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RECORD OF DECISION
SITES 6, 12, 15 AND 17
OPERABLE UNIT 9 (OU 9)

NAVAL WEAPONS STATION EARLE
Colts Neck, New Jersey

Naval Facilities Engineering Command
Mid-Atlantic

Contract No. N62472-03-D-0057
Contract Task Order 029

September 2007

TETRA TECH NUS, INC.

RECORD OF DECISION
SITES 6, 12, 15 AND 17
OPERABLE UNIT 9 (OU 9)

NAVAL WEAPONS STATION EARLE
Colts Neck, New Jersey

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TETRA TECH NUS, INC.

RECORD OF DECISION
NAVAL WEAPONS STATION EARLE
OPERABLE UNIT 9 (Sites 6, 12, 15, and 17)

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NAVAL WEAPONS STATION EARLE
OPERABLE UNIT 9

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RECORD OF DECISION
NAVAL WEAPONS STATION EARLE
OPERABLE UNIT 9

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RECORD OF DECISION
NAVAL WEAPONS STATION EARLE
OPERABLE UNIT 9

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RECORD OF DECISION
NAVAL WEAPONS STATION EARLE
OPERABLE UNIT 9 (SITES 6, 12, 15, AND 17)

PART I - DECLARATION

I. SITE NAME AND LOCATION

Naval Weapons Station Earle
Colts Neck, Monmouth County, New Jersey
ID Number: NJ0170022172

Operable Unit 9:	Landfill West of Normandy Road (Site 6)
	Battery Storage Area (Site 12)
	Sludge Disposal Site (Site 15)
	Landfill (Site 17)

Naval Weapons Station (NWS) Earle is located in Monmouth County New Jersey, approximately 47 miles south of New York City (Figure 1). All four Operable Unit (OU) 9 sites are located within the Waterfront Area of NWS Earle (Figures 2 and 3).

II. STATEMENT OF BASIS AND PURPOSE

This Record of Decision (ROD) presents the remedial action alternative selected for OU 9; no further action (NFA) for installation restoration (IR) Site 12 (former battery storage area) and land use controls and long-term monitoring to address residual contamination associated with Site 6, Site 15, and Site 17 at NWS Earle.

The remedial action decision is in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision document explains the factual and legal basis for selecting the remedial action and is based on the Administrative Record for OU 9. Remedial Investigation/Feasibility Study (RI/FS) reports and other information used in the remedy selection process are part of the Administrative Record file for OU 9, which is available at the Monmouth County Library, Eastern Branch, Route 35, Shrewsbury, New Jersey.

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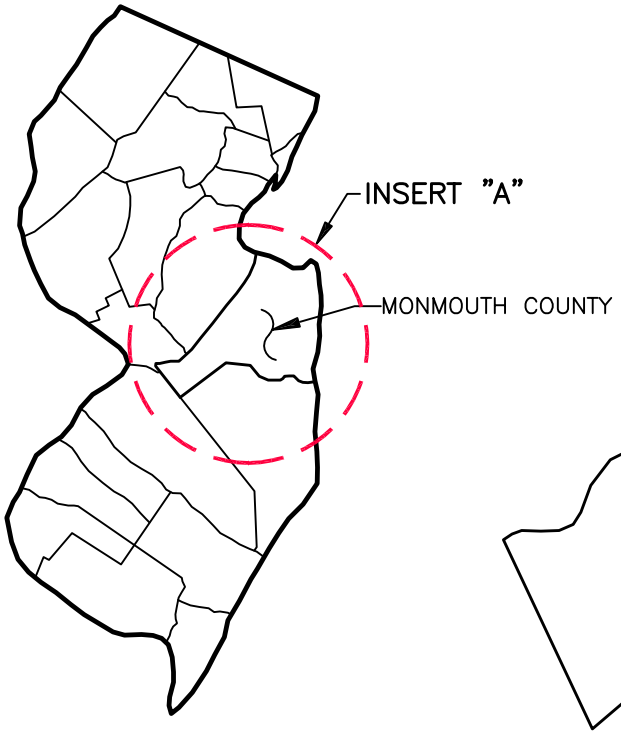
