhalation reference concentrations are only available for manganese.

2.7.1.4 Risk Characterization

Methodology

The risk characterization summarizes and combines outputs of the exposure and toxicity assessments to characterize baseline risks, both in quantitative expressions and in qualitative statements.

For carcinogens, risks are generally expressed as the incremental probability of an individual developing cancer over a lifetime of exposure to the carcinogen. Excess lifetime cancer risk is calculated from the following equation:

$$\text{Risk} = \text{CDI} \times \text{SF}$$

Where: risk = a probability (e.g., 2E-05) of an individual developing cancer (unitless)
CDI = chronic daily intake averaged over 70 years (mg/kg-day)
SF = slope factor, expressed as $(\text{mg/kg-day})^{-1}$

These risks are probabilities that usually are expressed in scientific notation (e.g., 1E-06). An excess lifetime cancer risk of 1E-06 indicates that an individual experiencing the reasonable maximum exposure

estimate has a 1 in 1,000,000 chance of developing cancer as a result of site-related exposure. This is referred to as an "excess lifetime cancer risk" because it would be in addition to the risks of cancer individuals face from other causes such as smoking or exposure to too much sun. The chance of an individual developing cancer from all other causes has been estimated to be as high as one in three (33 percent) for women and one in two (50 percent) for men. The EPA generally acceptable risk range for site-related exposure is 1E-04 to 1E-06 or an excess lifetime cancer risk of 1 in 10,000 to 1 in 1,000,000.

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

The HQ is calculated as follows:

Noncancer HQ = CDI/RfD

Where: CDI = chronic daily intake
RfD = reference dose

CDI and RfD are expressed in the same units and represent the same exposure period (i.e., chronic, subchronic, or short term).

Carcinogenic Risks

The only unacceptable carcinogenic risks were for the future child resident (3.71E-03, or about 4 in 1,000) and future adult resident (7.60E-03, or about 8 in 1,000). These are hypothetical exposure scenarios. Carcinogenic risks for all other evaluated receptors were within or below the EPA acceptable risk range (1E-04 to 1E-06) and are as follows:

- Maintenance Worker: 1.5E-07 (1.5 in 10 million)
- Full-Time Employee: 2.2E-06 (2.2 in 1 million)
- Adolescent Trespasser: 9.4E-06 (9.4 in 1 million)
- Construction Worker: 1.0E-06 (1 in 1 million)

Table 2-5 provides risk estimates for the hypothetical future child resident for the significant routes of exposure. These risk estimates are based on a reasonable maximum exposure and were developed by taking into account various conservative assumptions about the frequency and duration of a child's exposure to soil and shallow groundwater. The risk estimates are also based on the toxicity of the COCs (trichloroethene, vinyl chloride, and arsenic). There is no cancer toxicity information available for exposure to lead. The total risk from direct exposure to contaminated soil and shallow groundwater at Site 12 to a hypothetical future child resident is estimated to be 3.71E-03. The COCs contributing most to this risk level are vinyl chloride and arsenic in shallow groundwater. There are no unacceptable risks from exposure to soil. This risk level indicates that, if no clean-up action is taken, an individual child would have an increased probability of 4 in 1,000 of developing cancer as a result of site-related exposure to the COCs.

Table 2-6 provides risk estimates for the hypothetical future adult resident for the significant routes of exposure. These risk estimates are based on a reasonable maximum exposure and were developed by taking into account various conservative assumptions about the frequency and duration of an adult's exposure to soil and shallow groundwater. The risk estimates are also based on the toxicity of the COCs (trichloroethene, vinyl chloride, and arsenic). There is no cancer toxicity information available for exposure to lead. The total risk from direct exposure to contaminated soil and shallow groundwater at Site 12 to a hypothetical future adult resident is estimated to be 7.60E-03. The COCs contributing most to this risk level are vinyl chloride and arsenic in shallow groundwater. There are no unacceptable risks from exposure to soil. This risk level indicates that, if no clean-up action were taken, an individual adult would have an increased probability of 8 in 1,000 of developing cancer because of site-related exposure to the COCs.

Noncarcinogenic Risks

The only unacceptable noncarcinogenic risks were for the future child resident (HI = 41.7) and future adult resident (HI = 17.3). Noncarcinogenic risks for all other evaluated receptors have an HI less than 1.0 and are as follows:

- Maintenance Worker: 0.01
- Full-Time Employee: 0.16

- Adolescent Trespasser: 0.82
- Construction Worker: 0.71

Table 2-7 provides HQs for the hypothetical future child resident for each route of exposure and the HI for all routes of exposure. The Risk Assessment Guidance for Superfund (RAGs) states that, generally, an HI greater than 1.0 indicates the potential for adverse noncancer effects. The estimated HI of 41.7 indicates the potential for adverse noncancer health effects from exposure to contaminated soil and shallow groundwater. The COCs contributing the most to the HI are arsenic and iron in soil and cis-1,2-dichloroethene, arsenic, iron, and manganese in shallow groundwater. Although each of these COCs affect different target organs, the contributing HQ for each of the COCs is greater than 1.0.

Table 2-8 provides HQs for the hypothetical future adult resident for each route of exposure and the HI for all routes of exposure. The estimated HI of 17.3 indicates the potential for noncancer health effects from exposure to contaminated shallow groundwater. The COCs contributing the most to the HI are arsenic, iron, and manganese in shallow groundwater. Although these COCs affect different target organs, the shallow groundwater HQ for each of the COCs is greater than 1.0. The soil HI is less than 1.0, indicating that adverse noncancer health effects from exposure to contaminated soil are not anticipated.

Exposure to Lead

Lead was identified as a COPC in shallow groundwater at Site 12. Lead was detected at a maximum concentration of 34.5 µg/L, which exceeds the federal drinking water action level of 15 µg/L. The maximum detected concentration of lead in soil (67.6 mg/kg) was less than the screening level of 400 mg/kg for residential land use and the screening level of 1,000 mg/kg for industrial use.

Exposure to lead in soil and shallow groundwater by hypothetical future residential children was evaluated using the EPA Integrated Exposure Uptake Biokinetic (IEUBK) Model. As recommended by the IEUBK guidance, the average concentrations of 39.8 mg/kg for soil and 13.3 µg/L for shallow groundwater as well as several default parameters were used to estimate blood-lead levels for children in a residential setting. The estimated geometric mean blood-lead level from children exposed to site soil and shallow groundwater was 2.7 µg/dL, which is less than the established level of concern of 10 µg/dL (EPA, 1994). The results indicate that no adverse effects are anticipated for children exposed to lead in soil and shallow groundwater.

Uncertainty Analysis

There are several significant sources of uncertainty inherent in the human health risk assessment. Uncertainties are associated with evaluation of residential land use, evaluation of arsenic, and evaluation of iron.

Exposure to soil was evaluated for hypothetical future child and adult residents. However, the site is currently used as a military base, and the future use is expected to remain the same. Therefore, it is unlikely that this area would be rezoned residential and developed for residential use. Consequently, the estimated risks for the hypothetical residential exposure scenario were only presented for information purposes. In addition, exposure to groundwater is unlikely because state regulations prohibit potable water wells within 100 feet of identifiable sources of contamination.

Although the more restrictive basis for evaluating risk associated with exposure to arsenic is to assume it is a carcinogen, carcinogenic effects are not the primary health effects expected upon exposure to arsenic. Most scientific evidence indicates that humans are capable of metabolizing arsenic to expedite its elimination from the body. Its elimination from the body mitigates the possibility for arsenic to result in carcinogenic effects. Therefore, evaluating arsenic only as a noncarcinogen would be more appropriate.

No toxicity criteria are available for iron in the EPA Integrated Risk Information System (IRIS) or in EPA Health Effects Assessment Summary Tables (HEAST). The EPA Region 3 risk-based concentration (RBC) table lists an oral RfD for iron and references the EPA National Center for Environmental Assessment (NCEA). The NCEA value is based on the Food and Drug Administration (FDA) Recommended Daily Allowance (RDA) for children and adults and not on any adverse effect level. Since the RfD is not based on an adverse effect level, it is not appropriate to use this value to calculate risks. An unacceptable HI based on the NCEA oral reference will not necessarily indicate that adverse health effects are anticipated, only that the RDA has been exceeded. For example, the RDA of iron for children and adults is 18 mg/day, and this is the amount of iron included in vitamin supplements. Using the RDA of 18 mg-iron/day with the exposure assumptions for a hypothetical future on-site residential child and the NCEA RfD of 0.3 mg/kg/day results in an HI of 3.8. Women's vitamins can contain 27 mg of iron, which results in an HI of 1.2 for a hypothetical future on-site woman resident. Therefore, the NCEA RfD indicates that adverse health effects may be anticipated for hypothetical future child and adult women taking vitamin supplements. This suggests that it is not appropriate to use the NCEA RfD for iron to estimate HIs. Consequently, no adverse health effects are expected for exposure to iron in soil at the site. The estimated HQs for exposure to iron in soil were 1.1 (child) and 0.16 (adult). The estimated HQs for exposure to iron in groundwater were 17.8 (child) and 7.7 (adult).

2.7.2 Summary of Ecological Risk Assessment

The ecological risk assessment (ERA) was performed to characterize the potential risks to ecological receptors from site-related contaminants. This section of the ROD summarizes the results of the ERA for this site. The primary focus of this summary is on exposure pathways and chemicals found to potentially pose threats to ecological receptors.

The emphasis of this discussion is on exposure of ecological receptors to surface soil and foodchain modeling. However, an overview of the ERA process is included. The ERA for Site 12 only included the following steps of the eight-step EPA process:

- Step 1 – Preliminary Problem Formulation and Ecological Effects Evaluation
- Step 2 – Preliminary Exposure Assessment and Risk Calculation
- Step 3A – Refinement of COPCs
- Step 8 – Risk Management

2.7.2.1 Preliminary Problem Formulation

Habitat Types and Ecological Receptors

Two ponds are adjacent to the landfill, one on either side of Atkins Road Extension. The pond on the southwestern side of the road is approximately 3 acres in size and is fed by two streams to the northwest. The streams originate in industrial areas north and west of the site. The streams enter a marshy area dominated by cattails in the northwestern portion of the pond. The areas north and west of the marsh and pond are located on a hill and are dominated by mature oaks, tulip poplar, and locust. The portion of the landfill southwest of the road is covered with unmowed turfgrass, with some small, scattered, undeveloped trees present. Some debris is present at the shoreline adjacent to the landfill. The landfill slopes gently to the ponds. Consequently, drainage on the landfill is toward the ponds.

The pond on the northeastern side of Atkins Road Extension is fed by a drainageway to the north and a swampy area to the northwest. The pond is approximately 1 acre in size. Wooded areas are located to the west and east of the pond. The portion of the landfill northeast of the road is covered with unmowed turfgrass and some small stands of trees.

The marshes and ponds support an abundant growth of aquatic vegetation and a variety of planktonic organisms, aquatic insects, fish, reptiles, amphibians, wading birds, and waterfowl. The streams that feed the ponds are subject to extreme fluctuations in flow, temperature, and turbidity, limiting their biotic

communities. No rare, threatened, or endangered species are present in or near Site 12. However, the bald eagle, which is a threatened species, has been known to forage in the ponds.

Contaminant Sources, Release Mechanisms, and Migration Pathways

The major source of contamination at Site 12 is the landfill. However, upgradient contaminant sources exist (particularly Site 8, Nitroglycerin Plant Office and Site 56, Lead Contamination at Industrial Wastewater Outfall 87) that can contribute contaminants via the streams that feed the ponds. The contaminant release pathways include wind erosion, overland runoff, and infiltration of contaminants. Contaminated fugitive dust can be generated during ground-disturbing activities. The contaminants could then be dispersed in the surrounding environment, transported to downwind locations, and deposited in surface soil, surface water, and sediment. However, the site is currently inactive, and the turfgrass and weeds on and around the site perimeter serve to minimize the airborne contaminant transport pathway by binding soil and reducing fugitive dust.

Stormwater runoff can carry contaminants via overland runoff to the ponds. However, the thick grassy and brushy areas on the site may trap surface runoff. Infiltrating precipitation can cause contamination of subsurface soil and groundwater. Contaminants can be deposited in sediment or surface water and can potentially accumulate in the tissues of aquatic organisms in the ponds. Groundwater flow under the landfill is toward the ponds.

Exposure Routes

Terrestrial animals at Site 12 can be exposed to soil contaminants through the ingestion of contaminated food items. In addition, animals can incidentally ingest soil while grooming fur, preening feathers, digging, grazing close to the soil, or feeding on items that are covered with soil (e.g., roots, tubers). Terrestrial vegetation can be exposed to contaminants through direct aerial deposition and root translocation. Terrestrial receptors can also be exposed to contaminants in surface water by using it for drinking, although this exposure route generally represents a negligible portion of total exposure for most receptors.

Aquatic and semi-aquatic organisms can be exposed to contaminants through direct contact with surface water and sediment in the ponds, incidental ingestion of surface water and sediments in the ponds, and consumption of contaminated food items. Exposure to soil contaminants by dermal contact can occur but is unlikely to represent a major exposure pathway because fur, feathers, and chitinous exoskeletons minimize the transfer of contaminants across dermal tissue.

The air pathway was not considered for ecological receptors. Inhalation does not represent a significant exposure pathway, and inhalation ecotoxicity data for chronic exposure are lacking.

Selection of Analytes to be Assessed

Analytes initially assessed in the ERA were all contaminants detected in surface water, groundwater, sediment, and surface soil samples. Calcium, magnesium, potassium, and sodium were excluded because they are essential nutrients that are toxic only at extremely high concentrations.

Assessment and Measurement Endpoints

An assessment endpoint is defined as an explicit expression of actual environmental values that are to be protected. Measurement endpoints are measurable ecological characteristics that are related to the valued characteristic chosen as the assessment endpoint.

For this ERA, the assessment endpoints are protective of the following groups of receptors from adverse effects of contaminants on their growth, survival, and reproduction: benthic invertebrate communities, pelagic invertebrate communities, fish communities, birds that feed on aquatic organisms, carnivorous birds, omnivorous birds, carnivorous mammals, omnivorous animals (aquatic and terrestrial), mammals that feed on soil invertebrates, herbivorous mammals, terrestrial vegetation, amphibians and reptiles, and aquatic vegetation.

For surface water, the measurement endpoints were contaminant concentrations in surface water associated with adverse effects on growth, survival, and reproduction of aquatic organisms (surface water screening levels). For sediment, the measurement endpoints were contaminant concentrations in sediment associated with adverse effects on growth, survival, and reproduction of benthic organisms (sediment screening levels). For surface soil, the measurement endpoints were contaminant concentrations in surface soil associated with adverse effects on growth, survival, and reproduction of soil organisms (soil screening levels). For aquatic and terrestrial wildlife, the measurement endpoints were the contaminant doses associated with adverse effects on growth, survival, and reproduction of these receptors (toxicity reference values, or TRVs). The measurement endpoints listed above incorporate, to the fullest extent possible, the groups of receptors requiring protection (assessment endpoints).

Aquatic and terrestrial wildlife species used in the foodchain modeling were chosen to represent the groups of receptors most likely to be exposed to the highest contaminant concentrations. These receptors were selected to be representative of the groups of organisms specified in the assessment endpoints. Receptors used in the foodchain modeling included the red fox, red-tailed hawk, American

woodcock, short-tailed shrew, great blue heron, meadow vole, bullfrog, largemouth bass, American robin, deer mouse, and raccoon.

Conceptual Site Model

The compilation of contaminant sources, likely exposure pathways, and ecological receptors at Site 12 is depicted in the CSM (Figure 2-6).

2.7.2.2 Ecological Effects Evaluation

Ecologically based screening levels (e.g., concentrations of contaminants in various media protective of ecological receptors) were compared to exposure point concentrations of detected analytes in surface water, groundwater, sediment, and surface soil to determine if the analytes qualify as ecological COPCs at Site 12. The guidelines were EPA Region 3 Biological Technical Assistance Group (BTAG) screening levels. TRVs for foodchain modeling were based on no-observed-adverse-effects-levels (NOAELs) and lowest-observed-adverse-effects-levels (LOAELs).

2.7.2.3 Exposure Assessment

The maximum detected contaminant concentrations in surface water, groundwater, sediment, and soil were used as exposure point concentrations for screening against EPA Region 3 BTAG screening levels. The maximum concentrations of contaminants detected in Site 12 media were used for the foodchain modeling.

2.7.2.4 Preliminary Risk Calculation

The preliminary risk calculation step in the ERA process compares exposure point contaminant concentrations with screening levels protective of ecological receptors and compares contaminant doses to TRVs. The ratio of the exposure point concentration to the screening level is called the HQ and is defined as follows:

HQ = EPC/ESL (direct exposure to concentration in environmental media)

where: HQ = hazard quotient (unitless)
EPC = exposure point concentration (mg/kg or mg/L)
ESL = ecological screening level (mg/kg or mg/L)

or: HQ = Dose/TRV (exposure via the food chain)

where: HQ = hazard quotient (unitless)
Dose = contaminant dose (mg/kg/day)
TRV = toxicity reference value (mg/kg/day)

When the HQ equaled or exceeded 1.0, adverse impacts were considered possible and the contaminant was selected as a preliminary COPC. The HQ value is a numerical indicator of the extent to which an exposure point concentration exceeds or is less than a screening level. The HQ value should not be construed as being probabilistic. When HQ values equal or exceed 1.0, it is an indication that ecological receptors are potentially at risk. Additional evaluation or data may be necessary to confirm with greater certainty whether ecological receptors are actually at risk.

Results – Ecological Screening Assessment

As stated previously, ecological screening was conducted for all media, but only surface soil results are discussed. There is no exposure to groundwater, except after it discharges to surface water. Previous studies on the ponds indicated no adverse effects to ecological receptors from site-related contaminants. Results from all media were used in foodchain modeling, as appropriate.

Thirteen PAHs and Aroclor 1254 in surface soil had maximum concentrations that exceeded Region 3 screening values and were selected as COPCs (Table 2-9). The inorganics aluminum, beryllium, cadmium, chromium, copper, cyanide, iron, lead, manganese, mercury, nickel, silver, vanadium, and zinc had maximum concentrations higher than screening levels and were selected as COPCs. Bis(2-ethylhexyl)phthalate, carbazole, dibenzofuran, and nitrocellulose were selected as COPCs because no BTAG screening guidelines were available.

Results – Foodchain Modeling

Aroclor 1254, four PAHs, 4,4'-DDE, and 4,4'-DDT had at least one HQ greater than 1.0 in the terrestrial foodchain modeling (Table 2-10). Fourteen inorganics had at least one HQ greater than 1.0 in the terrestrial foodchain modeling. Dibenzofuran and iron were retained as COPCs because toxicity data for these compounds were not available.

Several PAHs and 4,4'-DDT and metabolites had at least one HQ greater than 1.0 in the aquatic foodchain modeling (Table 2-11). The inorganics antimony, aluminum, barium, arsenic, cadmium, chromium, cobalt, copper, iron, lead, mercury, vanadium, and zinc had at least one HQ greater than 1.0. Dibenzofuran, iron, and 2-butanone were retained as COPCs because toxicity data for these compounds were not available.

2.7.2.5 Step 3A – Refinement of Contaminants of Potential Concern

Step 3 of the eight-step EPA process is baseline ERA (BERA) problem formulation. This step consists of several sub-steps designed to develop the goals, breadth, and focus of the BERA. Generally, this step is beyond the scope of the initial, screening-level ERA. However, the initial sub-step in the process is the refinements of COPCs. The use of conservative guidelines and maximum detected concentrations in the screening-level assessment is necessary to ensure that potential risks are not underestimated. However, if the HQ from conservative comparisons is used as the single factor for including a COPC in a BERA without consideration of other relevant information, additional ecological studies, such as toxicity testing or tissue analysis, could be undertaken to investigate risks from a COPC that in actuality does not pose significant risk. Hence, refinement of COPCs, the first sub-step of Step 3 of the process, was incorporated into the RI. This sub-step is informally referred to as Step 3A. Step 3A involves using certain tools to reduce uncertainties and the conservative nature of the screening-level ERA. These tools include comparisons of COPCs to alternate guidelines, investigation of effects of less conservative parameters in the foodchain modeling, and toxicological evaluation of COPCs.

Less conservative guidelines are used for Step 3A to provide balance to the conservative screening-level assessment. Surface soil guidelines for some COPCs were available from Oak Ridge National Laboratory (ORNL) (Efroymson et al., 1997). These data were derived for screening the potential effects of contaminants on soil litter invertebrates (i.e., earthworms) and soil microbes. Alternative ecological soil guidelines from the Netherlands Ministry of Housing, Spatial Planning, and Environment were also used (NMHSP&E, 1994). These values are referred to as Dutch Target Values and Dutch Intervention Values. Target values represent the "soil quality required for the full restoration of the soil's functionality for human, animal and plant life" or "soil quality ultimately aimed for." The intervention values represent "the concentration levels of the chemicals in soil … above which the functionality of the soil for human, plant, or animal life is seriously impaired or threatened." The ORNL and Dutch alternative guidelines for surface soil are presented in Table 2-12. The weight of evidence was used when comparing maximum concentrations to alternative surface soil guidelines to better determine potential risks. In general, if the maximum concentration of a COPC exceeded none or one of the alternate guidelines, it was dropped from further consideration. If it exceeded two or more alternative guidelines, it was retained.

The foodchain modeling performed during Steps 1 and 2 used conservative input parameters, including maximum detected concentrations, 100 percent time spent on the affected area, 100 percent bioavailability of detected analytes, minimum available body weight, and maximum ingestion rates. For this ERA, these factors were evaluated qualitatively. For the most part, the use of literature-based input parameters in place of the conservative parameters from the initial foodchain modeling will reduce an HQ substantially, usually (but not always) by close to or approximately equal to an order of magnitude.

Therefore, if all the HQs were approximately 10 or less for a COPC, it was assumed that they would all drop to near or below unity if less conservative assumptions were used.

As part of Step 3A, toxicity data and information from various sources in the literature were reviewed as they relate to the interpretation of potential risks from each COPC. These sources included U.S. Fish and Wildlife Service Chemical Hazard Reviews, commonly referred to as the "Eisler" publications, Agency for Toxic Substances and Disease Registry toxicity profiles, and ecotoxicological journals.

Details on the refinement of the ecological COPCs are contained in the RI Report (TtNUS, 1999).

Based on Step 3A of the eight-step process, the following COPCs are recommended for retention in the process, including risk management:

- Surface soil – mercury and silver
- Terrestrial foodchain – arsenic, chromium, lead, mercury, silver, and Aroclor 1254

Refinement of COPCs for surface water, sediment, and aquatic foodchain was also conducted in the RI. The conclusions of Step 3A were the same as the conclusions of previous studies, which did not indicate any site-related ecological impacts on the ponds from any sites at NDW-IH.

2.7.2.6 Risk Management

Risk management considerations were investigated for terrestrial COPCs retained after Step 3A.

Mercury and silver were retained as surface soil and terrestrial foodchain COPCs after Step 3A. The maximum concentrations of mercury and silver occurred at the same sample location. The maximum concentration of mercury in surface soil (4 mg/kg) exceeds the base-wide average background concentration of 0.04 mg/kg and the ranges of background from other sources (Table 2-13). The other four detections of mercury were 0.28 mg/kg or less, which is higher than the base-wide background concentration but comparable to the regional background ranges. Similarly, the maximum concentration of silver was two to three orders of magnitude higher than the other detections, which were all 1.5 mg/kg or less. Silver was only detected in one surface water sample and was not elevated in sediments, suggesting that silver is not migrating to aquatic media at the site. It appears that potential risks from mercury and silver are confined to hot spots in site surface soils. The concentrations at the hot spots are of sufficient magnitude to indicate that mercury and silver should be retained as terrestrial COPCs.

Arsenic and chromium were retained as terrestrial foodchain COPCs after Step 3A. The average concentration of arsenic (8.34 mg/kg) was higher than the average concentration in base-wide

background samples (2.18 mg/kg). It was slightly higher than the background range in Maryland soils and within the range of eastern U.S. soils (Table 2-13). The average concentration of chromium (22.24 mg/kg) was higher than the average concentration in base-wide background samples (12 mg/kg) but was within the background ranges in Maryland soils and eastern U.S. soils. Arsenic and chromium were not generally elevated in any other medium at the site. For these reasons, potential risks from arsenic and chromium in surface soils are present but do not appear to be of sufficient magnitude to retain them as terrestrial COPCs.

Lead was retained as a terrestrial foodchain COPC after Step 3A. The average concentration of lead (39.8 mg/kg) was higher than the basewide background average concentration (20 mg/kg) but was within the ranges in background Maryland soils and eastern U.S. soils (Table 2-13). For these reasons, potential risks from lead in surface soils are present but do not appear to be of sufficient magnitude to retain lead as a terrestrial COPC.

Aroclor 1254 was also retained as a terrestrial foodchain COPC after Step 3A. It was detected in one surface soil sample at a concentration of 0.23 mg/kg, suggesting a hot spot of contamination. Aroclor 1254 was not detected in any other medium, indicating that it is not migrating. Potential terrestrial risks do not appear to be widespread, but the hot spot of Aroclor 1254 indicates that it should be retained as a surface soil COPC.

In summary, risk management considerations were investigated for terrestrial COPCs retained after Step 3A. These considerations indicate that potential risks are present from mercury, silver, and Aroclor 1254 but appear to be confined to hot spots in soils. The maximum concentrations of these COPCs were detected at one sample location (S12SS05). Potential risks from arsenic, chromium, and lead are present but appear to be generally low.

2.7.3 Conclusions

There are no unacceptable risks to human receptors under current land use and reasonably anticipated future land use. The only unacceptable risks to human health were for hypothetical future child and adult residents that are exposed to soil and use shallow groundwater as a source of drinking water. The risk drivers for soil are arsenic and iron. The risk drivers for groundwater are cis-1,2-dichloroethene, vinyl chloride, arsenic, iron, and manganese.

Potential risks to terrestrial ecological receptors are present from mercury, silver, and Aroclor 1254 but appear to be confined to hot spots in soils.

The response action selected in this ROD is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances, pollutants, or contaminants into the environment. The 2002 removal action addressed risks associated with exposure to soil contaminants.

2.8 REMEDIAL ACTION OBJECTIVES

Remedial action objectives (RAOs) provide a general description of what the cleanup will accomplish. These goals typically serve as the design basis for many of the remedial alternatives that are discussed in the next section. The RAOs provide a basis for evaluating clean-up options for the site and an understanding of how the risks identified in the previous section will be addressed by the response action.

Based on the recommendations in the RI Report, an evaluation of state solid waste management regulations, and anticipated non-residential future uses of the site, the media of interest at Site 12 are surface soil on the former landfill and the landfill waste.

Chemical concentrations in groundwater were above federal and state MCLs. Although the NCP expectation is that CERCLA remediation will return usable groundwaters to their beneficial uses wherever practicable, the shallow groundwater beneath the landfill is not within the area of attainment which, as defined by EPA, does not include the groundwater directly under the landfill. The discharge of on-site shallow groundwater is not adversely affecting surface water quality in the adjacent ponds. In addition, there is no known hydrogeological connection between the shallow water-table aquifer and the deeper aquifer used for drinking water.

The only unacceptable risks to human health are from exposure to soil and groundwater under the hypothetical future residential exposure scenario. Although residential land uses are not anticipated at Site 12 in the near future, one of the RAOs is to prevent future residential exposure to contaminants.

Based on the media of concern, the potential pathways and receptors of concern, and anticipated land use scenarios, one RAO was developed for surface soil. The RAO for surface soil is to eliminate receptor exposure pathways by removing the potential for direct contact between receptors and contaminants. The 2002 removal action satisfied this RAO.

Based on the intent of the state solid waste management regulations, one RAO was developed for the Site 12 landfill. The RAO is to close the landfill in a manner that protects human health and the environment and controls air, water, and land pollution. The 2002 removal action satisfied this RAO.

The remaining RAO for the remedial action is to prevent future residential exposure to soil and groundwater contaminants.

2.9 DESCRIPTION OF ALTERNATIVES

The Site 12 FS, which was incorporated into the Site 12 EE/CA, presents the results of the detailed analysis of five potential remedial action alternatives. These alternatives have been developed to provide a range of remedial actions for the site. This section of the ROD summarizes the alternatives that are described in the FS and presented in the EE/CA for the removal action that was conducted in 2002. The objective of this section is to provide a brief description of the remedial alternatives developed for the site.

2.9.1 Description of Remedy Components

This section provides a list of the major components of each alternative as they logically occur in the remediation process. The lists include removal components and the materials they will address, containment components and the materials they will address, land use controls, O&M activities required to maintain the integrity of the remedy, and monitoring requirements.

2.9.1.1 Alternative 1 – No Action

There are no remedy components for the no-action alternative. This alternative is required under CERCLA to establish a basis for comparison with other alternatives. No remedial actions would be implemented, and the property could be available for unrestricted use because no institutional controls would be implemented.

2.9.1.2 Alternative 2 – Soil Cover with Land Use Controls and Monitoring

Alternative 2 consists of the following major components: soil cover, land use controls, and monitoring.

Soil Cover

- Landfilled areas up to approximately 4.3 acres would be covered with a minimum of 2 feet of natural materials (including 6 inches of topsoil), graded, and revegetated with grass or other type of vegetation that would discourage animals from burrowing into the landfill. Maintenance of the cover and vegetation would be required.

- To preserve the existing shoreline, landfilled material near the edge of the ponds not covered with at least 2 feet of soil would be removed to a depth of at least 2 feet. The excavated soil and landfilled material would be disposed off site. The excavation would be backfilled with common clean soil fill.

- Wetlands along the edge of the proposed soil cover within the landfill area would be removed to a depth of 2 feet. Large items of exposed waste and debris along the edges of the ponds/pond waterline would be excavated and disposed off site. Soil and sediment removed during wetland excavation and debris removal would also be disposed off site. Disturbed wetland areas (0.43 acre) would be backfilled with suitable soil and revegetated to replace the wetland.

Land Use Controls and Monitoring

- Land use controls would consist of maintaining records of the restrictions in the Geographic Information System (GIS) that is maintained by NDW-IH. Residential development and groundwater use would not be permitted.

- Shallow groundwater and surface water samples would be collected on a regular basis and analyzed for TCL VOCs and TAL metals.

- At least every 5 years a site review would be conducted to evaluate the site status and determine whether further action is necessary.

2.9.1.3 Alternative 3 – Soil Cap with Land Use Controls and Monitoring

Alternative 3 consists of the following major components: soil cap, land use controls, and monitoring.

Soil Cap

- Common clean soil fill would be added to the existing landfill cover where necessary to achieve the regulatory requirement for a 2-foot soil cover over the existing waste prior to placement of a cap or cover system.

- A soil cap (4.3 acres) with the following layers (from bottom to top) would be installed over the landfill area: geotextile, 18-inch layer of common fill, 6-inch layer of topsoil, and vegetative stabilization/biotic barrier layer. Maintenance of the cap and vegetation would be required.

- To preserve the existing shoreline, landfilled material near the edge of the ponds not covered with at least 2 feet of soil would be removed to a depth of at least 2 feet. The excavated soil and landfilled material would be consolidated within the area to be capped. The excavation would be backfilled with common clean soil fill.

- Wetlands along the edge of the proposed soil cap within the landfill area would be removed to a depth of 2 feet. Large items of exposed waste and debris along the edges of the ponds/pond waterline would be excavated and disposed off site. Soil and sediment removed during wetland excavation and debris removal would be consolidated within the area to be capped. Disturbed wetland areas (0.43 acre) would be backfilled with suitable soil and revegetated to replace the wetland.

- Material would be excavated from the sides of Atkins Road Extension to allow the soil cap to be constructed with final grades matching those of the road. The excavated material would be consolidated within the area to be capped.

Land Use Controls and Monitoring

- Land use controls would consist of maintaining records of the restrictions in the GIS that is maintained by NDW-IH. Residential development and shallow groundwater use would not be permitted.

- Groundwater and surface water samples would be collected on a regular basis and analyzed for TCL VOCs and TAL metals.

- At least every 5 years, a site review would be conducted to evaluate the site status and determine whether further action is necessary.

2.9.1.4 Alternative 4 – Engineered Cap with Slurry Wall, Land Use Controls, and Monitoring

Alternative 4 consists of the following major components: engineered cap, slurry wall, land use controls, and monitoring.

Engineered Cap

- Common clean soil fill would be added to the existing landfill cover where necessary to achieve the regulatory requirement for a 2-foot soil cover over the existing waste prior to placement of a cap or cover system.

- An engineered cap (4.3 acres) with the following layers (from bottom to top) would be installed: low-permeability synthetic geomembrane, geo-composite drainage layer, 18-inch layer of common fill, 6-inch layer of topsoil, and vegetative stabilization layer. Maintenance of the cap and vegetation would be required.

- To preserve the existing shoreline, landfilled material near the edge of the ponds not covered with at least 2 feet of soil would be removed to a depth of at least 2 feet. The excavated soil and landfilled material would be consolidated within the area to be capped. The excavation would be backfilled with common clean soil fill.

- Wetlands along the edge of the proposed cap within the landfill area would be removed to a depth of 2 feet. Large items of exposed waste and debris along the edges of the ponds/pond waterline would be excavated and disposed off site. Soil and sediment removed during wetland excavation and debris removal would be consolidated within the area to be capped. Disturbed wetland areas (0.43 acre) would be backfilled with suitable soil and revegetated to replace the wetland.

- The Atkins Road Extension adjacent to the cap would be excavated along with 2 feet of material below the road. The engineered cap would be constructed to provide a continuous impermeable barrier under the road, and the road would be re-established at its current location and elevation. The excavated road and waste material would be consolidated within the limits of the landfill.

- The existing 18-inch-diameter river water pipeline along the south edge of Atkins Road would be relocated to the north side of the road.

Slurry Walls

- Slurry walls would be installed around the perimeter of the landfill area to minimize the potential for future shallow groundwater discharges to adversely affect surface water quality.

Land Use Controls and Monitoring

- Land use controls would consist of maintaining records of the restrictions in the GIS that is maintained by NDW-IH. Residential development and shallow groundwater use would not be permitted.

- Groundwater and surface water samples would be collected on a regular basis and analyzed for TCL VOCs and TAL metals.

- At least every 5 years, a site review would be conducted to evaluate the site status and determine whether further action is necessary.

2.9.1.5 Alternative 5 – Landfill Removal with Land Use Controls and Monitoring

Alternative 5 consists of the following major components: landfill removal, land use controls and monitoring.

Landfill Removal

- The landfill contents (approximately 70,000 cubic yards of debris and fill material) would be excavated and hauled off site for disposal. Based on available data, it is assumed that the material would be acceptable for disposal at an off-site permitted nonhazardous waste landfill. The excavation would be backfilled with clean material, covered with a 6-inch layer of topsoil, and revegetated. Wetland areas (0.43 acre) disturbed during implementation of the remedial action would be replaced.

- The existing 18-inch-diameter river water pipeline along the southern edge of Atkins Road would be relocated to the northern side of the road.

Land Use Controls and Monitoring

- Land use controls would consist of maintaining records of the shallow groundwater contamination in the GIS that is maintained by NDW-IH. Shallow groundwater use would not be permitted.

- Groundwater and surface water samples would be collected on a regular basis and analyzed for TCL VOCs and TAL metals.

- At least every 5 years, a site review would be conducted to evaluate the site status and determine whether further action is necessary.

2.9.2 Common Elements and Distinguishing Features of Each Alternative

This section describes common elements and distinguishing features unique to each response option.

No response actions would be implemented under Alternative 1, the no-action alternative.

Alternatives 2, 3, and 4 include various types of cover and cap systems to prevent direct contact with landfilled wastes and contaminated soil. Alternative 2 includes up to 2 feet of soil cover (including 6 inches of topsoil). Alternative 3 includes up to 2 feet of soil cover and a soil cap that includes 18 inches of soil and 6 inches of topsoil. Alternative 4 includes up to 2 feet of soil cover and an engineered cap that includes a synthetic membrane and a drainage layer. Alternatives 2, 3, and 4 include a vegetative layer

that would discourage animals from burrowing into the cover or cap system. The area to be capped (4.3 acres) is the same for all alternatives.

Alternative 4 includes the cover system design described in state solid waste landfill closure regulations (COMAR 26.04.07.21). However, the regulations also contain provisions for a variance to design requirements (COMAR 26.04.07.26). The proposed changes must conserve and protect public health, natural resources, and the environment and control air, water, and land pollution to the same extent as would be obtained by conformance to the design standard. The soil cover and soil cap included under Alternatives 2 and 3, respectively, meet the requirements for a variance and, therefore, meet the intent and performance standards of these regulations. MDE has granted the variance (MDE, 2001).

Alternative 4 is the only remedial option that includes a slurry wall to control shallow groundwater.

Alternative 5 is the only remedial option where all landfilled wastes are removed from the site; therefore, there are no long-term O&M concerns. Long-term maintenance of the cover or cap system would be required for Alternatives 2, 3, and 4.

Excavation of waste from wetland areas with subsequent replacement of the wetlands is a component of Alternatives 2, 3, 4, and 5. There would be short-term impacts to the wetlands until they can be replaced.

Land use controls that would be maintained by the Navy are a component of Alternatives 2, 3, 4, and 5. For Alternatives 2, 3, and 4, residential development and shallow groundwater use would not be permitted. For Alternative 5, shallow groundwater use would not be permitted, but the site could be used for all types of development because landfilled materials and contaminated soil would be permanently removed.

Alternatives 2, 3, 4, and 5 include collection of shallow groundwater and surface water samples on a regular basis, with analysis for TCL VOCs and TAL metals. In addition, 5-year reviews would be required because Alternatives 2, 3, 4, and 5 would result in hazardous substances, pollutants, or contaminants remaining on site above levels that allow for unlimited use and unrestricted exposure.

Alternative 2 would take 3 months to implement, Alternatives 3 and 4 would take 4 months to implement, and Alternative 5 would take 6 months to implement.

The present-worth cost for all alternatives is based on a 30-year maintenance life and a 7 percent annual discount factor. The present-worth cost of each alternative is as follows:

- Alternative 1: $0
- Alternative 2: $1,262,000
- Alternative 3: $2,226,000
- Alternative 4: $3,590,000
- Alternative 5: $4,868,000

The cost for Alternative 2 includes the cost for the 2002 removal action.

2.9.3 Expected Outcomes of Each Alternative

Under Alternative 1 (no action), the site could be released for unrestricted use. This could result in unacceptable risks to human health and the environment.

Under Alternatives 2, 3, and 4 (containment alternatives), the site could be used for any purpose except residential development. The use of shallow groundwater as a potable water source would not be permitted.

Under Alternative 5 (landfill removal), the site could be used for any purpose, including residential development. However, the use of shallow groundwater as a potable water source would not be permitted.

2.10 SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

This section of the ROD summarizes the comparative analysis of alternatives presented in the detailed analysis section of the FS Report. The major objective is to evaluate the relative performance of the alternatives with respect to the nine evaluation criteria so that the advantages and disadvantages of each are clearly understood. The first two evaluation criteria, Overall Protection of Human Health and the Environment and Compliance with Applicable or Relevant and Appropriate Requirements (ARARs) are threshold criteria that must be satisfied by any remedial alternative chosen for the site. Table 2-14 contains a summary of the comparative analysis of alternatives.

2.10.1 Overall Protection of Human Health and the Environment

This criterion addresses whether each alternative provides adequate protection of human health and the environment and describes how risks posed by each exposure pathway are eliminated, reduced, or controlled through removal, engineering controls, and/or institutional controls.

All the alternatives, except the no-action alternative, protect human health and the environment by eliminating, reducing, or controlling risks posed by the site through engineering controls, removal, and institutional controls. Therefore, the no-action alternative will not be considered further in this analysis because it does not satisfy this threshold criterion.

Alternative 5 would provide the greatest degree of protection because all landfilled materials and contaminated soil would be removed from the site.

Alternatives 2, 3, and 4 would provide adequate protection from exposure due to direct contact with landfilled materials and contaminated soil. However, cap maintenance would be required to ensure total protectiveness. Any breach in the cap could potentially expose human and ecological receptors to existing levels of contamination. However, the risks to human health would be mitigated by land use controls that would prevent residential development, which is the only exposure scenario that resulted in unacceptable risks. Risks to ecological receptors would be mitigated by planting vegetation that would discourage or prevent animals from burrowing into contaminated materials.

The engineered cap and slurry wall components of Alternative 4 would reduce the migration of waste and soil contamination to shallow groundwater and the migration of contaminated shallow groundwater to surface water. However, the RI indicated that the ponds adjacent to the site have not been adversely impacted by site activities.

Alternatives 2 through 5 would provide adequate protection from exposure to shallow groundwater contamination by implementing land use controls that prohibit shallow groundwater use. Shallow groundwater and surface water monitoring would be used to ensure that groundwater contaminants do not migrate beyond the site boundary or to surface water at unacceptable levels (e.g., concentrations greater than MCLs or state water quality criteria).

2.10.2 Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)

Section 121(d) of CERCLA and the NCP, 40 CFR 300.430(f)(1)(ii)(B), require that remedial actions at CERCLA sites at least attain legally applicable or relevant and appropriate federal and state requirements, standards, criteria, and limitations, unless such ARARs are waived under CERCLA section 121(d)(4).

Applicable requirements are those clean-up 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. Only those state standards that are

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

Relevant and appropriate requirements are those clean-up standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not applicable to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well-suited to the particular site. Only those state standards that are identified in a timely manner and are more stringent than federal requirements may be relevant and appropriate.

This criterion addresses whether a remedy will meet all the ARARs of federal and state environmental statutes or provides a basis for invoking a waiver.

Alternatives 2 through 5 will attain their federal and state ARARs.

Alternatives 2 through 4 have common ARARs associated with the construction of a cover or cap system on site. Alternative 4 includes the cover system design described in state solid waste landfill closure regulations (COMAR 26.04.07.21). However, the regulations also contain provisions for a variance to design requirements (COMAR 26.04.07.26). The proposed changes must conserve and protect the public health, the natural resources, and the environment and control, air, water, and land pollution to the same extent as would be obtained by compliance with the regulation. The soil cover and soil cap included under Alternatives 2 and 3, respectively, meet the requirements for a variance from design requirements and, therefore, meet these ARARs. Acquisition of permits would not be necessary for on-site containment operations.

Alternatives 2 through 5 have common ARARs associated with work in the ponds and associated wetlands. These include Maryland Regulations on Construction on Nontidal Waters and Floodplains (COMAR 26.17.04) and Maryland Nontidal Wetland Regulations (COMAR 26.23). Removal of material near the shorelines of the ponds would temporarily change the pond cross sections and would temporarily remove wetlands. After the remedial action has been completed, the pond cross sections and wetlands would be restored.

Alternatives 2 through 5 have common ARARs associated with erosion and sediment control (COMAR 26.17.01). The design standards and specifications would apply to land clearing, grading, and other earth disturbances.

The discharge of on-site shallow groundwater is not adversely affecting surface water quality. EPA defines the area of attainment over which clean-up levels will be achieved in the groundwater. It encompasses the area outside the boundary of any waste remaining in place and up to the boundary of the contaminant plume. If waste is managed or contained on site, the groundwater beneath the waste management area is not within the area of attainment. Consequently, ARAR-based clean-up levels would not apply within the boundary of waste remaining in place. In addition, state regulations (COMAR 26.04.04.05B) prohibit potable water supply wells in unconfined aquifers within 100 feet of identifiable sources of contamination.

2.10.3 Long-Term Effectiveness and Permanence

This criterion refers to expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, after response objectives have been met. This criterion includes the consideration of residual risk that will remain on site following remediation and the adequacy and reliability of controls.

Alternative 5 would be the most protective over the long term with respect to soil contamination because the landfill waste would be removed from the site.

Alternatives 2, 3, and 4 would be less effective in the long term because the landfill waste would remain on site and land use controls would be needed to restrict land use. However, the long-term effectiveness of these alternatives would be monitored, and corrective measures would be taken if necessary. The engineered cap included under Alternative 4 would reduce infiltration and contaminant migration more efficiently than the soil cover under Alternative 2 and the soil cap under Alternative 3. However, shallow groundwater beneath the site is not a current or potential source of drinking water, and the discharge of contaminated shallow groundwater has not adversely affected surface water quality.

Although Alternative 4 includes slurry walls to minimize migration of shallow groundwater contaminants to surface water, pre-design studies would be needed to ensure that the slurry walls would effectively shut off groundwater flow to the ponds. As stated previously, the discharge of contaminated shallow groundwater has not adversely affected surface water quality.

Alternatives 2 through 5 would rely on land use controls to prevent exposure to contaminated groundwater. Monitoring would be effective in determining whether groundwater contaminants are migrating beyond the site boundary or to surface water at unacceptable levels (e.g, concentrations greater than MCLs or state water quality criteria).

Reviews at least every 5 years, as required, would be necessary to evaluate the effectiveness of any of these alternatives because hazardous substances would remain on site at concentrations above health-based levels.

2.10.4 Reduction of Toxicity, Mobility, or Volume through Treatment

Reduction of toxicity, mobility, or volume through treatment refers to the anticipated performance of the treatment technologies that may be included as part of a remedy.

None of the remedial alternatives includes treatment as a component of the remedy. Therefore, none of the alternatives would reduce the toxicity, mobility, or volume of contamination at the site through treatment.

2.10.5 Short-Term Effectiveness

Short-term effectiveness addresses the time needed to implement the remedy and any adverse impacts that may be posed to workers, the community, and the environment during construction and operation of the remedy until clean-up levels are achieved.

Construction of Alternative 2 could be completed in approximately 3 months. Alternatives 3 and 4 could be completed in approximately 4 months. Alternative 5 could be completed in 6 months. The land use controls for these alternatives can be implemented before or during the construction activities.

No risks to the community are anticipated for Alternatives 2 through 5.

Exposure of workers to the contaminated media under Alternatives 2 through 5 could be controlled by appropriate protective equipment, engineered controls, and compliance with a site-specific health and safety plan (HASP) and Occupational Safety and Health Administration (OSHA) regulations.

Excavation and debris removal under Alternatives 2 through 5 would have a short-term impact to the wetlands along the shoreline. However, all these alternatives include replacement of wetland areas following installation of the cover systems or removal of landfill material and debris. Erosion controls would be provided for all these alternatives to prevent downstream migration of contaminants.

2.10.6 Implementability

Implementability addresses the technical and administrative feasibility of a remedy from design through construction and operation. Factors such as availability of services and materials, administrative feasibility, and coordination with other governmental entities are also considered.

All the alternatives are implementable. Construction of the cover and cap systems under Alternatives 2, 3, and 4 is relatively straightforward. Materials and equipment necessary for construction are readily available.

Excavation and disposal of debris under Alternatives 2 through 5 are relatively straightforward. Material and equipment for construction and off-site disposal facilities are readily available. There are some implementability concerns for Alternative 5 associated with waste excavation below the water table. The design would need to consider the handling and dewatering of saturated landfill material and soil and would need to ensure that the material contains no free liquids before it is disposed at the off-site landfill.

Pre-design studies would be needed for Alternative 4 slurry walls to ensure that site geologic and hydrogeologic conditions would not adversely affect the implementability.

The land use and groundwater use controls under Alternatives 2 through 5 can be strictly enforced because the site is located at a military facility. In addition, state regulations (COMAR 26.04.04.05.B) prohibit potable water supply wells in unconfined aquifers within 100 feet of identifiable sources of contamination. This would supplement the groundwater use restrictions.

2.10.7 Cost

The estimated present-worth costs for Alternatives 2 through 5 range from approximately $1.3 million for Alternative 2 to approximately $4.9 million for Alternative 5. Capital, annual O&M, and present-worth costs are provided in Table 2-14. Present-worth costs are listed below:

- Alternative 2: $1,262,000
- Alternative 3: $2,226,000
- Alternative 4: $3,590,000
- Alternative 5: $4,868,000

The cost for Alternative 2 includes the cost for the 2002 removal action.

2.10.8 State Acceptance

The state has expressed their support of Alternatives 2 through 5.

2.10.9 Community Acceptance

Based on comments expressed at the public meeting and receipt of written comments during the public comment period, it appears that the community generally agrees with the Selected Remedy. Specific responses to issues raised by the community can be found in the Responsiveness Summary section of this ROD.

2.11 PRINCIPAL THREAT WASTES

The NCP establishes an expectation that treatment will be used to address the principal threats posed by a site wherever practicable [40 CFR 300.430(a)(1)(iii)(A)]. Based on the results of the investigations, studies, and sampling conducted during the RI, the waste and soil at Site 12 do not constitute principal threat wastes as defined by the NCP.

2.12 SELECTED REMEDY

This section identifies the Selected Remedy and expands upon the details provided in the Description of Alternatives section of the ROD.

2.12.1 Summary of the Rationale for the Selected Remedy

This section provides a discussion of the principal factors upon which the remedy selection decision is based.

The Selected Remedy for Site 12 – Town Gut Landfill at NDW-IH is a modification of Alternative 2 – Soil Cover and Land Use Controls. This alternative meets the RAOs, provides adequate protection of human health and the environment, and attains ARARs in the most cost-effective manner of all the alternatives. Modified Alternative 2 provides for the implementation of land use controls to prohibit residential development or use of contaminated groundwater. The 2002 removal action included a soil cover and vegetative layer. Installation of a soil cover up to 2 feet thick (including 6 inches of topsoil) over the landfill eliminated direct contact by ecological and human receptors with contaminated surface soil and landfilled materials. The soil cover also reduced potential transport of surface soil contaminants to the adjacent ponds via stormwater runoff. Installation of a vegetative layer that will prevent or discourage animals from burrowing into the landfill also reduced risks to ecological receptors.

Alternative 3 (Soil Cap with Land Use Controls) is similar to Alternative 2 but provides for an additional 2 feet of soil (up to 4 feet) over the landfill. Although there is additional soil cover, the protection provided by Alternative 3 would be approximately the same as for Alternative 2; however, the present-worth cost is almost double that of Alternative 2.

Alternative 4 is similar to Alternative 3 except that it provides for the installation of a horizontal low-permeability barrier over the landfill and under the soil cap in addition to a low-permeability vertical barrier around the landfill perimeter. Previous studies have indicated that there have been no adverse effects on the ponds from the migration of groundwater contaminants. Therefore, there does not appear to be a need for the horizontal and vertical low-permeability barriers to reduce stormwater infiltration through the landfill into the groundwater and to reduce the discharge of contaminated groundwater to surface water. The present-worth cost for Alternative 4 is approximately three times higher than for the Selected Remedy.

Total removal of the landfill was considered under Alternative 5. This is much more extensive than necessary to meet the needs of non-residential land uses while meeting the state landfill closure requirements. The present-worth cost for Alternative 5 is approximately four times higher than for the Selected Remedy.

2.12.2 Description of the Selected Remedy

The Selected Remedy, a modification of Alternative 2 – Soil Cover with Land Use Controls and Monitoring, consists of land use controls, groundwater and surface water monitoring, and a maintenance program. Portions of the remedy (waste removal, soil cover, and vegetation) were implemented during the 2002 removal action.

2.12.2.1 Land Use Controls

Land use controls will include land and groundwater use restrictions to eliminate or reduce exposure pathways and prevent activities that could damage the soil cover. The land use control (LUC) performance objectives are:

- No residential use.
- No use of shallow groundwater as a potable water source.
- Other groundwater uses require Navy approval.
- After construction of the landfill cover, prior approval of any activities that may disturb the cover must be authorized by the Navy prior to said disturbance.

The areas subject to land use and groundwater use restrictions are shown on Figure 2-10.

The Navy is responsible for implementing inspecting, reporting, and enforcing the LUCs described in the ROD in accordance with the approved LUC Remedial Design. The LUCs will remain in effect until the contaminants drop to levels allowing unrestricted exposure and unlimited use. Although the Navy retains ultimate responsibility for the performance of these obligations, the Navy may arrange, by contract or otherwise, for another party(ies) to carry them out. Should any LUC remedy fail, the Navy will ensure that appropriate actions are taken to reestablish the remedy's protectiveness and may initiate legal action to either compel action by a third party(ies) and/or to recover the Navy's costs for remedying any discovered LUC violation(s).

The Navy will properly notify EPA and MDE of any construction activities at Site 12.

2.12.2.2 Long-Term Monitoring and Maintenance

A long-term monitoring plan has been developed and implemented with EPA and MDE concurrence to detail the frequency, media type, analysis, and locations of the long-term monitoring samples (EFACHES, 2002). The long-term monitoring plan includes collection of groundwater samples from seven monitoring well locations and surface water samples from four locations.

Maintenance of the soil cover and vegetation installed during the 2002 removal action will be required. The vegetation will not be mowed short. Many burrowing animals prefer a habitat with relatively short vegetation so that they can look for predators from the entrance to their burrows. It is anticipated that allowing the vegetation to grow will discourage burrowing animals from inhabiting the site. In addition, the thickness of the soil cover will also minimize the possibility of animals contacting contaminated soil and landfilled materials. A maintenance plan to include measures to verify the ongoing integrity of the soil cover and vegetation is needed. The long-term monitoring plan discussed above also includes a post-closure inspection program.

2.12.2.3 Site Review

Within 5 years, a site review will be conducted to evaluate the site status and determine whether further action is necessary. The site review will be required because the selected remedy will allow contaminants to remain at concentrations exceeding those suitable for unlimited use and unrestricted exposure.

2.12.3 Summary of the Estimated Remedy Costs

A cost estimate summary for the selected remedy, a modification of Alternative 2, is provided in Table 2-15 (capital cost), Table 2-16 (annual cost), and Table 2-17 (present-worth analysis). These estimates include costs associated with the 2002 removal action. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to -30 percent of the actual project cost. These estimates are refined as the remedy is designed and implemented. Even after a remedial action has been constructed, the total project cost is still reported as an estimate because of the uncertainty associated with annual O&M expenditures.

2.12.4 Expected Outcomes of Selected Remedy

This section presents the expected outcomes of the Selected Remedy in terms of resulting land and groundwater uses and risk reduction achieved as a result of the response action.

After the Selected Remedy has been implemented, Site 12 can be used for any non-residential activities that will not permanently damage the soil cover. Activities that repair the soil cover after it was disturbed will be allowed. The site can be available for such uses as soon as the construction activities have been completed.

The use of shallow groundwater at Site 12 will be restricted. The groundwater can possibly be used for non-potable uses depending on the contaminant levels at the time of proposed use. Groundwater can never be used for potable uses because state regulations (COMAR 26.04.04.05.B) prohibit potable water supply wells in unconfined aquifers within 100 feet of identifiable sources of contamination.

Remediation levels were not calculated for soil contaminants. The only risks to human health are for the hypothetical future residential scenario, and land use controls will control potential exposure for this exposure scenario. For ecological receptors, the soil and vegetative cover will eliminate terrestrial exposure routes, which would be of primary importance at the apparent hot spots of mercury, silver, and Aroclor 1254. This precludes the need for ecological remediation levels for surface soil.

There are no anticipated socio-economic or community revitalization impacts associated with the Selected Remedy.

Removal of waste and debris from the wetlands and ponds should provide environmental and ecological benefits. It is anticipated that the soil cover will reduce the potential for erosion of contaminated soil into the ponds. Although the ponds have not been adversely affected by site activities, the control of potentially contaminated runoff could have positive future environmental and ecological benefits.

2.13 STATUTORY DETERMINATIONS

Under CERCLA Section 121 and the NCP, the lead agency (i.e., Navy) must select remedies that are protective of human health and the environment, comply with ARARs (unless a statutory waiver is justified), are cost effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that employ treatment that permanently and significantly reduces the volume, toxicity, or mobility of hazardous wastes as a principal element and a bias against off-site disposal of untreated wastes. The following sections discuss how the Selected Remedy meets these statutory requirements.

2.13.1 Protection of Human Health and the Environment

The Selected Remedy, a modification of Alternative 2, will protect human health through land use controls to prohibit residential use and use of contaminated shallow groundwater. The discharge of groundwater has not adversely affected pond water quality, and state regulations prohibit potable water supply wells within 100 feet of known sources of contamination (i.e., the landfill). Therefore, no cleanup of shallow groundwater will be necessary to protect human health and the environment.

The land use controls will eliminate exposure to contaminated soil and shallow groundwater under the hypothetical future residential exposure scenario. Maintaining the vegetative layer to make the site an unattractive habitat for burrowing animals will minimize the threat to ecological receptors.

There are no short-term threats associated with the Selected Remedy that cannot be readily controlled. In addition, no adverse cross-media impacts are expected from the Selected Remedy. Long-term monitoring will be conducted to ensure that shallow groundwater contaminants are not migrating off site or adversely affecting the water quality of the ponds.

2.13.2 Compliance with ARARs

The Selected Remedy of land use controls and monitoring complies with all ARARs. The ARARs are presented below and in more detail in Table 2-18.

Chemical-specific ARARs include the following:

- Maryland Surface Water Quality Criteria (COMAR 26.08.02.03) establish minimum standards for surface water for each designated use. Standards are available for the protection of human health and protection of aquatic life.

- EPA Ambient Water Quality Criteria (40 CFR 136) were developed pursuant to Section 304(a) of the Clean Water Act for pollutants in surface water. Criteria are available for protection of human health from exposure to chemicals in drinking water and from ingestion of aquatic organisms and for protection of aquatic life.

There are no location-specific ARARs associated with the Selected Remedy.

Action-specific ARARs include the following:

- Maryland Regulations for Solid Waste Management (COMAR 26.04.07) establish standards for disposal of solid waste. The regulations include post-closure monitoring and maintenance requirements for closed nonhazardous waste landfills.

2.13.3 Cost Effectiveness

In the Navy's judgment, the Selected Remedy is cost effective. In making this determination, the following definition was used (40 CFR 300.430(f)(1)(ii)(D)): "A remedy shall be cost-effective if its costs are proportional to its overall effectiveness". This was accomplished by evaluating the "overall protectiveness" of those alternatives that satisfied the threshold criteria (i.e., were both protective of human health and the environment and ARAR compliant). Overall effectiveness was evaluated by assessing three of the five balancing criteria in combination (long-term effectiveness and permanence; reduction in toxicity, mobility, or volume through treatment; and short-term effectiveness). The overall effectiveness of all the alternatives was considered and then compared to each of their costs. Because all alternatives were more or less equally effective, the least costly alternative was chosen.

The estimated present-worth cost of the Selected Remedy (a modification of Alternative 2) is $1,244,000. This estimate includes costs associated with the 2002 removal action. The present-worth costs of Alternatives 3 and 4, which are also containment alternatives, are two to three times higher but do not provide significantly higher protection of human health and the environment. Total removal of the landfill was considered under Alternative 5, which costs approximately four times more than the selected remedy. Landfill removal would be much more extensive than necessary to meet the needs of non-residential land uses while meeting the state landfill closure requirements.

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

The Navy, with EPA and state concurrence, has determined that the Selected Remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a practicable manner at the site. Of those alternatives that are protective of human health and the environment and comply with ARARs, the Navy has determined that the Selected Remedy provides the best balance of trade-offs in terms of the five balancing criteria. The Navy also considered the statutory preference for treatment as a principal element, the bias against off-site treatment and disposal, and EPA, state, and community acceptance.

On-site treatment of the landfilled materials was not considered because the majority of the waste is rubble and landscaping wastes. On-site treatment of the soil hot-spot areas that pose potential risks to ecological receptors was not considered because the state requires a soil cover over the landfill and the cover and vegetative layer would eliminate the exposure pathway without the need for treatment. Without the cover, the only other practicable way to meet the RAOs would be to remove the landfill for off-site disposal. On-site treatment of shallow groundwater was not considered because it is not adversely affecting water quality in the adjacent ponds. In addition, there is no known hydrogeological connection between the shallow water-table aquifer and the deeper aquifer used for drinking water. Groundwater beneath the landfill is not within the area of attainment, as defined by EPA.

2.13.5 Preference for Treatment as a Principal Element

The Selected Remedy does not satisfy the statutory preference for treatment as a principal element. Although there are unacceptable risks to human health under a hypothetical future residential exposure scenario and potential risks to ecological receptors from soil hot spots, there are no principal threat wastes at Site 12 (see Section 2.11). The reasons why treatment of landfilled wastes, soil, or groundwater is not practicable were discussed above in Section 2.13.4.

2.13.6 Five-Year Review Requirement

Because the Selected Remedy will result in hazardous substances, pollutants, or contaminants remaining on site above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within 5 years after initiation of remedial action to ensure that the remedy is, or will be, protective of human health and the environment.

2.14 DOCUMENTATION OF SIGNIFICANT CHANGES

The Proposed Plan for Site 12, Town Gut Landfill, at NDW-IH, Indian Head, Maryland was released for public comment in January 2001. The Proposed Plan identified Alternative 2, Soil Cover with Land Use Controls and Monitoring, as the preferred alternative. After the public comment period, NDW-IH Safety Department identified the possibility that Site 12 soil may contain objects with explosive residue. Therefore, because of safety concerns, the Navy, EPA, and MDE decided that soil, sediment, and small objects removed from near the shore line of the ponds would be consolidated on site, as identified in Alternative 3, instead of being disposed off site. Large excavated objects would still be disposed off site.

The previous disagreement between the DOD and EPA over post-ROD requirements with respect to institutional controls delayed the signing of the ROD with this modification of Alternative 2 as the Selected Remedy. The Navy, EPA, and MDE were in agreement with the physical portion of the Selected Remedy and that the ROD dispute over land use controls should not impede its accomplishment. Therefore, the physical portion of the remedy was executed in 2002 under the Navy removal action authority. This ROD for land use controls and the remainder of the remedial action was deferred pending resolution of the dispute.

TABLE 2-1

SUMMARY OF CHEMICALS OF CONCERN AND MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATIONS
SITE 12 – TOWN GUT LANDFILL
NDW-IH, INDIAN HEAD, MARYLAND

Exposure Point	Chemical of Concern	Concentration Detected	Frequency of Detection	Exposure Point Concentration	Statistical Measure
Soil – ingestion, dermal contact, inhalation	Arsenic	5.5 – 14.4 mg/kg	5/5	14.4 mg/kg	Maximum
	Iron	20,600 – 23,000 mg/kg	5/5	23,000 mg/kg	Maximum
Groundwater – ingestion, dermal contact, inhalation	cis-1,2-Dichloroethene	306 µg/L	1/6	306 µg/L	Maximum
	Trichloroethene	12 µg/L	1/6	12 µg/L	Maximum
	Vinyl chloride	317 µg/L	1/6	317 µg/L	Maximum
	Arsenic	3.3 – 32.8 µg/L	5/6	32.8 µg/L	Maximum
	Iron	30,400 – 83,700 µg/L	6/6	83,700 µg/L	Maximum
	Lead	1.6 – 34.5 µg/L	5/6	34.5 µg/L	Maximum
	Manganese	624 – 4,470 µg/L	6/6	4,470 µg/L	Maximum

This table presents the chemicals of concern (COCs) and exposure point concentrations for each of the COCs detected in soil and groundwater (i.e., the concentration that will be used to estimate the exposure and risk from each COC). The table includes the range of concentrations detected for each COC, the frequency of detection (i.e., the number of times the chemical was detected in the samples collected at the site), the exposure point concentration, and how the exposure point concentration was derived. The table indicates that arsenic and iron were detected in all soil samples collected at the site. Arsenic, iron, lead, and manganese were the most frequently detected COCs in groundwater at the site. Due to the limited amount of sample data available, the maximum concentration was used as the default exposure point concentration.

TABLE 2-2

SUMMARY OF EXPOSURE SCENARIOS
SITE 12 – TOWN GUT LANDFILL
NDW-IH, INDIAN HEAD, MARYLAND

Medium	Receptor	Scenario	Exposure Route
Surface Soil	Maintenance Worker	Current and Future	Incidental Ingestion Dermal Contact Inhalation
	Full-Time Employee	Current and Future	Incidental Ingestion Dermal Contact Inhalation
	Adolescent Trespasser	Current and Future	Incidental Ingestion Dermal Contact Inhalation
	Construction Worker	Future	Incidental Ingestion Dermal Contact Inhalation
	Hypothetical On-Site Resident	Future	Incidental Ingestion Dermal Contact Inhalation
Groundwater	Construction Worker	Future	Dermal Contact Inhalation
	Hypothetical On-Site Resident	Future	Ingestion Dermal Contact Inhalation
Surface Water	Adolescent Trespasser	Current and Future	Incidental Ingestion Dermal Contact
	Hypothetical On-Site Resident	Future	Incidental Ingestion Dermal Contact
Sediment	Maintenance Worker	Current and Future	Incidental Ingestion Dermal Contact
	Full-Time Employee	Current and Future	Incidental Ingestion Dermal Contact
	Adolescent Trespasser	Current and Future	Incidental Ingestion Dermal Contact
	Construction Worker	Future	Incidental Ingestion Dermal Contact
	Hypothetical On-Site Resident	Future	Incidental Ingestion Dermal Contact
Fish	Adolescent Trespasser	Current and Future	Ingestion
	Hypothetical On-Site Resident	Future	Ingestion

TABLE 2-3

CANCER TOXICITY DATA SUMMARY
SITE 12 – TOWN GUT LANDFILL
NDW-IH, INDIAN HEAD, MARYLAND

Pathway: Ingestion, Dermal

Chemical of Concern	Oral Cancer Slope Factor	Dermal Cancer Slope Factor	Slope Factor Units	Weight of Evidence	Source	Date
cis-1,2-Dichloroethene	--	--	--	D	--	--
Trichloroethene	1.10E-02	1.10E-02	$(mg/kg/day)^{-1}$	--	NCEA	1996
Vinyl chloride	1.90E+00	1.90E+00	$(mg/kg/day)^{-1}$	A	HEAST	1997
Arsenic	1.50E+00	1.60E+00	$(mg/kg/day)^{-1}$	A	IRIS	1998
Iron	--	--	--	D	--	--
Lead	--	--	--	B2	--	--
Manganese	--	--	--	D	--	--

Pathway: Inhalation

Chemical of Concern	Unit Risk	Units	Inhalation Cancer Slope Factor	Units	Weight of Evidence	Source	Date
cis-1,2-Dichloroethene	--	--	--	--	D	--	--
Trichloroethene	1.71E-06	$(\mu g/m^3)^{-1}$	6.00E-03	$(mg/kg/day)^{-1}$	--	NCEA	1996
Vinyl chloride	8.57E-05	$(\mu g/m^3)^{-1}$	3.00E-01	$(mg/kg/day)^{-1}$	A	HEAST	1997
Arsenic	4.29E-03	$(\mu g/m^3)^{-1}$	1.50E+01	$(mg/kg/day)^{-1}$	A	IRIS	1998
Iron	--	--	--	--	D	--	--
Lead	--	--	--	--	B2	--	--
Manganese	--	--	--	--	D	--	--

--: No information available
HEAST: Health Effects Assessment Summary Table
IRIS: Integrated Risk Information System
NCEA: National Center for Environmental Assessment

TABLE 2-3

CANCER TOXICITY DATA SUMMARY
SITE 12 – TOWN GUT LANDFILL
NDW-IH, INDIAN HEAD, MARYLAND

Weight of Evidence
A: Human carcinogen
B2: Probable human carcinogen – indicates sufficient evidence for animals and inadequate or no evidence in humans
D: Not classifiable as a human carcinogen

This table provides carcinogenic risk information for the COCs in both soil and groundwater. At this time, cancer slope factors (CSFs) are not available for the dermal route of exposure. The dermal slope factors used in the assessment have been extrapolated from oral values. An adjustment factor is applied and is dependent upon how well the chemical is absorbed via the oral route. Adjustments are particularly important for chemicals with less than 50 percent absorption via the ingestion route. However, an adjustment was only necessary for arsenic. The oral values were used as the dermal CSFs for trichloroethene and vinyl chloride.

TABLE 2-4

NONCANCER TOXICITY DATA SUMMARY
SITE 12 – TOWN GUT LANDFILL
NDW-IH, INDIAN HEAD, MARYLAND

Pathway: Ingestion, Dermal

Chemical of Concern	Chronic/ Subchronic	Oral RfD	Dermal RfD	Units	Target Organ(s)	Uncertainty Factor	Source	Date
cis-1,2-Dichloroethene	Chronic	1.00E-02	--	mg/kg-day	--	3,000	HEAST	1997
Trichloroethene	Chronic	6.00E-03	6.00E-03	mg/kg-day	--	--	NCEA	1996
Vinyl chloride	--	--	--	--	--	--	--	--
Arsenic	Chronic	3.00E-04	2.9E-04	mg/kg-day	Skin	3	IRIS	1998
Iron	--	3.00E-01	3.00E-01	mg/kg-day	Lung and Digestive System	--	NCEA	1997
Lead	--	--	--	--	CNS	--	--	--
Manganese - Food	Chronic	1.40E-01	1.40E-01	mg/kg-day	CNS	1	IRIS	1998
Manganese - Nonfood	Chronic	2.00E-02	2.00E-02	mg/kg-day	CNS	1	IRIS	1998

Pathway: Inhalation

Chemical of Concern	Chronic/ Subchronic	Inhalation RfC	Units	Inhalation RfD	Units	Primary Target Organ	Uncertainty Factor	Source	Date
cis-1,2-Dichloroethene	--	--	--	--	--	--	--	--	--
Trichloroethene	--	--	--	--	--	--	--	--	--
Vinyl chloride	--	--	--	--	--	--	--	--	--
Arsenic	--	--	--	--	--	--	--	--	--
Iron	--	--	--	--	--	--	--	--	--
Lead	--	--	--	--	--	--	--	--	--
Manganese	Chronic	5.00E-05	mg/m^3	1.4E-05	mg/kg-day	CNS	1,000	IRIS	1998

--: No information available
CNS: central nervous system
HEAST: Health Effects Assessment Summary Table

TABLE 2-4

NONCANCER TOXICITY DATA SUMMARY
SITE 12 – TOWN GUT LANDFILL
NDW-IH, INDIAN HEAD, MARYLAND

IRIS: Integrated Risk Information System
NCEA: National Center for Environmental Assessment

This table provides noncarcinogenic risk information for the COCs in both soil and groundwater. Five of the COCs (cis-1,2-dichloroethene, trichloroethene, arsenic, iron, and manganese) have toxicity data indicating their potential for adverse noncarcinogenic risks effects in humans. The chronic toxicity data available for oral exposures have been used to develop oral reference doses (RfDs). The available toxicity information data indicate that arsenic primarily affects the skin, iron primarily affects the lung and digestive system, and lead and manganese primarily affect the CNS. RfDs are not available for lead or vinyl chloride. As was the case with carcinogenic data, dermal RfDs can be extrapolated from oral values applying an adjustment factor as appropriate. However, an adjustment was only necessary for arsenic. No adjustment was needed for the other COCs, and the oral values were used as the dermal RfDs for these contaminants. At this time, inhalation reference concentrations are only available for manganese.

TABLE 2-5

FUTURE CHILD RESIDENT RISK CHARACTERIZATION SUMMARY – CARCINOGENS
SITE 12 – TOWN GUT LANDFILL
NDW-IH, INDIAN HEAD, MARYLAND

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk			
				Ingestion	Dermal	Inhalation	Exposure Route Total
Soil	Soil	Direct Contact	Arsenic	2.37E-05	6.95E-06	NA	3.07E-05
	Dust	Inhalation	Arsenic	NA	NA	1.08E-08	1.08E-08
						Soil risk total =	**3.07E-05**
Groundwater	Groundwater	Tap Water	Trichloroethene	7.23E-07	8.27E-08	NA	8.06E-07
	Groundwater	Tap Water	Vinyl chloride	3.30E-03	1.06E-04	NA	3.41E-03
	Groundwater	Tap Water	Arsenic	2.7E-04	4.94E-07	NA	2.70E-04
						Groundwater risk total =	**3.68E-03**
						Total Risk =	**3.71E-03**

NA: Route of exposure is not applicable to this medium

This table provides risk estimates for the future child resident for the significant routes of exposure. These risk estimates are based on a reasonable maximum exposure and were developed by taking into account various conservative assumptions about the frequency and duration of a child's exposure to soil and groundwater. The risk estimates are also based on the toxicity of the COCs (trichloroethene, vinyl chloride, and arsenic). There is no cancer toxicity information available for exposure to lead. The total risk from direct exposure to contaminated soil and groundwater at Site 12 to a future child resident is estimated to be 3.71E-03. The COCs contributing most to this risk level are vinyl chloride and arsenic in groundwater. There are no unacceptable risks from exposure to soil. This risk level indicates that, if no clean-up action is taken, an individual child would have an increased probability of 4 in 1,000 of developing cancer as a result of site-related exposure to the COCs.

TABLE 2-6

FUTURE ADULT RESIDENT RISK CHARACTERIZATION SUMMARY – CARCINOGENS
SITE 12 – TOWN GUT LANDFILL
NDW-IH, INDIAN HEAD, MARYLAND

Medium	Exposure Medium	Exposure Point	Contaminant of Concern	Carcinogenic Risk			
				Ingestion	Dermal	Inhalation	Exposure Routes Total
Soil	Soil	Direct Contact	Arsenic	1.01E-05	1.71E-05	NA	2.72E-05
	Dust	Inhalation	Arsenic	NA	NA	1.55E-08	1.55E-08
						Soil total risk =	**2.72E-05**
Groundwater	Groundwater	Tap Water	Trichloroethene	1.24E-06	1.22E-07	NA	1.36E-06
	Groundwater	Tap Water	Vinyl chloride	5.66E-03	1.23E-04	NA	5.78E-03
	Groundwater	Tap Water	Arsenic	4.62E-04	1.22E-06	NA	4.63E-04
	Groundwater	Inhalation of Volatiles	Trichloroethene	NA	NA	7.50E-07	7.50E-07
	Groundwater	Inhalation of Volatiles	Vinyl chloride	NA	NA	1.32E-03	1.32E-03
	Groundwater	Inhalation of Volatiles	Arsenic	NA	NA	NA	NA
						Groundwater total risk =	**7.57E-03**
						Total Risk =	**7.60E-03**

NA: Route of exposure is not applicable to this medium.

This table provides risk estimates for the future adult resident for the significant routes of exposure. These risk estimates are based on a reasonable maximum exposure and were developed by taking into account various conservative assumptions about the frequency and duration of an adult's exposure to soil and groundwater. The risk estimates are also based on the toxicity of the COCs (trichloroethene, vinyl chloride, and arsenic). There is no cancer toxicity information available for exposure to lead. The total risk from direct exposure to contaminated groundwater at Site 12 to a future adult resident is estimated to be 7.60E-03. The COCs contributing most to this risk level are vinyl chloride and arsenic in groundwater. There are no unacceptable risks from exposure to soil. The risk level indicates that, if no clean-up action is taken, an individual adult would have an increased probability of 8 in 1,000 of developing cancer as a result of site-related exposure to COCs.

TABLE 2-7

FUTURE CHILD RISK CHARACTERIZATION SUMMARY – NONCARCINOGENS
SITE 12 – TOWN GUT LANDFILL
NDW-IH, INDIAN HEAD, MARYLAND

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Noncarcinogenic Hazard Quotient			
					Ingestion	Dermal	Inhalation	Exposure Route Total
Soil	Soil	Direct Contact	Arsenic	Skin	6.14E-01	1.8E-01	NA	0.79
	Soil	Direct Contact	Iron	Lung and Digestive System	9.80E-01	8.54E-02	NA	1.1
	Soil	Direct Contact	Manganese	CNS	3.69E-01	3.21E-02	NA	0.4
	Dust	Inhalation	Arsenic	Skin	NA	NA	NT	NT
	Dust	Inhalation	Iron	Lung and Digestive System	NA	NA	NT	NT
	Dust	Inhalation	Manganese	CNS	NA	NA	2.34E-02	0.02
							Soil Hazard Index Total =	**2.31**
Groundwater	Groundwater	Tap Water	cis-1,2-Dichloroethene	No Data	1.96E+00	1.10E-01	NA	2.07
	Groundwater	Tap Water	Trichloroethene	No Data	1.28E-01	1.46E-02	NA	0.14
	Groundwater	Tap Water	Arsenic	Skin	6.99E+00	1.28E-02	NA	7.0
	Groundwater	Tap Water	Iron	Lung and Digestive System	1.78E+01	3.11E-02	NA	17.8
	Groundwater	Tap Water	Manganese	CNS	1.24E+01	2.16E-02	NA	12.4
							Groundwater Hazard Index Total =	**39.4**
							Total Receptor Hazard Index =	**41.7**

CNS: Central Nervous System
NA: Route of exposure is not applicable to this medium
NT: Toxicity criteria are not available to quantitatively address this route of exposure

TABLE 2-7

FUTURE CHILD RISK CHARACTERIZATION SUMMARY – NONCARCINOGENS
SITE 12 – TOWN GUT LANDFILL
NDW-IH, INDIAN HEAD, MARYLAND

This table provides hazard quotients (HQs) for each route of exposure and the hazard index (HI) for all routes of exposure. The Risk Assessment Guidance for Superfund (RAGS) states that, generally, an HI greater than 1.0 indicates the potential for adverse noncancer effects. The estimated HI of 41.7 indicates the potential for adverse noncancer health effects from exposure to contaminated soil and groundwater. The COCs contributing the most to the HI are arsenic and iron in soil and cis-1,2-dichloroethene, arsenic, iron, and manganese in groundwater. All these COCs affect different target organs.

TABLE 2-8

FUTURE ADULT RESIDENT RISK CHARACTERIZATION SUMMARY – NONCARCINOGENS
SITE 12 – TOWN GUT LANDFILL
NDW-IH, INDIAN HEAD, MARYLAND

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Noncarinogenic Hazard Quotient			
					Ingestion	Dermal	Inhalation	Exposure Route Total
Soil	Soil	Direct Contact	Arsenic	Skin	6.58E-02	1.11E-01	NA	0.18
	Soil	Direct Contact	Iron	Lung; Digestive System	1.05E-01	5.25E-02	NA	0.16
	Soil	Direct Contact	Manganese	CNS	3.95E-02	1.98E-02	NA	0.06
	Dust	Inhalation	Arsenic	Skin	NA	NA	NT	--
	Dust	Inhalation	Iron	Lung and Digestive System	NA	NA	NT	--
	Dust	Inhalation	Manganese	CNS	NA	NA	8.37E-03	0.008
							Soil Hazard Index Total =	**0.41**
Groundwater	Groundwater	Tap Water	cis-1,2-Dichloroethene	No Data	8.38E-01	3.80E-02	NA	0.88
	Groundwater	Tap Water	Trichloroethene	No Data	5.48E-02	5.41E-03	NA	0.06
	Groundwater	Tap Water	Arsenic	Skin	3.00E+00	7.88E-03	NA	3.0
	Groundwater	Tap Water	Iron	Lung and Digestive System	7.64E+00	1.92E-02	NA	7.7
	Groundwater	Tap Water	Manganese	CNS	5.32E+00	1.33E-02	NA	5.3
	Volatiles	Inhalation	cis-1,2-Dichloroethene	No Data	NA	NA	NT	--
	Volatiles	Inhalation	Trichloroethene	No Data	NA	NA	NT	--
	Volatiles	Inhalation	Arsenic	Skin	NA	NA	NA	--
	Volatiles	Inhalation	Iron	Lung and Digestive System	NA	NA	NA	--
	Volatiles	Inhalation	Manganese	CNS	NA	NA	NA	--
							Groundwater Hazard Index Total =	**16.9**
							Total Receptor Hazard Index =	**17.3**

CNS: Central Nervous System
NA: Route of exposure is not applicable to this medium
NT: Toxicity criteria are not available to quantitatively address this route of exposure

TABLE 2-8

FUTURE ADULT RESIDENT RISK CHARACTERIZATION SUMMARY – NONCARCINOGENS
SITE 12 – TOWN GUT LANDFILL
NDW-IH, INDIAN HEAD, MARYLAND

This table provides hazard quotients (HQs) for each route of exposure and the hazard index (HI) for all routes of exposure. The Risk Assessment Guidance for Superfund (RAGS) states that, generally, an HI greater than 1.0 indicates the potential for adverse noncancer effects. The estimated HI of 17.0 indicates the potential for adverse noncancer health effects from exposure to contaminated soil and groundwater. The COCs contributing the most to the HI are arsenic, iron, and manganese in groundwater. Although these COCs affect different target organs, the groundwater HQ for each of the COCs is greater than 1.0. The soil HI is less than 1.0, indicating that adverse noncancer effects from exposure to contaminated soil are not anticipated.

TABLE 2-9

SELECTION OF PRELIMINARY CHEMICALS OF POTENTIAL CONCERN - SURFACE SOIL
SITE 12 - TOWN GUT LANDFILL
NDW-IH, INDIAN HEAD, MARYLAND

Chemical	Frequency of Detection	Range of Detection (mg/kg)		Location of Maximum	EPA Region 3 Screening Level (mg/kg)	Maximum Hazard Quotient	Selected as Potential COPC (Y/N?)
		Min.	Max.				
Semivolatile Organic Compounds							
Acenaphthene	1/5	0.092	0.092	S12SS01	0.1	0.92	N
Anthracene	1/5	0.23	0.23	S12SS01	0.1	2.3	Y
Benzo(a)anthracene	3/5	0.14	1.2	S12SS01	0.1	12	Y
Benzo(a)pyrene	4/5	0.07	1.1	S12SS01	0.1	11	Y
Benzo(b)fluoranthene	5/5	0.066	1.5	S12SS01	0.1	15	Y
Benzo(g,h,i)perylene	3/5	0.12	0.74	S12SS01	0.1	7.4	Y
Benzo(k)fluoranthene	2/5	0.17	0.7	S12SS01	0.1	7	Y
Bis(2-ethylhexyl)phthalate	2/5	0.057	0.13	S12SS01	NA	NA	Y
Carbazole	1/5	0.15	0.15	S12SS01	NA	NA	Y
Chrysene	4/5	0.064	1.1	S12SS01	0.1	11	Y
Dibenzo(a,h)anthracene	2/5	0.091	0.21	S12SS01	0.1	2.1	Y
Dibenzofuran	1/5	0.07	0.07	S12SS01	NA	NA	Y
Fluoranthene	5/5	0.066	1.7	S12SS01	0.1	17	Y
Fluorene	1/5	0.13	0.13	S12SS01	0.1	1.3	Y
Indeno(1,2,3-cd)pyrene	3/5	0.13	0.73	S12SS01	0.1	7.3	Y
Phenanthrene	3/5	0.11	1.3	S12SS01	0.1	13	Y
Pyrene	5/5	0.064	2.2	S12SS01	0.1	22	Y
Energetics							
Nitrocellulose	1/5	46.2	46.2	S12SS05	NA	NA	Y
Pesticides and PCBs							
4,4'-DDD	4/5	0.00093	0.0053	S12SS04	0.1	0.053	N
4,4'-DDE	5/5	0.0013	0.021	S12SS05	0.1	0.21	N
4,4'-DDT	5/5	0.002	0.017	S12SS01	0.1	0.17	N
Aroclor 1254	1/5	0.23	0.23	S12SS05	0.1	2.3	Y
alpha-Chlordane	2/5	0.0019	0.036	S12SS05	0.1	0.36	N
gamma-Chlordane	2/5	0.00094	0.023	S12SS05	0.1	0.23	N
Dieldrin	1/5	0.0011	0.0011	S12SS03	0.1	0.011	N
Heptachlor epoxide	2/5	0.00091	0.0044	S12SS05	0.1	0.044	N
Metals and Inorganic Compounds							
Aluminum	5/5	10600	16300	S12SS03	1	16300.00	Y

TABLE 2-9

SELECTION OF PRELIMINARY CHEMICALS OF POTENTIAL CONCERN - SURFACE SOIL
SITE 12 - TOWN GUT LANDFILL
NDW-IH, INDIAN HEAD, MARYLAND

Chemical	Frequency of Detection	Range of Detection (mg/kg)		Location of Maximum	EPA Region 3 Screening Level (mg/kg)	Maximum Hazard Quotient	Selected as Potential COPC (Y/N?)
		Min.	Max.				
Arsenic	5/5	5.5	14.4	S12SS05	328	0.04	N
Barium	5/5	42.1	174	S12SS05	440	0.40	N
Beryllium	2/5	0.28	0.56	S12SS05	0.02	28.00	Y
Cadmium	4/5	0.58	3.6	S12SS01	2.5	1.44	Y
Chromium	5/5	17.3	34.6	S12SS05	0.0075	4613.33	Y
Cobalt	5/5	3.8	13	S12SS05	100	0.13	N
Copper	5/5	13.1	81.3	S12SS01	15	5.42	Y
Cyanide	1/5	0.34	0.34	S12SS03	0.005	68.00	Y
Iron	5/5	20600	23000	S12SS05	12	1916.67	Y
Lead	5/5	17.3	67.6	S12SS05	0.01	6760.00	Y
Manganese	5/5	158	577	S12SS03	330	1.75	Y
Mercury	5/5	0.1	4	S12SS05	0.058	68.97	Y
Nickel	5/5	7.2	13.3	S12SS05	2	6.65	Y
Selenium	5/5	0.8	1.1	S12SS04	1.8	0.61	N
Silver	3/5	0.41	125	S12SS05	0.0000098	1.28E+07	Y
Vanadium	5/5	33.3	53.1	S12SS05	0.5	106.20	Y
Zinc	5/5	71.1	261	S12SS05	10	26.10	Y

NA - None Available
Y - Yes
N - No

TABLE 2-10

FOOD CHAIN HAZARD QUOTIENTS USING MAXIMUM CONCENTRATIONS, TERRESTRIAL RECEPTORS, CONSERVATIVE INPUTS
SITE 12 - TOWN GUT LANDFILL
NDW-IH, INDIAN HEAD, MARYLAND

Chemical	Vole		Shrew		Robin		Hawk		Woodcock		Fox		Mouse	
	NOAEL HQ_n	LOAEL HQ_l	NOAEL HQ_n	LOAEL HQ_l	NOAEL HQ_n	LOAEL HQ_l	NOAEL HQ_n	LOAEL HQ_l	NOAEL HQ_n	LOAEL HQ_l	NOAEL HQ_n	LOAEL HQ_l	NOAEL HQ_n	LOAEL HQ_l
Volatile Organic Compounds														
Acetone	2.37E-04	4.74E-05	1.75E-04	3.50E-05	NA	NA	NA	NA	NA	NA	6.85E-05	1.37E-05	2.38E-04	4.76E-05
Semivolatile Organics														
Acenaphthene	5.93E-02	5.93E-03	7.11E-02	7.11E-03	1.54E-02	1.54E-03	1.23E-03	1.23E-04	1.18E-02	1.18E-03	1.51E-02	1.51E-03	4.22E-02	4.22E-03
Anthracene	1.48E-01	1.48E-02	1.78E-01	1.78E-02	3.85E-02	3.85E-03	3.08E-03	3.08E-04	2.94E-02	2.94E-03	3.78E-02	3.78E-03	1.06E-01	1.06E-02
Benzo(a)anthracene	7.73E-01	7.73E-02	9.27E-01	9.27E-02	2.01E-01	2.01E-02	1.61E-02	1.61E-03	1.54E-01	1.54E-02	1.97E-01	1.97E-02	5.51E-01	5.51E-02
Benzo(a)pyrene	7.09E-01	7.09E-02	8.50E-01	8.50E-02	1.84E-01	1.84E-02	1.47E-02	1.47E-03	1.41E-01	1.41E-02	1.81E-01	1.81E-02	5.05E-01	5.05E-02
Benzo(b)fluoranthene	9.67E-01	9.67E-02	**1.16E+00**	1.16E-01	2.51E-01	2.51E-02	2.01E-02	2.01E-03	1.92E-01	1.92E-02	2.47E-01	2.47E-02	6.89E-01	6.89E-02
Benzo(g,h,i)perylene	4.77E-01	4.77E-02	5.72E-01	5.72E-02	1.24E-01	1.24E-02	9.91E-03	9.91E-04	9.47E-02	9.47E-03	1.22E-01	1.22E-02	3.40E-01	3.40E-02
Benzo(k)fluoranthene	4.51E-01	4.51E-02	5.41E-01	5.41E-02	1.17E-01	1.17E-02	9.37E-03	9.37E-04	8.96E-02	8.96E-03	1.15E-01	1.15E-02	3.21E-01	3.21E-02
Bis(2-Ethylhexyl)phthalate	4.58E-03	4.58E-04	5.49E-03	5.49E-04	1.98E-01	1.98E-02	1.58E-02	1.58E-03	1.51E-01	1.51E-02	1.17E-03	1.17E-04	3.26E-03	3.26E-04
Carbazole	9.67E-02	9.67E-03	1.16E-01	1.16E-02	2.51E-02	2.51E-03	2.01E-03	2.01E-04	1.92E-02	1.92E-03	2.47E-02	2.47E-03	6.89E-02	6.89E-03
Chrysene	7.09E-01	7.09E-02	8.50E-01	8.50E-02	1.84E-01	1.84E-02	1.47E-02	1.47E-03	1.41E-01	1.41E-02	1.81E-01	1.81E-02	5.05E-01	5.05E-02
Di-n-butyl phthalate	1.35E-05	4.06E-06	1.00E-05	3.00E-06	2.93E-02	2.93E-03	1.40E-02	1.40E-03	2.05E-02	2.05E-03	3.91E-06	1.17E-06	1.36E-05	4.08E-06
Dibenzo(a,h)anthracene	1.35E-01	1.35E-02	1.62E-01	1.62E-02	3.51E-02	3.51E-03	2.81E-03	2.81E-04	2.69E-02	2.69E-03	3.45E-02	3.45E-03	9.64E-02	9.64E-03
Dibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	**1.10E+00**	1.10E-01	**1.31E+00**	1.31E-01	2.84E-01	2.84E-02	2.28E-02	2.28E-03	2.18E-01	2.18E-02	2.80E-01	2.80E-02	7.80E-01	7.80E-02
Fluorene	8.38E-02	8.38E-03	1.00E-01	1.00E-02	2.17E-02	2.17E-03	1.74E-03	1.74E-04	1.66E-02	1.66E-03	2.14E-02	2.14E-03	5.97E-02	5.97E-03
Indeno(1,2,3-cd)pyrene	4.70E-01	4.70E-02	5.64E-01	5.64E-02	1.22E-01	1.22E-02	9.77E-03	9.77E-04	9.34E-02	9.34E-03	1.20E-01	1.20E-02	3.35E-01	3.35E-02
Phenanthrene	8.38E-01	8.38E-02	**1.00E+00**	1.00E-01	2.17E-01	2.17E-02	1.74E-02	1.74E-03	1.66E-01	1.66E-02	2.14E-01	2.14E-02	5.97E-01	5.97E-02
Pyrene	**1.42E+00**	1.42E-01	**1.70E+00**	1.70E-01	3.68E-01	3.68E-02	2.95E-02	2.95E-03	2.82E-01	2.82E-02	3.62E-01	3.62E-02	**1.01E+00**	1.01E-01
Pesticides, PCBs, and Dioxins														
4,4'-DDD	4.27E-04	8.54E-05	5.12E-04	1.02E-04	3.16E-01	3.16E-02	2.53E-02	2.53E-03	2.42E-01	2.42E-02	1.09E-04	2.18E-05	3.04E-04	6.08E-05
4,4'-DDE	1.69E-02	3.38E-03	2.03E-02	4.06E-03	**1.25E+01**	**1.25E+00**	**1.00E+00**	1.00E-01	**9.60E+00**	9.60E-01	4.32E-03	8.64E-04	1.20E-02	2.41E-03
4,4'-DDT	1.37E-02	2.74E-03	1.64E-02	3.28E-03	**1.02E+01**	**1.02E+00**	8.13E-01	8.13E-02	**7.77E+00**	7.77E-01	3.50E-03	6.99E-04	9.75E-03	1.95E-03
Alpha-Chlordane	5.04E-03	2.52E-03	6.05E-03	3.02E-03	2.81E-02	5.63E-03	2.25E-03	4.50E-04	2.15E-02	4.31E-03	1.29E-03	6.44E-04	3.59E-03	1.80E-03
Aroclor-1254	**2.18E+00**	2.18E-01	**2.61E+00**	2.61E-01	**2.14E+00**	2.14E-01	1.71E-01	1.71E-02	**1.64E+00**	1.64E-01	5.56E-01	5.56E-02	**1.55E+00**	1.55E-01
Dieldrin	3.54E-02	3.54E-03	4.25E-02	4.25E-03	2.39E-02	2.39E-03	1.91E-03	1.91E-04	1.83E-02	1.83E-03	9.05E-03	9.05E-04	2.52E-02	2.52E-03
Endosulfan II	1.13E-05	1.13E-06	8.33E-06	8.33E-07	7.34E-08	7.34E-09	3.50E-08	3.50E-09	5.13E-08	5.13E-09	3.26E-06	3.26E-07	1.13E-05	1.13E-06
Gamma-Chlordane	3.22E-03	5.43E-02	3.86E-03	6.51E-02	1.80E-02	3.59E-03	1.44E-03	2.88E-04	1.38E-02	2.75E-03	8.22E-04	1.39E-02	2.30E-03	3.87E-02
Heptachlor Epoxide	2.84E-02	2.84E-03	3.40E-02	3.40E-03	NA	NA	NA	NA	NA	NA	7.24E-03	7.24E-04	2.02E-02	2.02E-03
Energetics														
Nitrocellulose	2.32E-02	2.32E-03	2.78E-02	2.78E-03	NA	NA	NA	NA	NA	NA	5.91E-03	5.91E-04	1.65E-02	1.65E-03

TABLE 2-10

FOOD CHAIN HAZARD QUOTIENTS USING MAXIMUM CONCENTRATIONS, TERRESTRIAL RECEPTORS, CONSERVATIVE INPUTS
SITE 12 - TOWN GUT LANDFILL
NDW-IH, INDIAN HEAD, MARYLAND

Chemical	Vole		Shrew		Robin		Hawk		Woodcock		Fox		Mouse	
	NOAEL HQ_n	LOAEL HQ_l	NOAEL HQ_n	LOAEL HQ_l	NOAEL HQ_n	LOAEL HQ_l	NOAEL HQ_n	LOAEL HQ_l	NOAEL HQ_n	LOAEL HQ_l	NOAEL HQ_n	LOAEL HQ_l	NOAEL HQ_n	LOAEL HQ_l
Metals														
Aluminum	**5.44E+03**	**5.44E+02**	**6.53E+03**	**6.53E+02**	**2.48E+02**	**2.48E+01**	**1.99E+01**	**1.99E+00**	**1.90E+02**	**1.90E+01**	**1.39E+03**	**1.39E+02**	**3.88E+03**	**3.88E+02**
Antimony	7.58E-03	7.58E-04	5.60E-03	5.60E-04	NA	NA	NA	NA	NA	NA	2.19E-03	2.19E-04	7.62E-03	7.62E-04
Arsenic	**7.37E+01**	**7.37E+00**	**8.83E+01**	**8.83E+00**	**9.79E+00**	**3.26E+00**	7.84E-01	2.61E-01	**7.49E+00**	**2.50E+00**	**1.88E+01**	**1.88E+00**	**5.25E+01**	**5.25E+00**
Barium	**2.20E+01**	**2.20E+00**	**2.64E+01**	**2.64E+00**	**1.40E+01**	**6.98E+00**	**1.12E+00**	5.59E-01	**1.07E+01**	**5.34E+00**	**5.61E+00**	5.61E-01	**1.57E+01**	**1.57E+00**
Beryllium	5.47E-01	5.47E-02	6.56E-01	6.56E-02	NA	NA	NA	NA	NA	NA	1.40E-01	1.40E-02	3.89E-01	3.89E-02
Cadmium	**2.32E+00**	2.32E-01	**2.78E+00**	2.78E-01	4.15E+00	3.01E-01	3.32E-01	2.41E-02	**3.18E+00**	**2.30E-01**	5.92E-01	5.92E-02	**1.65E+00**	1.65E-01
Chromium	**6.80E+00**	6.80E-01	**8.15E+00**	8.15E-01	**5.79E+01**	**1.16E+01**	**4.63E+00**	9.26E-01	**4.43E+01**	**8.86E+00**	**1.74E+00**	1.74E-01	**4.84E+00**	4.84E-01
Cobalt	**8.38E+00**	8.38E-01	**1.00E+01**	**1.00E+00**	**2.17E+01**	**2.17E+00**	**1.74E+00**	1.74E-01	**1.66E+01**	**1.66E+00**	**2.14E+00**	2.14E-01	**5.97E+00**	5.97E-01
Copper	**4.48E+00**	**3.46E+00**	**5.37E+00**	**4.15E+00**	**2.89E+00**	**2.20E+00**	2.32E-01	1.76E-01	**2.21E+00**	**1.69E+00**	**1.14E+00**	8.83E-01	**3.19E+00**	**2.46E+00**
Cyanide	3.19E-03	3.19E-04	3.82E-03	3.82E-04	NA	NA	NA	NA	NA	NA	8.14E-04	8.14E-05	2.27E-03	2.27E-04
Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	**5.45E+00**	5.45E-01	**6.53E+00**	6.53E-01	**1.00E+02**	**1.00E+01**	**8.01E+00**	8.01E-01	**7.66E+01**	**7.66E+00**	**1.39E+00**	1.39E-01	**3.88E+00**	3.88E-01
Manganese	**4.23E+00**	**1.31E+00**	**5.07E+00**	**1.57E+00**	9.88E-01	9.88E-02	7.91E-02	7.91E-03	7.56E-01	7.56E-02	**1.08E+00**	3.34E-01	**3.01E+00**	9.33E-01
Mercury	**1.72E+02**	**1.03E+02**	**2.06E+02**	**1.24E+02**	**1.05E+03**	**1.05E+02**	**8.37E+01**	**8.37E+00**	**8.00E+02**	**8.00E+01**	**4.39E+01**	**2.63E+01**	**1.22E+02**	**7.34E+01**
Nickel	2.14E-01	1.07E-01	2.57E-01	1.28E-01	2.87E-01	2.08E-01	2.30E-02	1.66E-02	2.20E-01	1.59E-01	5.47E-02	2.73E-02	1.53E-01	7.63E-02
Selenium	**3.54E+00**	**2.15E+00**	**4.25E+00**	**2.58E+00**	**3.68E+00**	**1.84E+00**	2.95E-01	1.47E-01	**2.82E+00**	**1.41E+00**	9.05E-01	5.48E-01	**2.52E+00**	**1.53E+00**
Silver	**4.48E+01**	**4.48E+00**	**5.37E+01**	**5.37E+00**	NA	NA	NA	NA	NA	NA	**1.14E+01**	**1.14E+00**	**3.19E+01**	**3.19E+00**
Vanadium	**1.63E+02**	**1.63E+01**	**1.95E+02**	**1.95E+01**	**7.79E+00**	7.79E-01	6.24E-01	6.24E-02	**5.96E+00**	5.96E-01	**4.16E+01**	**4.16E+00**	**1.16E+02**	**1.16E+01**
Zinc	**1.05E+00**	5.26E-01	**1.26E+00**	6.30E-01	**3.01E+01**	**3.33E+00**	**2.41E+00**	2.67E-01	**2.30E+01**	**2.55E+00**	2.68E-01	1.34E-01	7.49E-01	3.74E-01

HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
NA - None Available
NOAEL - No Observed Adverse Effects Level

TABLE 2-11

FOOD CHAIN HAZARD QUOTIENTS USING MAXIMUM CONCENTRATIONS, AQUATIC RECEPTORS, CONSERVATIVE INPUTS
SITE 12 - TOWN GUT LANDFILL
NDW-IH, INDIAN HEAD, MARYLAND

Chemical	Frog		Heron		Wren		Bass		Raccoon	
	NOAEL HQ_n	LOAEL HQ_l	NOAEL HQ_n	LOAEL HQ_l	NOAEL HQ_n	LOAEL HQ_l	NOAEL HQ_n	LOAEL HQ_l	NOAEL HQ_n	LOAEL HQ_l
Volatile Organics										
2-Butanone	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acetone	NA	NA	NA	NA	NA	NA	NA	NA	5.81E-05	1.16E-05
Semivolatile Organics										
Acenaphthene	6.52E-01	6.52E-02	7.63E-02	7.63E-03	2.84E-01	2.84E-02	**1.05E+00**	1.05E-01	1.59E-01	1.59E-02
Anthracene	**1.08E+00**	1.08E-01	1.26E-01	1.26E-02	4.70E-01	4.70E-02	**1.73E+00**	1.73E-01	2.63E-01	2.63E-02
Benzo(a)anthracene	**3.51E+00**	3.51E-01	4.11E-01	4.11E-02	**1.53E+00**	1.53E-01	**5.64E+00**	5.64E-01	8.56E-01	8.56E-02
Benzo(a)pyrene	**3.01E+00**	3.01E-01	3.52E-01	3.52E-02	**1.31E+00**	1.31E-01	**4.84E+00**	4.84E-01	7.34E-01	7.34E-02
Benzo(b)fluoranthene	**4.76E+00**	4.76E-01	5.57E-01	5.57E-02	**2.08E+00**	2.08E-01	**7.66E+00**	7.66E-01	**1.16E+00**	1.16E-01
Benzo(g,h,i)perylene	**1.90E+00**	1.90E-01	2.23E-01	2.23E-02	8.31E-01	8.31E-02	**3.06E+00**	3.06E-01	4.65E-01	4.65E-02
Benzo(k)fluoranthene	**1.45E+00**	1.45E-01	1.70E-01	1.70E-02	6.34E-01	6.34E-02	**2.34E+00**	2.34E-01	3.55E-01	3.55E-02
Bis(2-Ethylhexyl)phthalate	NA	NA	2.93E-02	2.93E-03	1.09E-01	1.09E-02	NA	NA	3.67E-04	3.67E-05
Carbazole	5.26E-01	5.26E-02	6.16E-02	6.16E-03	2.30E-01	2.30E-02	8.46E-01	8.46E-02	1.28E-01	1.28E-02
Chrysene	**3.51E+00**	3.51E-01	4.11E-01	4.11E-02	**1.53E+00**	1.53E-01	**5.64E+00**	5.64E-01	8.56E-01	8.56E-02
Di-n-butyl phthalate	NA	NA	1.08E-02	1.08E-03	6.26E-02	6.26E-03	NA	NA	3.32E-06	9.95E-07
Dibenzo(a,h)anthracene	5.76E-01	5.76E-02	6.75E-02	6.75E-03	2.51E-01	2.51E-02	9.27E-01	9.27E-02	1.41E-01	1.41E-02
Dibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	**5.51E+00**	5.51E-01	6.45E-01	6.45E-02	**2.40E+00**	2.40E-01	**8.87E+00**	8.87E-01	**1.35E+00**	1.35E-01
Fluorene	4.76E-01	4.76E-02	5.57E-02	5.57E-03	2.08E-01	2.08E-02	7.66E-01	7.66E-02	1.16E-01	1.16E-02
Indeno(1,2,3-cd)pyrene	**1.73E+00**	1.73E-01	2.02E-01	2.02E-02	7.54E-01	7.54E-02	**2.78E+00**	2.78E-01	4.22E-01	4.22E-02
Phenanthrene	**4.26E+00**	4.26E-01	4.99E-01	4.99E-02	**1.86E+00**	1.86E-01	**6.85E+00**	6.85E-01	**1.04E+00**	1.04E-01
Pyrene	**6.02E+00**	6.02E-01	7.04E-01	7.04E-02	**2.62E+00**	2.62E-01	**9.67E+00**	9.67E-01	**1.47E+00**	1.47E-01
Pesticides and PCBs										
4,4'-DDD	NA	NA	**3.46E+00**	3.46E-01	**1.29E+01**	**1.29E+00**	NA	NA	2.52E-03	5.04E-04
4,4'-DDE	NA	NA	**4.30E+00**	4.30E-01	**1.60E+01**	**1.60E+00**	NA	NA	3.13E-03	6.27E-04
4,4'-DDT	NA	NA	**5.55E+00**	5.55E-01	**2.07E+01**	**2.07E+00**	NA	NA	4.05E-03	8.10E-04
Aroclor-1260	NA	NA	1.63E-01	1.63E-02	6.07E-01	6.07E-02	NA	NA	8.99E-02	8.99E-03
Alpha-Chlordane	NA	NA	3.43E-04	6.86E-05	1.28E-03	2.55E-04	NA	NA	3.32E-05	1.66E-05
Gamma-Chlordane	NA	NA	2.47E-04	4.94E-05	9.19E-04	1.84E-04	NA	NA	2.39E-05	4.03E-04
Dieldrin	NA	NA	9.15E-03	9.15E-04	3.41E-02	3.41E-03	NA	NA	7.34E-03	7.34E-04
Endosulfan II	NA	NA	9.39E-05	9.39E-06	3.50E-04	3.50E-05	NA	NA	1.31E-03	1.31E-04

TABLE 2-11

FOOD CHAIN HAZARD QUOTIENTS USING MAXIMUM CONCENTRATIONS, AQUATIC RECEPTORS, CONSERVATIVE INPUTS
SITE 12 - TOWN GUT LANDFILL
NDW-IH, INDIAN HEAD, MARYLAND

Chemical	Frog		Heron		Wren		Bass		Raccoon	
	NOAEL HQ_n	LOAEL HQ_l	NOAEL HQ_n	LOAEL HQ_l	NOAEL HQ_n	LOAEL HQ_l	NOAEL HQ_n	LOAEL HQ_l	NOAEL HQ_n	LOAEL HQ_l
Heptachlor epoxide	NA	NA	NA	NA	NA	NA	NA	NA	4.98E-06	4.98E-07
Energetics										
Nitrocellulose	NA	NA	NA	NA	NA	NA	NA	NA	2.25E-02	2.25E-03
Metals										
Aluminum	NA	NA	**2.67E+01**	**2.67E+00**	**9.96E+01**	**9.96E+00**	NA	NA	**3.17E+02**	**3.17E+01**
Antimony	NA	NA	NA	NA	NA	NA	NA	NA	**1.22E+00**	1.22E-01
Arsenic	NA	NA	**2.35E+00**	7.83E-01	**8.75E+00**	**2.92E+00**	**4.04E+00**	3.35E-01	**9.56E+00**	9.56E-01
Barium	NA	NA	9.25E-01	4.62E-01	**3.45E+00**	**1.72E+00**	NA	NA	7.87E-01	7.87E-02
Beryllium	NA	NA	NA	NA	NA	NA	NA	NA	2.22E-02	2.22E-03
Cadmium	NA	NA	8.09E-01	5.87E-02	**3.02E+00**	2.19E-01	NA	NA	2.45E-01	2.45E-02
Cobalt	NA	NA	**2.55E+00**	2.55E-01	**9.51E+00**	9.51E-01	NA	NA	5.32E-01	5.32E-02
Chromium	NA	NA	**1.04E+01**	**2.09E+00**	**3.89E+01**	**7.78E+00**	**2.15E+02**	**3.59E+01**	6.64E-01	6.64E-02
Copper	NA	NA	3.87E-01	2.95E-01	**1.44E+00**	**1.10E+00**	NA	NA	3.24E-01	2.50E-01
Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	NA	NA	**3.40E+01**	**3.40E+00**	**1.27E+02**	**1.27E+01**	NA	NA	**1.00E+00**	1.00E-01
Manganese	NA	NA	8.14E-02	8.14E-03	3.03E-01	3.03E-02	NA	NA	1.88E-01	5.84E-02
Mercury	**3.62E+00**	3.62E-01	**5.96E+01**	**5.96E+00**	**2.22E+02**	**2.22E+01**	**1.67E+00**	1.67E-01	**5.30E+00**	**3.18E+00**
Nickel	NA	NA	3.68E-01	2.67E-01	**1.37E+00**	9.93E-01	NA	NA	1.49E-01	7.43E-02
Silver	NA	NA	NA	NA	NA	NA	NA	NA	6.46E-02	6.46E-03
Vanadium	NA	NA	**3.81E+00**	3.81E-01	**1.42E+01**	**1.42E+00**	NA	NA	**4.31E+01**	**4.31E+00**
Zinc	2.50E-01	2.50E-02	**2.49E+00**	2.75E-01	**9.27E+00**	**1.03E+00**	NA	NA	4.70E-02	2.35E-02

HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
NA - None Available
NOAEL - No Obersved Adverse Effects Level

TABLE 2-12

REFINEMENT OF COPCs
COMPARISON OF SURFACE SOIL DATA TO ALTERNATE GUIDELINES
SITE 12 - TOWN GUT LANDFILL
NDW-IH, INDIAN HEAD, MARYLAND

Preliminary COPC	Range of Detection (mg/kg)		ORNL Protection of Invertebrates (mg/kg)	Dutch Target '1994* (mg/kg)	Dutch Intervention 1994* (mg/kg)
	Min	Max			
Acenaphthene	0.092	0.092	NA	1	40
Anthracene	0.23	0.23	NA	1	40
Benzo(a)anthracene	0.14	1.2	NA	1	40
Benzo(a)pyrene	0.07	1.1	NA	1	40
Benzo(b)fluoranthene	0.066	1.5	NA	1	40
Benzo(g,h,i)perylene	0.12	0.74	NA	1	40
Benzo(k)fluoranthene	0.17	0.7	NA	1	40
Bis(2-ethylhexyl)phthalate	0.057	0.13	NA	0.1	60
Carbazole	0.15	0.15	NA	1	40
Chrysene	0.064	1.1	NA	1	40
Dibenzo(a,h)anthracene	0.091	0.21	NA	1	40
Dibenzofuran	0.07	0.07	NA	NA	NA
Fluoranthene	0.066	1.7	NA	1	40
Fluorene	0.13	0.13	NA	NA	40
Indeno(1,2,3-cd)pyrene	0.13	0.73	NA	1	40
Phenanthrene	0.11	1.3	NA	1	40
Pyrene	0.064	2.2	NA	1	40
4,4'-DDD	0.00093	0.0053	NA	0.0025	4
4,4'-DDE	0.0013	0.021	NA	0.0025	4
4,4'-DDT	0.002	0.017	NA	0.0025	4
alpha-Chlordane	0.0019	0.036	NA	NA	NA
gamma-Chlordane	0.00094	0.023	NA	NA	NA
Aroclor-1254	0.23	0.23	NA	0.02	1
Nitrocellulose	46.2	46.2	NA	NA	NA
Aluminum	10600	16300	NA	NA	NA
Arsenic	5.5	14.4	60.00	29	55
Barium	42.1	174	NA	200	625
Beryllium	0.28	0.56	NA	NA	NA
Cadmium	0.58	3.6	20.00	0.8	12
Chromium	17.3	34.6	0.40	100	380
Cobalt	3.8	13	NA	20	240
Copper	13.1	81.3	50.00	36	190
Cyanide	0.34	0.34	NA	NA	NA
Iron	20600	23000	NA	NA	NA
Lead	17.3	67.6	500.00	85	530
Manganese	158	577	NA	NA	NA
Mercury	0.1	4	0.10	0.3	10
Nickel	7.2	13.3	200.00	35	210
Selenium	0.8	1.1	70.00	NA	NA
Silver	0.41	125	NA	NA	NA
Vanadium	33.3	53.1	NA	NA	NA
Zinc	71.1	261	200.00	140	720

COPC - Contaminant of Potential Concern
ORNL- Oak Ridge National Laboratory
NA - None Available
*value for PAHs is for total PAHs; DDT, DDD, and DDE values are for total DDTR; value for bis(2-ethylhexylphthalate is for total phthalates; value for Aroclor 1254 is for total PCBs.

TABLE 2-13

ECOLOGICAL RISK MANAGEMENT
SURFACE SOIL
SITE 12 - TOWN GUT LANDFILL
NDW-IH, INDIAN HEAD, MARYLAND

COPC	Frequency of Detection	Range of Detection (mg/kg)		Mean of Positive Detections (mg/kg)	Mean of All Samples (mg/kg)	Background Average of Positive Detects (mg/kg)	Eastern U.S. Soils (mg/kg)	Maryland Soils (mg/kg)
		Min	Max					
Aroclor-1254	1/5	0.23	0.23	0.23	0.0671	NA	NA	NA
Arsenic	5/5	5.5	14.4	8.34	8.34	2.18	<0.1-73	1.1-7.1
Chromium	5/5	17.3	34.6	22.24	22.24	12.00	1-1000	15-100
Lead	5/5	17.3	67.6	39.8	39.8	20.00	<10-300	10-50
Mercury	5/5	0.1	4	0.916	0.916	0.04	0.01-3.4	0.04-0.14
Silver	3/5	0.41	125	43.3	25.43	NA	NA	NA

COC - Contaminant of Potential Concern
NA - None Available

TABLE 2-14

SUMMARY OF EVALUATION OF ALTERNATIVES
SITE 12 – TOWN GUT LANDFILL
NDW-IH, INDIAN HEAD, MARYLAND

Evaluation Criteria	Alternative 1 – No Action	Alternative 2 - Soil Cover with Land Use Controls and Monitoring
Threshold Criteria		
Overall Protection of Human Health and the Environment	No reduction in potential risks.	The soil cover, vegetative barrier, and land use controls will reduce risks to human health as well as ecological receptors and the environment.
Compliance with ARARs		
Chemical-specific	Would not comply.	Would comply.
Location-specific	Not applicable.	Can be designed to attain ARARs that apply.
Action-specific	Not applicable.	Qualifies for a variance from state landfill closure requirements
Primary Balancing Criteria		
Long-Term Effectiveness and Permanence	Allows risk to remain uncontrolled.	The soil cover, vegetative barrier, and land use controls would reduce risks to human health as well as ecological receptors. Monitoring and use restrictions provide adequate and reliable controls.
Reduction of Toxicity, Mobility, or Volume through Treatment	No treatment.	No treatment.
Short-Term Effectiveness	Not applicable. No short-term impacts or concerns.	No impacts to community. Exposure of workers to contaminated media can be adequately controlled. Short-term impact to wetlands. Three months to implement.
Implementability	Nothing to implement. No monitoring to show effectiveness.	Alternative consists of common remediation practices that are readily available and implementable.
Costs		
Capital	$0	$938,600
O&M	$0	$24,300
NPW	$0	$1,262,000
Modifying Criteria		
State Acceptance	Not acceptable	Acceptable
Community Acceptance	Not acceptable	Acceptable

TABLE 2-14

SUMMARY OF EVALUATION OF ALTERNATIVES
SITE 12 – TOWN GUT LANDFILL
NDW-IH, INDIAN HEAD, MARYLAND

Evaluation Criteria	Alternative 3 – Soil Cap with Land Use Controls and Monitoring	Alternative 4 – Engineered Cap with Land Use Controls and Monitoring
Threshold Criteria		
Overall Protection of Human Health and the Environment	The soil cap, vegetative barrier, and land use controls will reduce risks to human health as well as ecological receptors and the environment.	Landfill cap, slurry wall, vegetative barrier, and land use controls will reduce risks to human health as well as ecological receptors and the environment.
Compliance with ARARs		
Chemical-specific	Would comply.	Would comply.
Location-specific	Can be designed to attain ARARs that apply.	Can be designed to attain ARARs that apply.
Action-specific	Can be designed to attain ARARs that apply. Qualifies for a variance from state landfill closure requirements.	Can be designed to attain ARARs that apply.
Primary Balancing Criteria		
Long-term Effectiveness and Permanence	The soil cap with biotic barrier and land use controls would reduce human health and ecological risks. Monitoring and use restrictions provide adequate and reliable controls.	Landfill cap, slurry wall, biotic barrier, and land use controls would reduce human health and ecological risks. Required depth of slurry wall needs to be determined during the design. Monitoring and use restrictions provide adequate and reliable controls.
Reduction of Toxicity, Mobility, or Volume through Treatment	No treatment.	No treatment.
Short-term Effectiveness	No impacts to community. Exposure of workers to contaminated media can be adequately controlled. Exposure would be eliminated after the installation of the first soil cover component. Short-term impact to wetlands. Four months to implement.	No impacts to community. Exposure of workers to contaminated media can be adequately controlled and would be eliminated after the placement of the first landfill cap component. Short-term impacts to wetlands. Four months to implements.
Implementability	Alternative consists of common remediation practices that are readily available and implementable.	Alternative consists of common remediation practices that are readily available and implementable. Excessive depth to confining layer could adversely affect implementability of slurry wall.
Costs		
Capital	$1,902,400	$3,266,100
O&M	$24,300	$24,300
NPW	$2,226,000	$3,590,000
Modifying Criteria		
State Acceptance	Acceptable	Acceptable
Community Acceptance	Acceptable	Acceptable

TABLE 2-14

SUMMARY OF EVALUATION OF ALTERNATIVES
SITE 12 – TOWN GUT LANDFILL
NDW-IH, INDIAN HEAD, MARYLAND

Evaluation Criteria	Alternative 5 – Landfill Removals and Monitoring
Threshold Criteria	
Overall Protection of Human Health and the Environment	Landfill removal and land use controls will eliminate and reduce risks to human health and the environment.
Compliance with ARARs	
Chemical-specific	Would comply.
Location-specific	Can be designed to attain ARARs that apply.
Action-specific	Can be designed to attain ARARs that apply.
Primary Balancing Criteria	
Long-term Effectiveness and Permanence	Landfill removal and land use controls would reduce human health and ecological risks. Monitoring and use restrictions provide adequate and reliable controls.
Reduction of Toxicity, Mobility, or Volume through Treatment	No treatment.
Short-term Effectiveness	No impacts to community. Exposure of workers to contaminated media can be adequately controlled. Short-term impacts to wetlands. Six months to implement.
Implementability	Alternative consists of common remediation practices that are readily available and implementable. There are some implementability concerns associated with excavation below the water table.
Costs	
Capital	$4,657,600
O&M	$15,300
NPW	$4,868,000
Modifying Criteria	
State Acceptance	Acceptable
Community Acceptance	Acceptable

TABLE 2-15

CAPITAL COST ESTIMATE SUMMARY FOR THE SELECTED REMEDY
SITE 12 - TOWN GUT LANDFILL
NDW-IH, INIDAN HEAD, MARYLAND

Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Total Cost Subcontract	Total Cost Material	Total Cost Labor	Total Cost Equipment	Total Direct Cost
1 PROJECT DOCUMENTS											
1.1 Prepare Documents & Plans including Permits	100	hr			$40.00		$0	$0	$4,000	$0	$4,000
2 MOBILIZATION/DEMOBILIZATION											
2.1 Office Trailer (2)	6	mo	$194.00				$1,164	$0	$0	$0	$1,164
2.2 Storage Trailer (1)	3	mo	$85.00				$255	$0	$0	$0	$255
2.3 Construction Survey	1	ls	$1,000.00				$1,000	$0	$0	$0	$1,000
2.4 Equipment Mobilization/Demobilization	1	ls			$100.00	$500.00	$0	$0	$100	$500	$600
2.5 Site Utilities	3	mo	$1,000.00				$3,000	$0	$0	$0	$3,000
3 DECONTAMINATION											
3.1 Decontamination Trailer	3	mo	$2,200.00				$6,600	$0	$0	$0	$6,600
3.2 Equipment Decon Pad	1	ls		$500.00	$450.00	$155.00	$0	$500	$450	$155	$1,105
3.3 Decon Water	3,000	gal	$0.20				$600	$0	$0	$0	$600
3.4 Decon Water Storage Tank, 6,000 gallon	3	mo	$577.50				$1,733	$0	$0	$0	$1,733
3.5 Clean Water Storage Tank, 4,000 gallon	3	mo	$472.50				$1,418	$0	$0	$0	$1,418
3.6 PPE (6 p * 5 days * 12 weeks)	360	day		$30.00			$0	$10,800	$0	$0	$10,800
3.7 Disposal of Decon Waste (liquid & solid)	3	mo	$900.00				$2,700	$0	$0	$0	$2,700
4 SITE PREPARATION AND SOIL COVER											
4.1 Site Clearing (level D)	4.3	acre			$324.00	$560.00	$0	$0	$1,393	$2,408	$3,801
4.2 Common Earth (fill) 18" thick	5,200	cy		$5.05	$0.38	$0.76	$0	$26,260	$1,976	$3,952	$32,188
4.3 Confirmation Sampling of Fill	1	ea	$875.00	$20.00	$50.00	$15.00	$875	$20	$50	$15	$960
4.4 Haul Earth (16 cy/truck,10 mile R/T)	5,200	cy			$2.21	$7.00	$0	$0	$11,492	$36,400	$47,892
4.5 Grade Earth	5,200	cy			$0.31	$0.84	$0	$0	$1,612	$4,368	$5,980
4.6 Compact Earth (12" lifts)	5,200	cy			$0.06	$0.11	$0	$0	$312	$572	$884
5 WETLAND AND LANDFILL MATERIAL REMOVAL											
5.1 Exposed Material Excavation, 1 cy backhoe (level D)	5	day			$521.00	$547.60	$0	$0	$2,605	$2,738	$5,343
5.2 Haul Material to County Landfill	1	ls			$65.00	$185.00	$0	$0	$65	$185	$250
5.3 Disposal Fee	30	ton	$57.00				$1,710	$0	$0	$0	$1,710
5.4 Turbidity Curtain	650	lf		$8.22	$1.04		$0	$5,343	$676	$0	$6,019
5.5 Excavate & Load (2 cy bucket, level D)	960	cy			$0.86	$1.50	$0	$0	$826	$1,440	$2,266
5.6 Haul Material to Dewatering Pad, 2 trucks for 30 days	60	day			$176.80	$364.30	$0	$0	$10,608	$21,858	$32,466
5.7 Construct & Remove Dewatering Pad (50' * 50')	2,500	sf	$0.97	$6.83	$0.94	$0.96	$2,425	$17,075	$2,350	$2,400	$24,250
5.8 Spread/Mix/Load Material on Dewatering Pad	30	day			$398.80	$290.10	$0	$0	$11,964	$8,703	$20,667
5.9 Dewatering Pad Pumps, Piping & Misc Equipment	30	day			$78.00	$46.10	$0	$0	$2,340	$1,383	$3,723
5.10 Regrade and Compact Landfill Material (Level D)	960	cy			$0.49	$1.00	$0	$0	$470	$960	$1,430
6 SITE RESTORATION											
6.1 Common Earth (fill)	198	cy		$5.05	$0.38	$0.76	$0	$1,000	$75	$150	$1,226
6.2 Confirmation Sampling of Fill	1	ea	$875.00	$20.00	$50.00	$15.00	$875	$20	$50	$15	$960
6.3 Haul Earth (16 cy/truck,10 mile R/T)	198	cy			$2.21	$7.00	$0	$0	$438	$1,386	$1,824
6.4 Grade Earth	198	cy			$0.31	$0.84	$0	$0	$61	$166	$228
6.5 Compact Earth (12" lifts)	198	cy			$0.06	$0.11	$0	$0	$12	$22	$34
6.6 Topsoil Cover, 6" thick	1,800	cy		$14.15	$0.38	$0.76	$0	$25,470	$684	$1,368	$27,522
6.7 Confirmation Sampling of Topsoil	1	ea	$875.00	$20.00	$50.00	$15.00	$875	$20	$50	$15	$960
6.8 Haul Topsoil Cover (16 cy/truck,10 mile R/T)	1,800	cy			$2.21	$7.00	$0	$0	$3,978	$12,600	$16,578
6.9 Till Existing Surface	10,475	cy			$0.24	$0.09	$0	$0	$2,514	$943	$3,457

TABLE 2-15

CAPITAL COST ESTIMATE SUMMARY FOR THE SELECTED REMEDY
SITE 12 - TOWN GUT LANDFILL
NDW-IH, INIDAN HEAD, MARYLAND

Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Total Cost Subcontract	Total Cost Material	Total Cost Labor	Total Cost Equipment	Total Direct Cost
6.10 "Wetlands Soil"	696	cy		$14.15	$0.38	$0.76	$0	$9,848	$264	$529	$10,642
6.11 Confirmation Sampling of "Wetlands Soil"	1	ea	$875.00	$20.00	$50.00	$15.00	$875	$20	$50	$15	$960
6.12 Haul "Wetlands Soil" (16 cy/truck,10 mile R/T)	696	cy			$2.21	$7.00	$0	$0	$1,538	$4,872	$6,410
6.13 Wetlands Soil Placement, 1 cy backhoe	3	day			$521.00	$547.60	$0	$0	$1,563	$1,643	$3,206
6.14 Fine Grade & Seed Topsoil	20,980	sy		$0.30	$1.09	$0.22	$0	$6,294	$22,868	$4,616	$33,778
6.15 Wetlands Vegetation Planting	93	csf		$15.33	$8.34		$0	$1,426	$776	$0	$2,201
7 MONITORING WELLS											
7.1 Rig Mob/Demob	1	ls	$2,500.00				$2,500	$0	$0	$0	$2,500
7.2 Abandon Existing Wells (6 @ 15')	90	lf	$12.00				$1,080	$0	$0	$0	$1,080
7.3 Install Monitoring Wells (6 @ 15')	90	lf	$18.00				$1,620	$0	$0	$0	$1,620
7.4 Well Outer Casing	6	ea	$200.00				$1,200	$0	$0	$0	$1,200
7.5 Well Development (4 hours each well)	24	hr	$30.00				$720	$0	$0	$0	$720
7.6 Collect/Containerize IDW (1 drum per well)	6	ea	$50.00				$300	$0	$0	$0	$300
7.7 Transport/Dispose IDW Off Site	6	ea	$150.00				$900	$0	$0	$0	$900
7.8 Survey Well Locations	1	ls	$700.00				$700	$0	$0	$0	$700
8 CONSTRUCTION OVERSIGHT											
8.1 Professional Oversight (5p * 12 weeks)	12	mwk			$5,200.00		$0	$0	$62,400	$0	$62,400
Subtotal							$35,124	$104,096	$150,611	$116,377	$406,207
Local Area Adjustments							100.0%	83.4%	98.2%	98.2%	
Subtotal							$35,124	$86,816	$147,900	$114,282	$384,122
Overhead on Labor Cost @ 30%									$44,370		$44,370
G & A on Labor Cost @ 10%									$14,790		$14,790
G & A on Material Cost @ 10%								$8,682			$8,682
G & A on Subcontract Cost @ 10%							$3,512				$3,512
Total Direct Cost							$38,636	$95,498	$207,060	$114,282	$455,476
Indirects on Total Direct Labor Cost @ 50%									$103,530		$103,530
Profit on Total Direct Cost @ 10%											$45,548
Subtotal 3											$604,554
Health & Safety Monitoring @ 2%											$12,091
Total Field Cost											$616,645
Contingency on Total Field Cost @ 20%											$123,329
Engineering on Total Field Cost @ $180,000											$180,000
TOTAL COST											**$919,974**

TABLE 2-16

ANNUAL COST ESTIMATE SUMMARY FOR THE SELECTED REMEDY
SITE 12 - TOWN GUT LANDFILL
NDW-IH, INDIAN HEAD, MARYLAND

Item	Item Cost Annually	Item Cost per 5 Years	Notes
Site Maintenance	$6,480		1 Laborer / 2 Days per Month for 12 Months
	$2,000		Mobilization & Demobilization (pickup truck)
	$100		Misc. Materials (seed, gravel, soil)
	$500		Misc. Equipment (mowers, hand tools)
Sampling	$5,260		Collect six groundwater and six surface water samples, per sampling period (once per year), plus travel and living
Analysis/Water	$6,000		Water samples, per sampling period, (including blanks & duplicates for each medium) SVOCs and inorganics
Report	$4,000		Obtain lab, prepare sampling plan, document sampling events and results
Site Review	$0	$10,000	Review of documents and data evaluation/recommendations
TOTALS	$24,340	$10,000	

TABLE 2-17

PRESENT-WORTH ANALYSIS FOR THE SELECTED REMEDY
SITE 12 - TOWN GUT LANDFILL
NDW-IH, INDIAN HEAD, MARYLAND

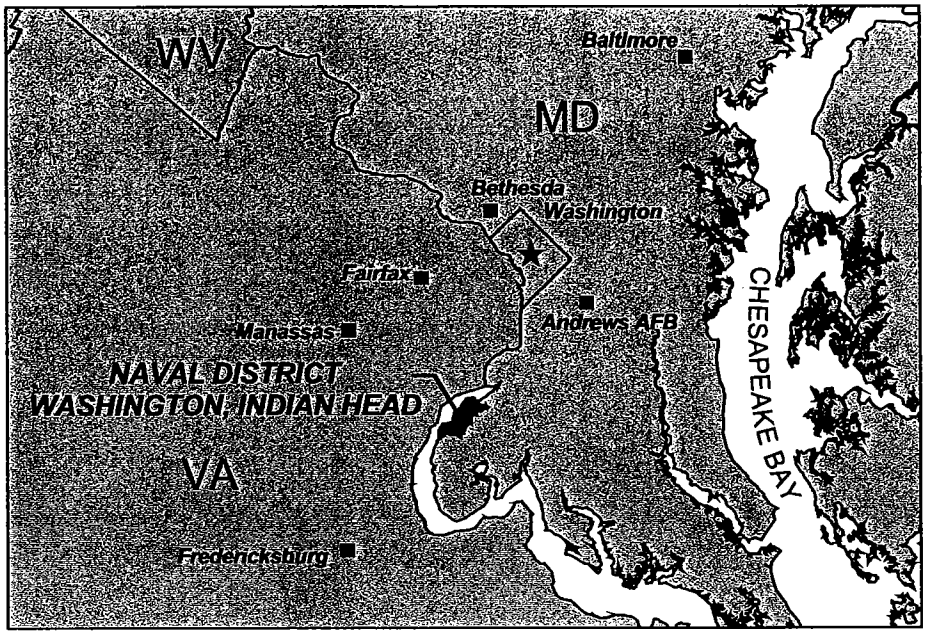
Year	Capital Cost	Annual Cost	Total Year Cost	Annual Discount Rate at 7%	Present Worth
0	$919,973		$919,973	1.000	$919,973
1		$24,340	$24,340	0.935	$22,758
2		$24,340	$24,340	0.873	$21,249
3		$24,340	$24,340	0.816	$19,861
4		$24,340	$24,340	0.763	$18,571
5		$34,340	$34,340	0.713	$24,484
6		$24,340	$24,340	0.666	$16,210
7		$24,340	$24,340	0.623	$15,164
8		$24,340	$24,340	0.582	$14,166
9		$24,340	$24,340	0.544	$13,241
10		$34,340	$34,340	0.508	$17,445
11		$24,340	$24,340	0.475	$11,562
12		$24,340	$24,340	0.444	$10,807
13		$24,340	$24,340	0.415	$10,101
14		$24,340	$24,340	0.388	$9,444
15		$34,340	$34,340	0.362	$12,431
16		$24,340	$24,340	0.339	$8,251
17		$24,340	$24,340	0.317	$7,716
18		$24,340	$24,340	0.296	$7,205
19		$24,340	$24,340	0.277	$6,742
20		$34,340	$34,340	0.258	$8,860
21		$24,340	$24,340	0.242	$5,890
22		$24,340	$24,340	0.226	$5,501
23		$24,340	$24,340	0.211	$5,136
24		$24,340	$24,340	0.197	$4,795
25		$34,340	$34,340	0.184	$6,319
26		$24,340	$24,340	0.172	$4,186
27		$24,340	$24,340	0.161	$3,919
28		$24,340	$24,340	0.150	$3,651
29		$24,340	$24,340	0.141	$3,432
30		$34,340	$34,340	0.131	$4,499
				TOTAL PRESENT WORTH	**$1,243,568**

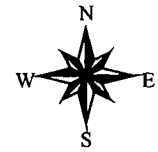
TABLE 2-18

DESCRIPTION OF ARARs FOR SELECTED REMEDY
SITE 12 – TOWN GUT LANDFILL
NDW-IH, INDIAN HEAD, MARYLAND

Authority	Medium	Requirement	Status	Synopsis of Requirement	Action to be Taken to Attain Requirement
Chemical-Specific					
State Regulatory Requirement	Surface Water	Maryland Surface Water Quality Criteria (COMAR 26.08.02.03)	Applicable	These requirements establish minimum standards for surface water for each designated use.	Results from surface water monitoring will be compared to these criteria.
Federal Regulatory Requirement	Surface Water	EPA Ambient Water Quality Criteria (40 CFR 136)	Relevant and Appropriate	These criteria are guidelines for pollutants in surface water.	Results from surface water monitoring will be compared to these criteria.
Action-Specific					
State Regulatory Requirement	Solid Waste (Landfilled Material)	Maryland Regulations for Solid Waste Management (COMAR 26.04.07)	Applicable	These requirements establish standards for disposal of solid waste. The regulations include landfill post-closure monitoring and maintenance requirements.	Monitoring and maintenance meet the post-closure requirements.

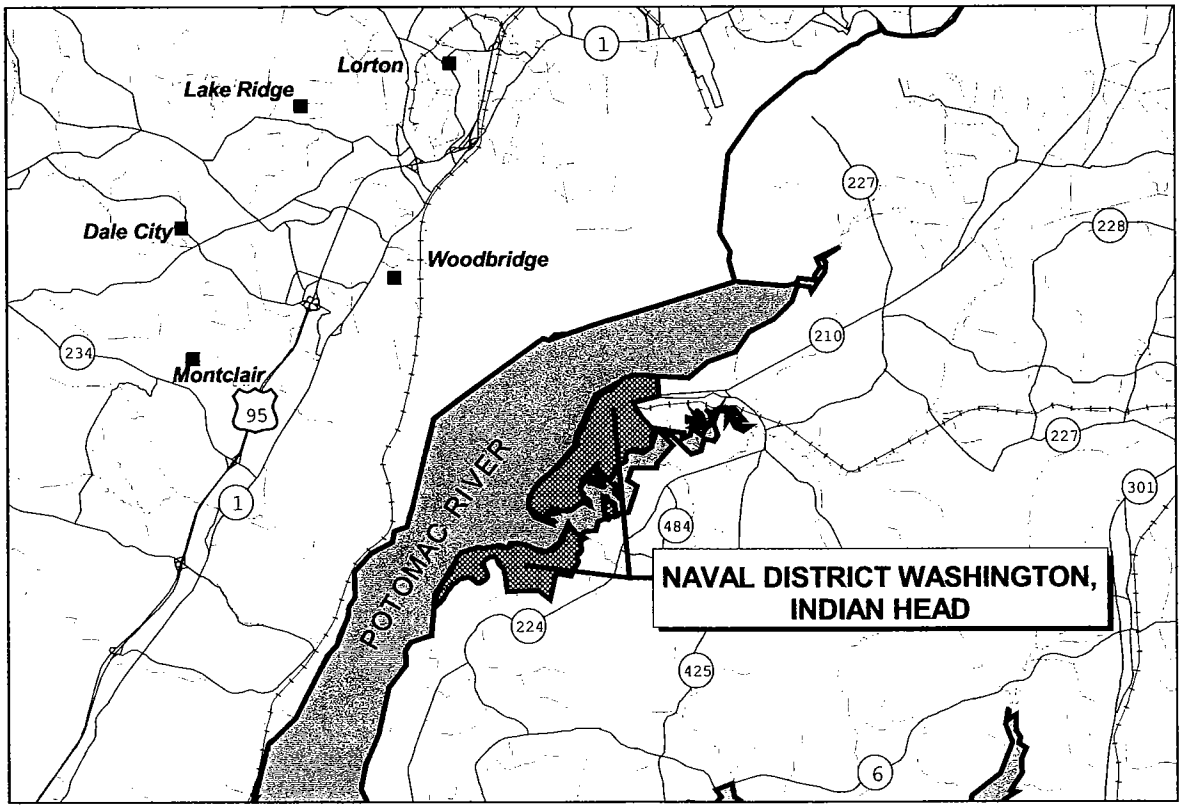
Note: Refer to FS (TtNUS, 2001) for ARARs for other alternatives.





LEGEND

- City
- Highway
- Railroad
- River



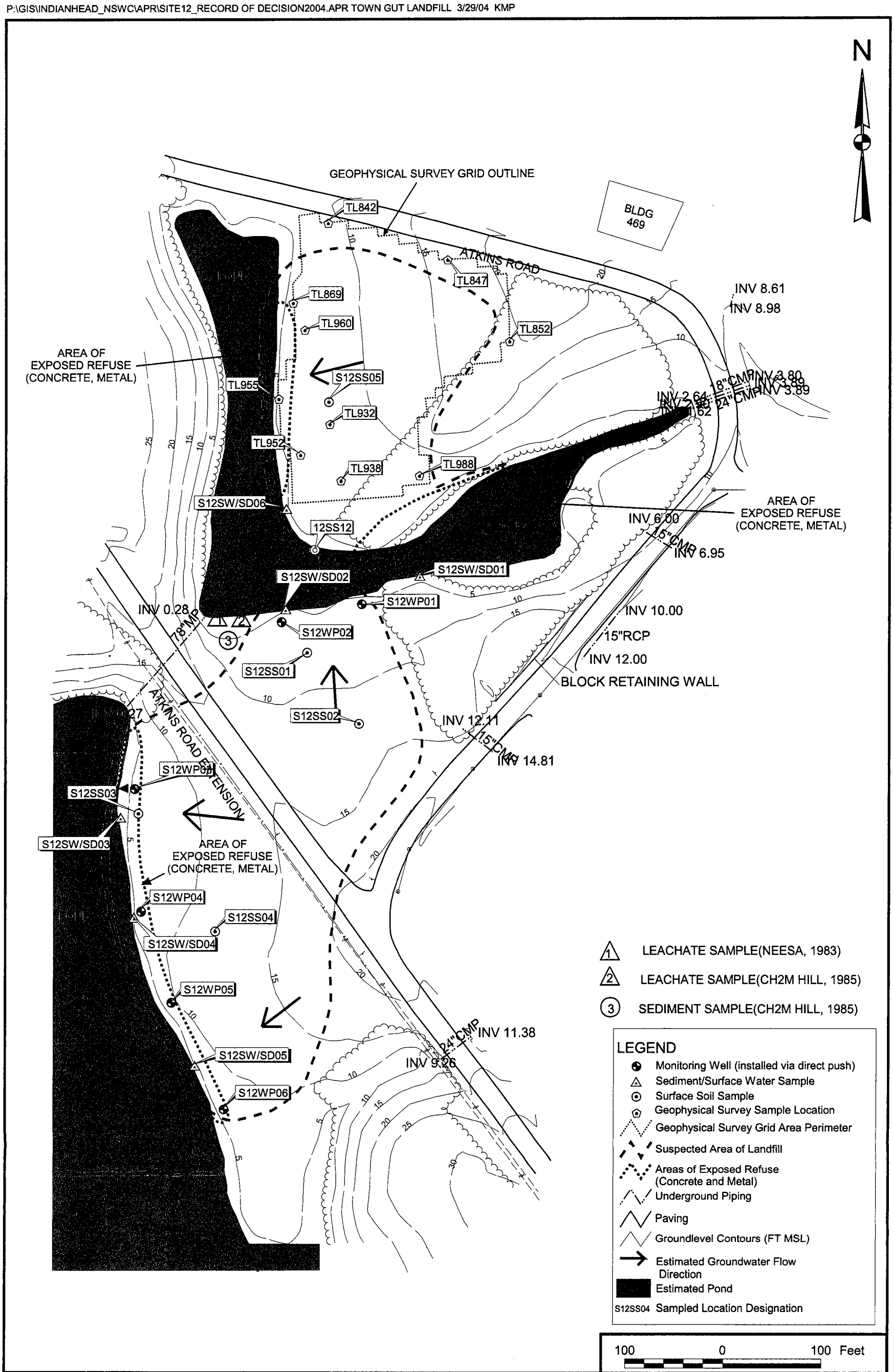
DRAWN BY K. PEILA	DATE 3/18/04	Tetra Tech NUS, Inc.	CONTRACT NUMBER 4020	OWNER NO. CTO 0805
CHECKED BY G. LATULIPPE	DATE 3/18/04	FACILITY LOCATION MAP NAVAL DISTRICT WASHINGTON, INDIAN HEAD INDIAN HEAD, MARYLAND	APPROVED BY GJL	DATE 3/18/04
COST/SCHEDULE-AREA			APPROVED BY —	DATE —
SCALE AS NOTED			DRAWING NO. FIGURE 2-1	REV 0

P:\GIS\NSWC_INDIAN_HEAD\WORKPLAN_SITELOCATION.APR FACILITY LOCATION MAP 3/18/04 KMP

P:\GIS\INDIANHEAD_NSWC\APR\COMMUNITYRELATIONSPLAN.APR 12_TOWNGUTLANDFILL 3/31/04 KMP

DRAWN BY K. PEILA — DATE 7/26/02	Tetra Tech NUS, Inc.	CONTRACT NUMBER 4020	OWNER NUMBER 0805
CHECKED BY GJL — DATE 7/26/02	SITE LOCATION MAP MAIN AREA NAVAL DISTRICT WASHINGTON, INDIAN HEAD INDIAN HEAD, MARYLAND	APPROVED BY GJL	DATE 8/8/02
COST/SCHEDULE-AREA		APPROVED BY —	DATE —
SCALE AS NOTED		DRAWING NO. FIGURE 2-2	REV 0

P:\GIS\INDIANHEAD_NSWC\APR\SITE12_RECORD OF DECISION2004.APR TOWN GUT LANDFILL 3/29/04 KMP



DRAWN BY J. BELLONE	DATE 1/10/00	Tetra Tech NUS, Inc.	CONTRACT NUMBER 4020	OWNER NUMBER 0805
CHECKED BY KCT	DATE 3/29/04	RI/FS SITE CONDITIONS MAP SITE 12 - TOWN GUT LANDFILL NAVAL DISTRICT WASHINGTON, INDIAN HEAD INDIAN HEAD, MARYLAND	APPROVED BY —	DATE —
COST/SCHEDULE-AREA			APPROVED BY —	DATE —
SCALE AS NOTED			DRAWING NO. FIGURE 2-3	REV 0

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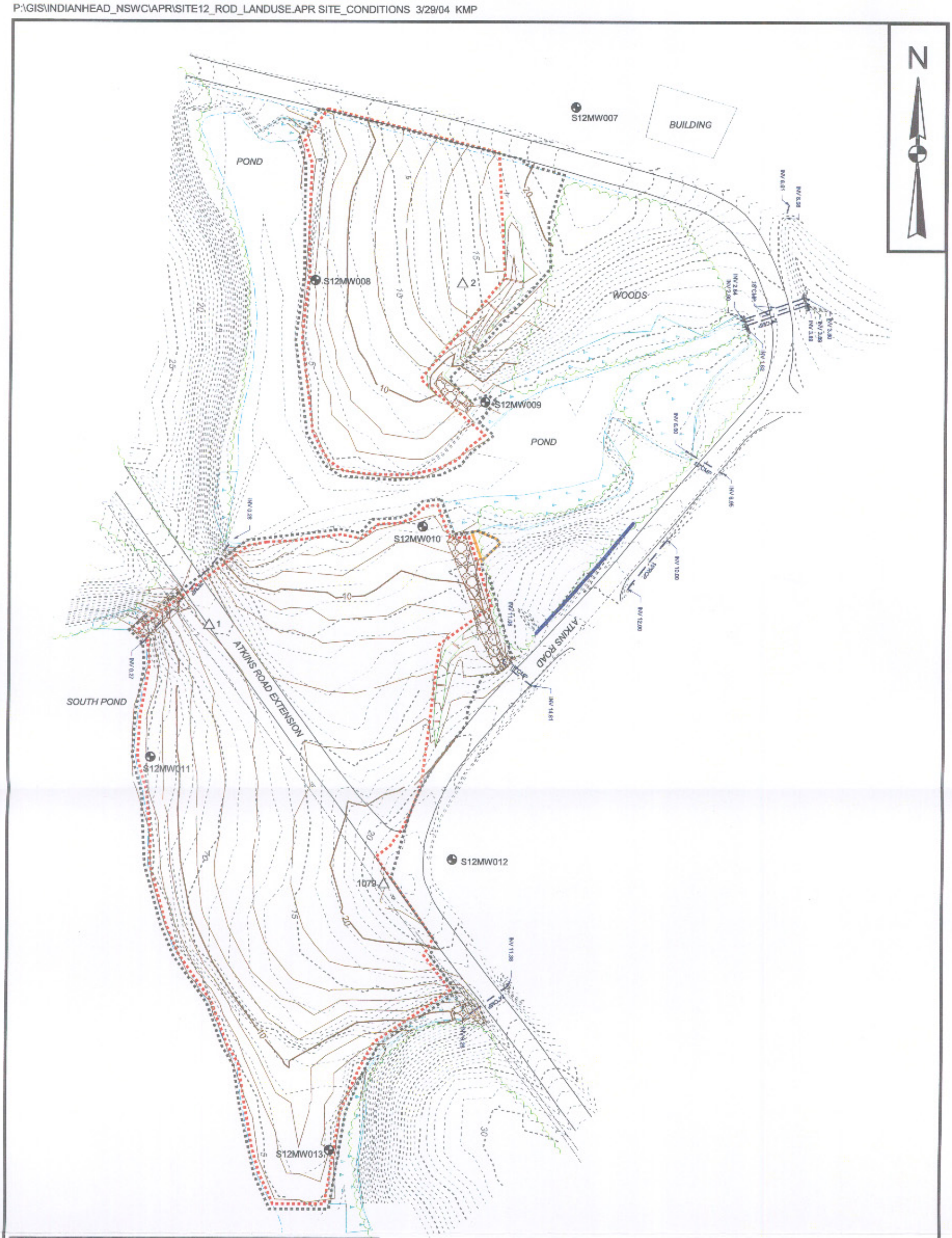


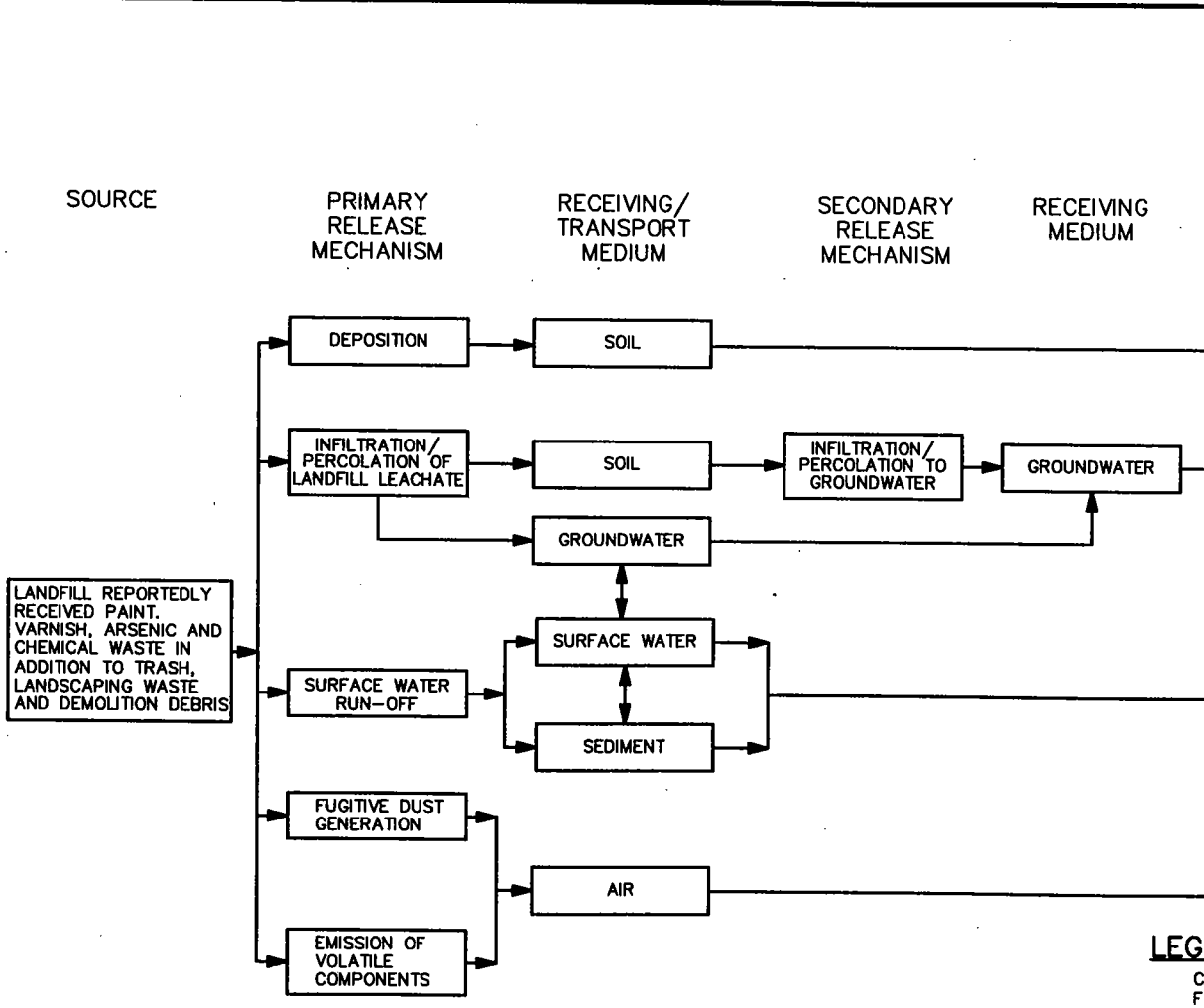
LEGEND

- Benchmark
- New Groundwater Monitoring Well
- Warning Sign
- Final Grade Topographic Contour (Contour Interval = 1 ft.)
- Original Grade Topographic Contour (Contour Interval = 1 ft.)
- Road
- Culvert
- Limits of Cover System
- Approximate Limit of Waste
- Wetland
- Structure
- Retaining Wall
- Treeline
- Existing Water Line
- Existing Overhead Electric
- Existing Storm Water Line
- Rock Check Dam
- Water
- Waste Relocated to Within Landfill Cover
- Riprap

100 0 100 Feet

DRAWN BY K. PEILA	DATE 3/12/04	Tetra Tech NUS, Inc.	CONTRACT NUMBER 4020 / OWNER NUMBER 0805
CHECKED BY K. TURNBULL	DATE 3/12/04	CURRENT SITE CONDITIONS MAP SITE 12 - TOWN GUT LANDFILL NAVAL DISTRICT WASHINGTON, INDIAN HEAD INDIAN HEAD, MARYLAND	APPROVED BY K. TURNBULL / DATE 3/12/04
COST/SCHEDULE-AREA			APPROVED BY — / DATE —
SCALE AS NOTED			DRAWING NO. FIGURE 2-4 / REV 0

ACAD: 4020CF03.dwg 03/16/04 HJB PIT



HUMAN RECEPTORS

EXPOSURE ROUTES	MAINTENANCE WORKER/ FULL-TIME EMPLOYEE	ADOLESCENT TRESPASSER	ADULT RECREATIONAL USER	CONSTRUCTION WORKER	ONSITE RESIDENT
DERMAL CONTACT	CF	CF		F	F
INCIDENTAL INGESTION	CF	CF		F	F
DRINKING WATER INGESTION					F
INHALATION OF VOLATILES				F	F
DERMAL CONTACT				F	F
INGESTION OF SURFACE WATER		CF			F
DERMAL CONTACT WITH SURFACE WATER		CF			F
FOOD INGESTION (INCLUDING FISH)		CF			F
INHALATION OF VOLATILE ORGANICS FROM SURFACE WATER					
INGESTION OF SEDIMENT	CF	CF		F	F
DERMAL CONTACT WITH SEDIMENT	CF	CF		F	F
INHALATION	CF	CF		F	F

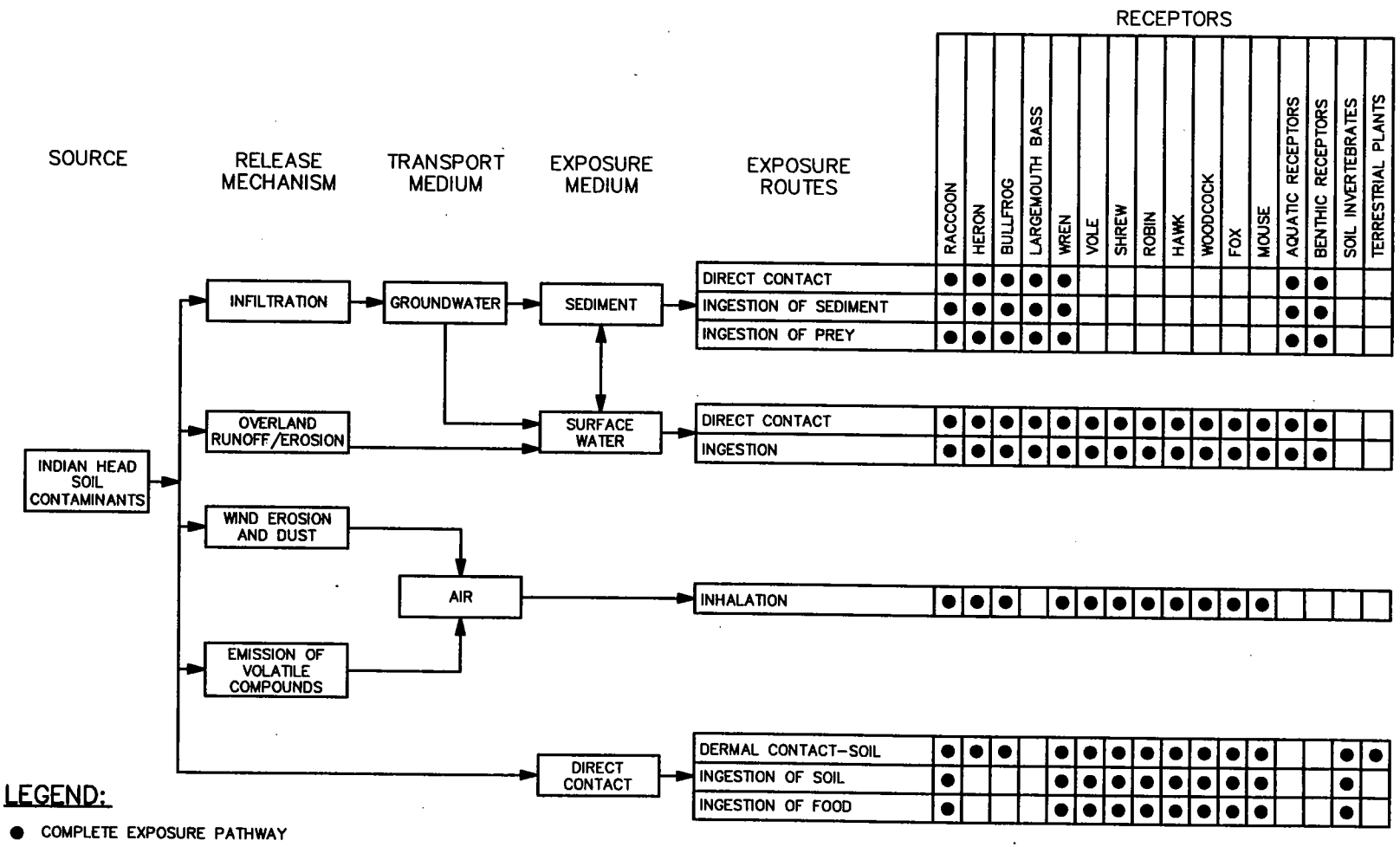
LEGEND:

C – EXPOSURE UNDER CURRENT LAND USE SCENARIO
F – EXPOSURE UNDER FUTURE LAND USE SCENARIO
BLANK – NO EXPOSURE

DRAWN BY HJB DATE 3/16/04	Tetra Tech NUS, Inc.	CONTRACT NO. 4020	OWNER NO. 0805
CHECKED BY KCT DATE 3/16/04	HUMAN HEALTH CONCEPTUAL SITE MODEL SITE 12 – TOWN GUT LANDFILL NDW, IH INDIAN HEAD, MARYLAND	APPROVED BY	DATE
COST/SCHED-AREA		APPROVED BY	DATE
SCALE NOT TO SCALE		DRAWING NO. FIGURE 2-5	REV. 0

FORM CADD NO. SOUTH_AV.DWG - REV 0 - 02/07/97

ACAD: 4020CF04.dwg 03/17/04 HJB PIT

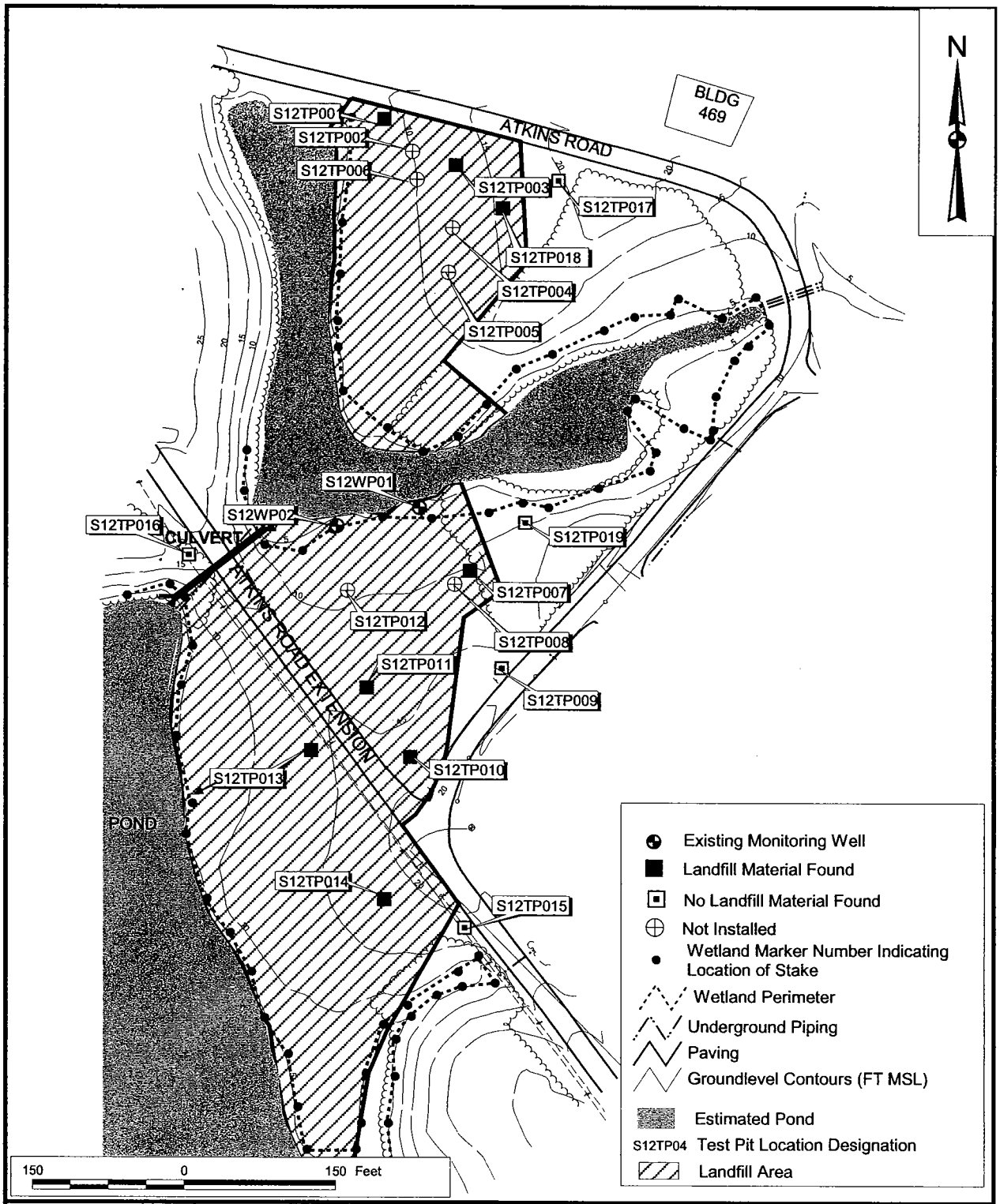


LEGEND:

● COMPLETE EXPOSURE PATHWAY

DRAWN BY HJB DATE 3/16/04	Tetra Tech NUS, Inc.	CONTRACT NO. 4020	OWNER NO. 0805
CHECKED BY KCT DATE 3/17/04	ECOLOGICAL CONCEPTUAL SITE MODEL SITE 12 – TOWN GUT LANDFILL NDW, IH INDIAN HEAD, MARYLAND	APPROVED BY	DATE
COST/SCHED-AREA		APPROVED BY	DATE
SCALE NOT TO SCALE		DRAWING NO. FIGURE 2-6	REV. 0

FORM CADD NO. SOUTH_AV.DWG - REV 0 - 02/07/97



DRAWN BY	DATE	Tetra Tech NUS, Inc.	CONTRACT NUMBER	OWNER NO.
J. BELLONE	8/29/00		4020	0805
CHECKED BY	DATE	TEST PIT LOCATIONS	APPROVED BY	DATE
KCT	3/29/04	SITE 12 - TOWN GUT LANDFILL		
COST/SCHEDULE-AREA		NAVAL DISTRICT WASHINGTON, INDIAN HEAD	APPROVED BY	DATE
SCALE		INDIAN HEAD, MARYLAND	DRAWING NO.	REV
AS NOTED			FIGURE 2-7	0

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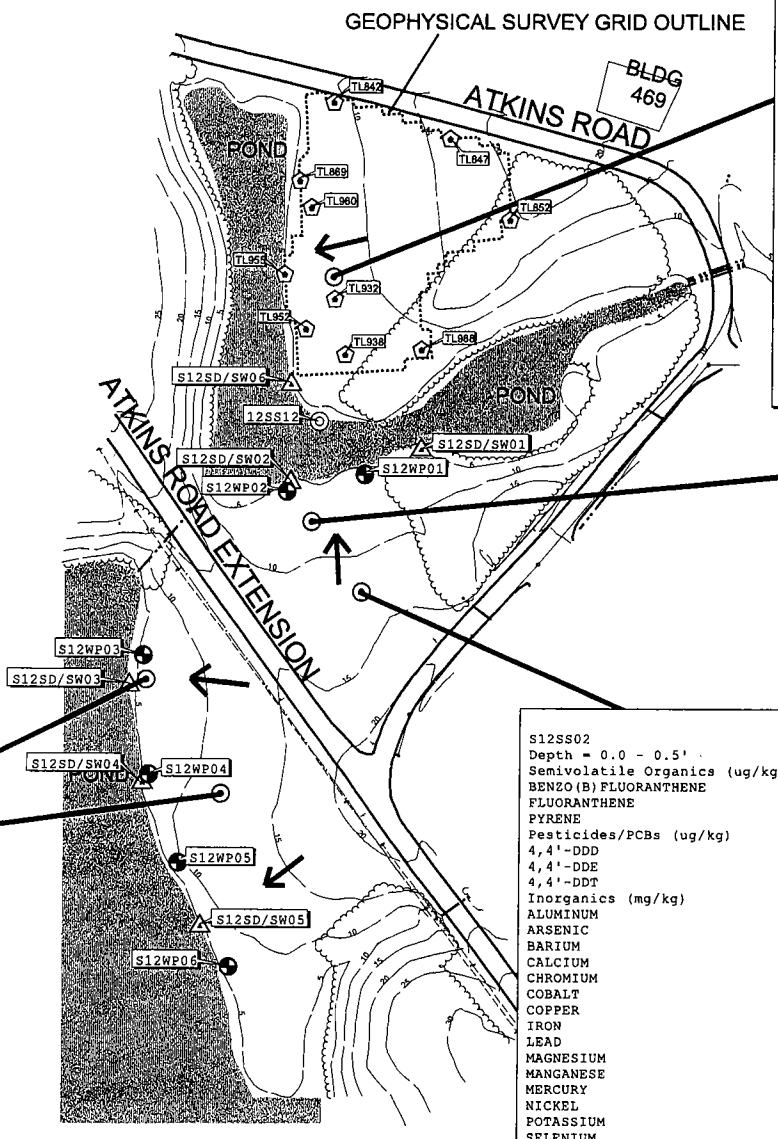

N

S12SS05
Depth = 0.0 - 0.5'

Semivolatile Organics (ug/kg)		
BENZO(A)ANTHRACENE	140	J
BENZO(A)PYRENE	150	J
BENZO(B)FLUORANTHENE	340	J
BENZO(G,H,I)PERYLENE	120	J
BIS(2-ETHYLHEXYL)PHTHALATE	130	J
CHRYSENE	170	J
FLUORANTHENE	240	J
INDENO(1,2,3-CD)PYRENE	130	J
PHENANTHRENE	110	J
PYRENE	220	J
Pesticides/PCBs (ug/kg)		
4,4'-DDE	21	J
4,4'-DDT	7.6	J
ALPHA-CHLORDANE	36	J
AROCLOR-1254	230	J
GAMMA-CHLORDANE	23	J
HEPTACHLOR EPOXIDE	4.4	J
Explosives (ug/kg)		
NITROCELLULOSE	46200	
Inorganics (mg/kg)		
ALUMINUM	13700	J
ARSENIC	14.4	
BARIUM	174	
BERYLLIUM	0.56	
CADMIUM	1.8	
CALCIUM	3220	
CHROMIUM	34.6	J
COBALT	13.0	
COPPER	60.3	
IRON	23000	
LEAD	67.6	J
MAGNESIUM	1420	J
MANGANESE	332	J
MERCURY	4.0	
NICKEL	13.3	J
POTASSIUM	1120	J
SELENIUM	1.1	K
SILVER	125	
VANADIUM	53.1	
ZINC	261	

S12SS03
Depth = 0.0 - 0.5'

Semivolatile Organics (ug/kg)		
BENZO(A)PYRENE	70	J
BENZO(B)FLUORANTHENE	120	J
CHRYSENE	64	J
FLUORANTHENE	86	J
PYRENE	110	J
Pesticides/PCBs (ug/kg)		
4,4'-DDD	1.5	J
4,4'-DDE	2	J
4,4'-DDT	2.1	J
DIELDRIN	1.1	J
Inorganics (mg/kg)		
ALUMINUM	16300	J
ARSENIC	6.3	
BARIUM	70.2	
CADMIUM	0.6	
CALCIUM	1840	K
CHROMIUM	21.7	J
COBALT	7.7	
COPPER	13.4	
CYANIDE	0.34	L
IRON	22800	
LEAD	21.7	J
MAGNESIUM	1540	J
MANGANESE	577	J
MERCURY	0.1	
NICKEL	11.6	J
POTASSIUM	1540	J
SELENIUM	0.9	
VANADIUM	44.9	
ZINC	91.0	

S12SS04
Depth = 0.0 - 0.5'

Semivolatile Organics (ug/kg)		
BENZO(A)ANTHRACENE	320	J
BENZO(A)PYRENE	340	J
BENZO(B)FLUORANTHENE	440	J
BENZO(G,H,I)PERYLENE	190	J
BENZO(K)FLUORANTHENE	170	J
CHRYSENE	310	J
DIBENZO(A,H)ANTHRACENE	91	J
FLUORANTHENE	480	J
INDENO(1,2,3-CD)PYRENE	210	J
PHENANTHRENE	270	J
PYRENE	650	J
Pesticides/PCBs (ug/kg)		
4,4'-DDD	5.3	J
4,4'-DDE	6	J
4,4'-DDT	5.9	J
ALPHA-CHLORDANE	1.9	J
GAMMA-CHLORDANE	0.94	J
HEPTACHLOR EPOXIDE	0.91	J
Inorganics (mg/kg)		
ALUMINUM	11000	J
ARSENIC	7.4	
BARIUM	60.5	
BERYLLIUM	0.28	
CADMIUM	0.58	
CALCIUM	3230	
CHROMIUM	17.3	J
COBALT	7.9	
COPPER	17.3	
IRON	22400	
LEAD	44.1	J
MAGNESIUM	1120	J
MANGANESE	271	J
MERCURY	0.1	
NICKEL	13.1	J
POTASSIUM	1000	J
SELENIUM	1.1	K
SILVER	1.5	
VANADIUM	33.3	
ZINC	78.4	

S12SS02
Depth = 0.0 - 0.5'

Semivolatile Organics (ug/kg)		
BENZO(B)FLUORANTHENE	66	J
FLUORANTHENE	66	J
PYRENE	64	J
Pesticides/PCBs (ug/kg)		
4,4'-DDD	0.93	J
4,4'-DDE	1.3	J
4,4'-DDT	2	J
Inorganics (mg/kg)		
ALUMINUM	13500	J
ARSENIC	5.5	
BARIUM	42.1	
CALCIUM	1150	K
CHROMIUM	18.2	J
COBALT	3.8	
COPPER	13.1	
IRON	22100	
LEAD	17.3	J
MAGNESIUM	760	J
MANGANESE	239	J
MERCURY	0.1	
NICKEL	7.2	J
POTASSIUM	728	J
SELENIUM	0.8	
VANADIUM	35.8	
ZINC	71.1	

S12SS01
Depth = 0.0 - 0.5'

Semivolatile Organics (ug/kg)		
ACENAPHTHENE	92	J
ANTHRACENE	230	J
BENZO(A)ANTHRACENE	1200	J
BENZO(A)PYRENE	1100	J
BENZO(B)FLUORANTHENE	1500	J
BENZO(G,H,I)PERYLENE	740	J
BENZO(K)FLUORANTHENE	700	J
BIS(2-ETHYLHEXYL)PHTHALATE	57	J
CARBAZOLE	150	J
CHRYSENE	1100	J
DIBENZO(A,H)ANTHRACENE	210	J
DIBENZOFURAN	70	J
FLUORANTHENE	1700	J
FLUORENE	130	J
INDENO(1,2,3-CD)PYRENE	730	J
PHENANTHRENE	1300	J
PYRENE	2200	J
Pesticides/PCBs (ug/kg)		
4,4'-DDD	5.2	J
4,4'-DDE	6.2	J
4,4'-DDT	17	J
Inorganics (mg/kg)		
ALUMINUM	10600	J
ARSENIC	8.1	
BARIUM	42.1	
CADMIUM	3.6	
CALCIUM	2040	J
CHROMIUM	19.4	
COBALT	4.3	
COPPER	81.3	
IRON	20600	
LEAD	48.3	J
MAGNESIUM	1040	J
MANGANESE	158	J
MERCURY	0.28	
NICKEL	11.9	J
POTASSIUM	1100	J
SELENIUM	0.89	
SILVER	0.41	
VANADIUM	35.9	
ZINC	108	

LEGEND

- Monitoring Well (installed via direct push)
- Sediment/Surface Water Sample
- Surface Soil Sample
- Geophysical Survey Sample Location
- Geophysical Survey Grid Area Perimeter
- Suspected Area of Landfill
- Areas of Exposed Refuse (Concrete and Metal)
- Underground Piping
- Paving
- Groundlevel Contours (FT MSL)
- Estimated Groundwater Flow Direction
- Estimated Pond
- S12SS04 Sampled Location Designation

J - Estimate
K - Biased-high Estimate
L - Biased-low Estimate

200 0 200 Feet

DRAWN BY J. BELLONE	DATE 8/29/00	Tetra Tech NUS, Inc.	CONTRACT NUMBER 4020 / OWNER NUMBER 0805
CHECKED BY KCT	DATE 3/29/04	SURFACE SOIL POSITIVE DETECTIONS SITE 12 - TOWN GUT LANDFILL NAVAL DISTRICT WASHINGTON, INDIAN HEAD INDIAN HEAD, MARYLAND	APPROVED BY — DATE —
COST/SCHEDULE-AREA			APPROVED BY — DATE —
SCALE AS NOTED			DRAWING NO. FIGURE 2-8 / REV 0

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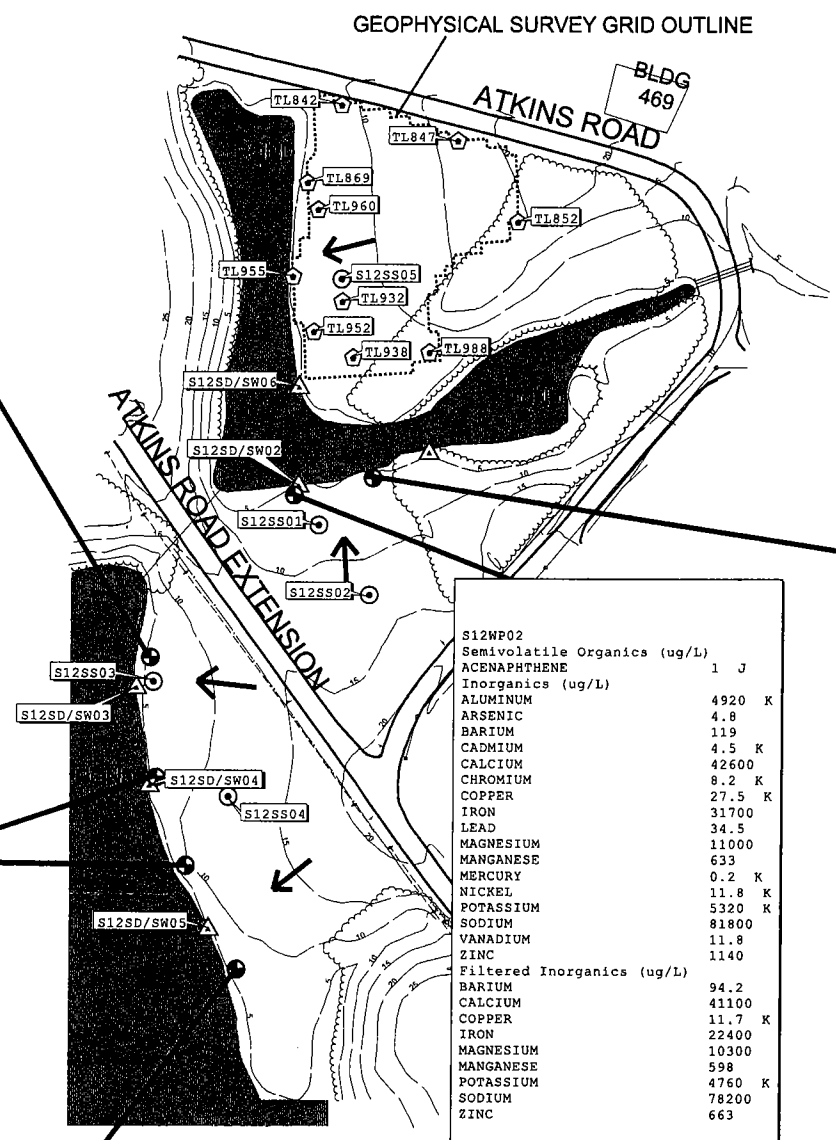


S12WP03	
Semivolatile Organics (ug/L)	
N-NITROSODIPHENYLAMINE	17
Inorganics (ug/L)	
ARSENIC	3.3
BARIUM	249
CALCIUM	69500
COPPER	10.8 K
IRON	83700
LEAD	2.9 K
MAGNESIUM	14700
MANGANESE	722
POTASSIUM	6290 K
SODIUM	44900
ZINC	189
Filtered Inorganics (ug/L)	
ARSENIC	3.8
BARIUM	595
CALCIUM	69200
IRON	78200
MAGNESIUM	14800
MANGANESE	708
POTASSIUM	6270 K
SODIUM	55300
ZINC	250

S12WP04	
Inorganics (ug/L)	
ARSENIC	30
BARIUM	248
CALCIUM	176000
CHROMIUM	2.4 K
COPPER	11 K
IRON	81700
LEAD	1.6 K
MAGNESIUM	27200
MANGANESE	2190
POTASSIUM	5720 K
SODIUM	40300
VANADIUM	2.8 L
Filtered Inorganics (ug/L)	
ARSENIC	31.3
BARIUM	606
CALCIUM	180000
CHROMIUM	2.5 K
IRON	81700
MAGNESIUM	28100
MANGANESE	2210
POTASSIUM	6070 K
SODIUM	54900
VANADIUM	2.6 L
ZINC	153

S12WP05	
Volatile Organics (ug/L)	
CHLOROETHANE	1
Semivolatile Organics (ug/L)	
ACENAPHTHENE	4 J
FLUORENE	2 J
Pesticides/PCBs (ug/L)	
ALPHA-CHLORDANE	0.004 J
DIELDRIN	0.005 J
GAMMA-CHLORDANE	0.002 J
Inorganics (ug/L)	
ALUMINUM	726
ARSENIC	32.6 K
BARIUM	244 J
CALCIUM	118000
IRON	65300
MAGNESIUM	23400
MANGANESE	1300 J
POTASSIUM	10700
SODIUM	54200
Filtered Inorganics (ug/L)	
ARSENIC	34.2 K
BARIUM	346 J
CALCIUM	116000
IRON	63500
MAGNESIUM	23100
MANGANESE	1280 J
POTASSIUM	10600
SODIUM	58000
ZINC	37 K

S12WP05 (DUP)	
Volatile Organics (ug/L)	
CHLOROETHANE	1
Semivolatile Organics (ug/L)	
ACENAPHTHENE	4 J
BIS(2-ETHYLHEXYL) PHTHALATE	2 J
FLUORENE	2 J
Pesticides/PCBs (ug/L)	
ALPHA-CHLORDANE	0.003 J
DIELDRIN	0.003 J
Inorganics (ug/L)	
ALUMINUM	3860
ARSENIC	32.8 K
BARIUM	246 J
CALCIUM	114000
CHROMIUM	4.8 K
IRON	66400
MAGNESIUM	23000
MANGANESE	1270 J
POTASSIUM	10800
SODIUM	53000
ZINC	21.9 K
Filtered Inorganics (ug/L)	
ARSENIC	34.2 K
BARIUM	487 J
CALCIUM	124000
IRON	67800
MAGNESIUM	24600
MANGANESE	1370 J
POTASSIUM	10900
SODIUM	62000
ZINC	81.8

S12WP06	
Semivolatile Organics (ug/L)	
4-METHYLPHENOL	2 J
Pesticides/PCBs (ug/L)	
HEPTACHLOR EPOXIDE	0.003 J
Inorganics (ug/L)	
ALUMINUM	4620
ARSENIC	30.2 K
BARIUM	356 J
CALCIUM	193000
CHROMIUM	8.1 K
COBALT	14.4
IRON	69000
LEAD	17.3 K
MAGNESIUM	33100
MANGANESE	4470 J
NICKEL	21.8
POTASSIUM	15200
SODIUM	35900
ZINC	46.6 K
Filtered Inorganics (ug/L)	
ARSENIC	24.6 K
BARIUM	535 J
CALCIUM	184000
IRON	56900
MAGNESIUM	31000
MANGANESE	4240 J
NICKEL	15.4
POTASSIUM	13800
SODIUM	40300
ZINC	95.1

S12WP02	
Semivolatile Organics (ug/L)	
ACENAPHTHENE	1 J
Inorganics (ug/L)	
ALUMINUM	4920 K
ARSENIC	4.8
BARIUM	119
CADMIUM	4.5 K
CALCIUM	42600
CHROMIUM	8.2 K
COPPER	27.5 K
IRON	31700
LEAD	34.5
MAGNESIUM	11000
MANGANESE	633
MERCURY	0.2 K
NICKEL	11.8 K
POTASSIUM	5320 K
SODIUM	81800
VANADIUM	11.8
ZINC	1140
Filtered Inorganics (ug/L)	
BARIUM	94.2
CALCIUM	41100
COPPER	11.7 K
IRON	22400
MAGNESIUM	10300
MANGANESE	598
POTASSIUM	4760 K
SODIUM	78200
ZINC	663

S12WP02 (DUP)	
Semivolatile Organics (ug/L)	
ACENAPHTHENE	1 J
Inorganics (ug/L)	
ALUMINUM	4210 K
ARSENIC	6.1
BARIUM	114
CADMIUM	4.2 K
CALCIUM	42200
CHROMIUM	7.3 K
COPPER	31.6 K
IRON	30400
LEAD	32.9
MAGNESIUM	10800
MANGANESE	624
MERCURY	0.17 K
NICKEL	11.2 K
POTASSIUM	5140 K
SODIUM	79900
VANADIUM	10.8
ZINC	1100
Filtered Inorganics (ug/L)	
BARIUM	94.6
CALCIUM	41800
IRON	22700
MAGNESIUM	10400
MANGANESE	604
POTASSIUM	4760 K
SODIUM	78800
ZINC	685

S12WP01	
Volatile Organics (ug/L)	
CIS-1,2-DICHLOROETHENE	306
TRANS-1,2-DICHLOROETHENE	2
TRICHLOROETHENE	12
VINYL CHLORIDE	317
Semivolatile Organics (ug/L)	
NAPHTHALENE	2 J
Inorganics (ug/L)	
ALUMINUM	649 K
BARIUM	133
CALCIUM	46400
CHROMIUM	2.4 K
COPPER	16.6 K
IRON	45700
LEAD	21.6
MAGNESIUM	7480 K
MANGANESE	676
NICKEL	12.1 K
POTASSIUM	3400 K
SODIUM	57000
VANADIUM	2.8
ZINC	180
Filtered Inorganics (ug/L)	
BARIUM	127
CALCIUM	46400
CHROMIUM	0.92 K
COPPER	14.1 K
IRON	43700
LEAD	1.3 K
MAGNESIUM	7450 K
MANGANESE	674
NICKEL	10.4 K
POTASSIUM	3340 K
SODIUM	57000
ZINC	59.6

LEGEND

- Monitoring Well (installed via direct push)
- Sediment/Surface Water Sample
- Surface Soil Sample
- Geophysical Survey Sample Location
- Geophysical Survey Grid Area Perimeter
- Suspected Area of Landfill
- Areas of Exposed Refuse (Concrete and Metal)
- Underground Piping
- Paving
- Groundlevel Contours (FT MSL)
- Estimated Groundwater Flow Direction
- Estimated Pond
- S12SS04 Sampled Location Designation

J - Estimate
K - Biased-high Estimate
L - Biased-low Estimate

200 0 200 Feet

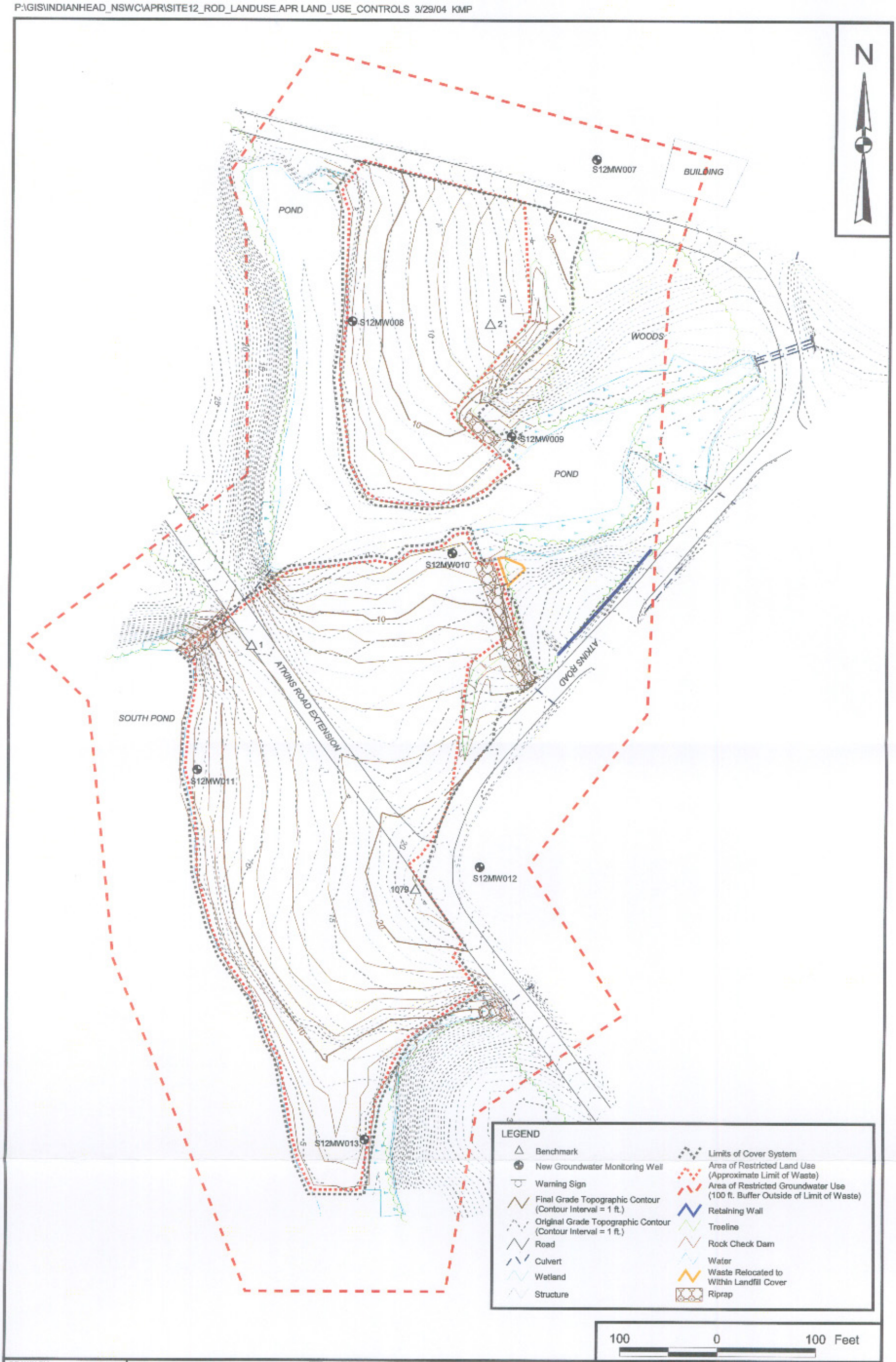
DRAWN BY	DATE
J. BELLONE	8/29/00
CHECKED BY	DATE
KCT	3/29/04
COST/SCHEDULE-AREA	
SCALE	AS NOTED

Tetra Tech NUS, Inc.

GROUNDWATER POSITIVE DETECTIONS
SITE 12 - TOWN GUT LANDFILL
NAVAL DISTRICT WASHINGTON, INDIAN HEAD
INDIAN HEAD, MARYLAND

CONTRACT NUMBER	OWNER NUMBER
4020	0805
APPROVED BY	DATE
APPROVED BY	DATE
DRAWING NO. FIGURE 2-9	REV 0

P:\GIS\INDIANHEAD_NSWC\APR\SITE12_ROD_LANDUSE.APR LAND_USE_CONTROLS 3/29/04 KMP



DRAWN BY K. PEILA — DATE 3/12/04	Tetra Tech NUS, Inc.	CONTRACT NUMBER 4020	OWNER NUMBER 0805
CHECKED BY K. TURNBULL — DATE 3/12/04	LAND USE CONTROLS SITE 12 - TOWN GUT LANDFILL NAVAL DISTRICT WASHINGTON, INDIAN HEAD INDIAN HEAD, MARYLAND	APPROVED BY K. TURNBULL	DATE 3/12/04
COST/SCHEDULE-AREA		APPROVED BY —	DATE —
SCALE AS NOTED		DRAWING NO. FIGURE 2-10	REV 0

3.0 RESPONSIVENESS SUMMARY

The Responsiveness Summary is a concise and complete summary of significant comments received from the public and includes responses to these comments. The Responsiveness Summary was prepared after the public comment period (which ended on March 2, 2001) in accordance with guidance in "Community Relations in Superfund: A Handbook" (OSWER Directive 9320.3B, January 1992). The Responsiveness Summary provides the decision makers 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 significant comments.

3.1 OVERVIEW

The Proposed Plan as presented to the public identified removal, containment, land use controls, monitoring, and 5-year site reviews as the preferred remedial alternative. Wastes in the wetland areas and adjacent to the ponds would be excavated and hauled off site for disposal. The landfill would be covered with at least 2 feet of soil and revegetated.

Land use controls would consist of maintaining records of the contamination at Site 12 in the GIS and designating the site as a restricted or limited-use area. Residential development and shallow groundwater use would not be permitted. EPA and the state would be notified of proposed construction plans at Site 12 prior to commencement of any construction activities.

Long-term monitoring of groundwater and surface water would be conducted to confirm that migration of contaminants from the site into the environment is not occurring and to determine the need for future actions. A statutory review will be conducted within 5 years after initiation of remedial action to ensure that the remedy is, or will be, protective of human health and the environment.

3.2 BACKGROUND ON COMMUNITY INVOLVEMENT

The public comment period for the proposed action for Site 12 began on January 16, 2001 and ended on March 2, 2001. A public meeting was held on January 23, 2001 at the Indian Head Senior Center, 100 Cornwallis Square, Indian Head, Maryland, to accept oral comments on the proposed action. None of the comments received would require a revision to the proposed remedy.

3.3 SUMMARY OF COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD AND NAVY RESPONSES

Following is a summary of the responses to comments received during the public comment period.

1. When will the Base Master Plan be updated?

Response: There is currently no schedule in place for updating the Base Master Plan. However, funding has been approved for this effort. Until the Navy updates the Base Master Plan for NDW-IH, we will continue to use the systems we have in place to ensure that personnel are not put at risk from IR sites.

2. What are the systems the Navy has in place to control risks?

Response: Site 12 is located within the facility's restricted access area. As a result, a permit must be secured from the Safety Department prior to commencing construction activities on the site. Safety Department personnel at NDW-IH review GIS maps, which include IR sites, prior to approving any permits for construction work. In addition, through the National Environmental Policy Act (NEPA), the environmental office reviews work proposed by the Public Works Department for environmental issues, including the location of IR sites, prior to approving them. In addition, NDW-IH has implemented a training program for personnel that work or may possibly work at sites where there is a potential for unacceptable health risks. Training includes information on the contamination present, the potential risks involved in working at the site, and ways to reduce or eliminate those risks. This will be an ongoing process and will include employees and contractors whose work involves the disturbance of soil at or near IR sites.

3. I continue to be bothered by the failure to designate a buffer area around the site. A buffer area would be of use if leaching of contaminants and migration outside the site area may occur between the 5-year periodic review cycles. I urge that a buffer area of at least 50 feet be designated around the site.

Response: The Navy, with concurrence of the EPA and MDE, does not believe that a buffer area around this site would be necessary to protect human health or the environment. The proposed cover protects human health and ecological receptors by eliminating direct contact with contaminants. Site 12 is within an industrial area with controlled access. Signs will be posted to minimize the potential for trespassers.

The additional soil and the smooth surface grades resulting from the installation of the soil cover would also minimize the potential for leachate generation. Contaminants that leach from the landfill would migrate to shallow groundwater. At Site 12, shallow groundwater flows toward the adjacent ponds. The ponds have not been adversely affected by groundwater discharges

although the landfill has been present for more than 30 years. Therefore, it is unlikely that the ponds would be adversely affected within 5 years. In addition, the 5-year reviews are formal reports that document the results from long-term monitoring. Initially, this monitoring will be conducted more frequently than every 5 years and will include sampling to ensure that the ponds do not become adversely affected by the landfill. The Navy will review the sampling results and will submit them to EPA and MDE for review.

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APPENDIX A

GLOSSARY

APPENDIX A - GLOSSARY

This glossary defines terms used in this ROD describing CERCLA activities. The definitions apply specifically to this ROD and may have other meanings when used in different circumstances.

Action Memorandum: A concise, written record of the decision to select an appropriate removal action. As the primary decision document, it substantiates the need for a removal action, identifies the proposed action, and explains the rationale for the removal action selection. An Action Memorandum parallels the function of a ROD but is not as elaborate.

Administrative Record File: A file that contains all information used by the lead agency to make its decision in selecting a response under CERCLA. This file is to be available for public review, and a copy is to be established at or near the site, usually at one of the information repositories. Also, a duplicate is filed in a central location, such as a regional or state office.

Applicable or Relevant and Appropriate Requirements (ARARs): The federal and state environmental laws and regulations that a selected remedy will meet. These requirements may vary for different sites or different remedies.

Aquifer: An underground formation of materials such as sand, soil, or gravel that can store and supply groundwater to wells and springs.

Background Concentrations: Concentrations of chemical compounds or elements in environmental media that are representative of naturally occurring conditions or that may be attributable to historic, widespread human activity.

Baseline Risk Assessment: A study conducted as a supplement to a remedial investigation to determine the nature and extent of contamination at a Superfund site and the risks posed to public health and the environment.

Carcinogen: A substance that may cause cancer.

Clean-up: Actions taken to deal with a release or threatened release of hazardous substances that could affect public health or the environment. It is sometimes used interchangeably with the terms remedial action, removal action, response action, or remedial response.

Comment Period: A time during which the public can review and comment on various documents and actions taken, either by the Navy, EPA, or MDE. For example, a comment period is provided when EPA proposes to add sites to the National Priorities List. A minimum 30-day comment period is held to allow community members to review the Administrative Record file and review and comment on the Proposed Plan.

Community Relations: The Navy and NDW-IH program to inform and involve the public in the Superfund process and respond to community concerns.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA): A federal law passed in 1980 and modified in 1986 by the Superfund Amendments and Reauthorization Act (SARA). The act created a special tax that goes into a trust fund to investigate and clean up abandoned or uncontrolled hazardous waste sites. Under the program, EPA can do either of the following:

- Pay for site cleanup when parties responsible for the contamination cannot be located or are unwilling to perform the work.

- Take legal action to force parties responsible for site contamination to clean up the site or pay back the federal government for the cost of the cleanup.

Contaminant: Any physical, biological, or radiological substance or matter that, at a high enough concentration, could have an adverse effect on human health or the environment.

Drinking Water Standards: Standards for the quality of drinking water that are set forth by EPA and MDE.

Ecological Receptor: A plant or animal that may be exposed to a contaminant in the environment.

Engineering Evaluation/Cost Analysis (EE/CA): Used to identify objectives for a non-time-critical removal action and to analyze the various alternatives that may be used to satisfy these objectives. An EE/CA is similar to the RI/FS conducted for remedial actions but is less comprehensive.

Feasibility Study: See Remedial Investigation and Feasibility Study.

Groundwater: Water beneath the ground surface that fills spaces between materials such as sand, soil, or gravel to the point of saturation. In aquifers, groundwater occurs in quantities sufficient for drinking

water, irrigation, and other uses. Groundwater may transport substances that have percolated downward from the ground surface as it flows toward its point of discharge.

Hazardous Substance: Any material that poses a threat to public health or the environment. Typical hazardous substances are materials that are toxic, corrosive, ignitable, explosive, or chemically reactive.

Information Repository: A file containing information, technical reports, and reference documents regarding a Superfund site that is made available to the public. The information repository is at NDW-IH General Library, Naval District Washington, Indian Head, Building 620, 101 Strauss Avenue, Indian Head, Maryland.

Maximum Contaminant Levels (MCLs): National standards for acceptable levels of contaminants in public drinking water systems. These are legally enforceable standards for supplies of drinking water set by EPA under the Safe Drinking Water Act and by MDE.

Metals: Metals are naturally occurring elements in the earth. Arsenic, cadmium, iron, mercury, and silver are examples of metals. Exposure to some metals, such as arsenic and mercury, can have toxic effects. Other metals, such as iron, are essential to the metabolisms of humans and animals.

Monitoring: Ongoing collection of information about the environment that helps determine the effectiveness of a clean-up action. This includes the collection of samples and laboratory analysis for the contaminants of interest.

Monitoring Wells: Wells drilled at specific locations on or near a site where groundwater can be sampled at selected depths and studied to assess the groundwater flow direction and the types and amounts of contaminants present.

National Oil and Hazardous Substances Pollution Contingency Plan (NCP): Federal regulations that provide the organizational structure and procedures for preparing for and responding to discharges of oil and release of hazardous substances, pollutants, or contaminants.

National Priorities List (NPL): The EPA list of the most serious uncontrolled or abandoned hazardous waste sites identified for possible long-term remedial response. The list is based on the score a site receives in the Hazard Ranking System. EPA is required to update the NPL at least once a year.

Organic Compounds: Naturally occurring or man-made chemicals containing carbon. Volatile organics can evaporate more quickly than semivolatile organics. Other organics include pesticides and

polychlorinated biphenyls (PCBs). Some organic compounds may cause cancer; however, their strength as a cancer-causing agent can vary widely. Other organics may not cause cancer but may be toxic. The concentrations that can cause harmful effects can also vary widely.

Parts per Billion (ppb)/Parts per Million (ppm): Units commonly used to express low concentrations of contaminants. For example, one ounce of a chemical in a million ounces of water is 1 ppm. One ounce of a chemical in a billion ounces of water is 1 ppb. If one drop of a chemical is mixed in a competition-size swimming pool, the water will contain about 1 ppb of the chemical. Parts per million are equivalent to mg/L and mg/kg. Parts per billion are equivalent to µg/L and µg/kg.

Present Worth: A present-worth analysis is used to evaluate costs that occur over different time periods by discounting all future costs to a common base year. It represents the amount of money that, if invested in the base year and dispersed as needed, would be sufficient to cover all costs associated with the remedial action over its planned life. Net present worth considers both capital (construction) costs and costs for annual operation and maintenance.

Proposed Plan: A public participation requirement of SARA in which the lead agency summarizes for the public the preferred clean-up strategy and rationale for preference and reviews the alternatives presented in the detailed analysis of the FS. The Proposed Plan may be prepared either as a fact sheet or as a separate document. In either case, it must actively solicit public review and comment on all alternatives under consideration.

Record of Decision (ROD): An official public document that determines which clean-up alternative(s) will be used at NPL sites. The ROD is based on information and technical analysis generated during the RI/FS and consideration of public comments and community concerns. The ROD explains the remedy selection process and is issued by the lead agency following the public comment period.

Remedial Action: The actual construction or implementation phase that follows the remedial design for the selected clean-up alternative at a site on the NPL.

Remedial Investigation/Feasibility Study (RI/FS): Investigation and analytical studies usually performed at the same time in an interactive process and together referred to as the RI/FS. They are intended to gather data needed to determine the type and extent of contamination, establish criteria for cleaning up the site, identify and screen clean-up alternatives for remedial action, and analyze in detail the performance and costs of the alternatives.

Remedial Response: A long-term action that stops or substantially reduces a release or threatened release of hazardous substances that is serious but does not pose an immediate threat to public health or the environment.

Removal Action: 1) An action to abate, minimize, stabilize, remove, or eliminate the release or threat of release of a hazardous substance, pollutant, or contaminant. 2) The cleanup or removal of hazardous substances, pollutants, and/or contaminants from the environment.

Response Action: As defined by CERCLA Section 101(25), means remove, removal, remedy, or remedial action, including enforcement activities.

Responsiveness Summary: A summary of oral and written public comments received by the lead agency during a comment period and the responses to these comments prepared by the lead agency. The responsiveness summary is an important part of the ROD, highlighting community concerns for decision makers.

Revegetate: To replace topsoil, seed, and mulch on prepared soil to prevent wind and water erosion.

Secondary Drinking Water Standards: Secondary drinking water standards are set by EPA. These guidelines are not designed to protect public health. Instead, they are intended to protect public welfare by providing guidelines regarding the taste, odor, color, and other aesthetic aspects of drinking water that do not present a health risk.

Superfund: An informal name for CERCLA.

Superfund Amendments and Reauthorization Act (SARA): The public law enacted to reauthorize the funding provisions and amend the authorities and requirements of CERCLA and associated laws. Section 120 of SARA requires that all federal facilities be subject to and comply with this act in the same manner and to the same extent as any non-government entity.

Surface Water: Bodies of water that are above ground, such as rivers, lakes, ponds, and streams.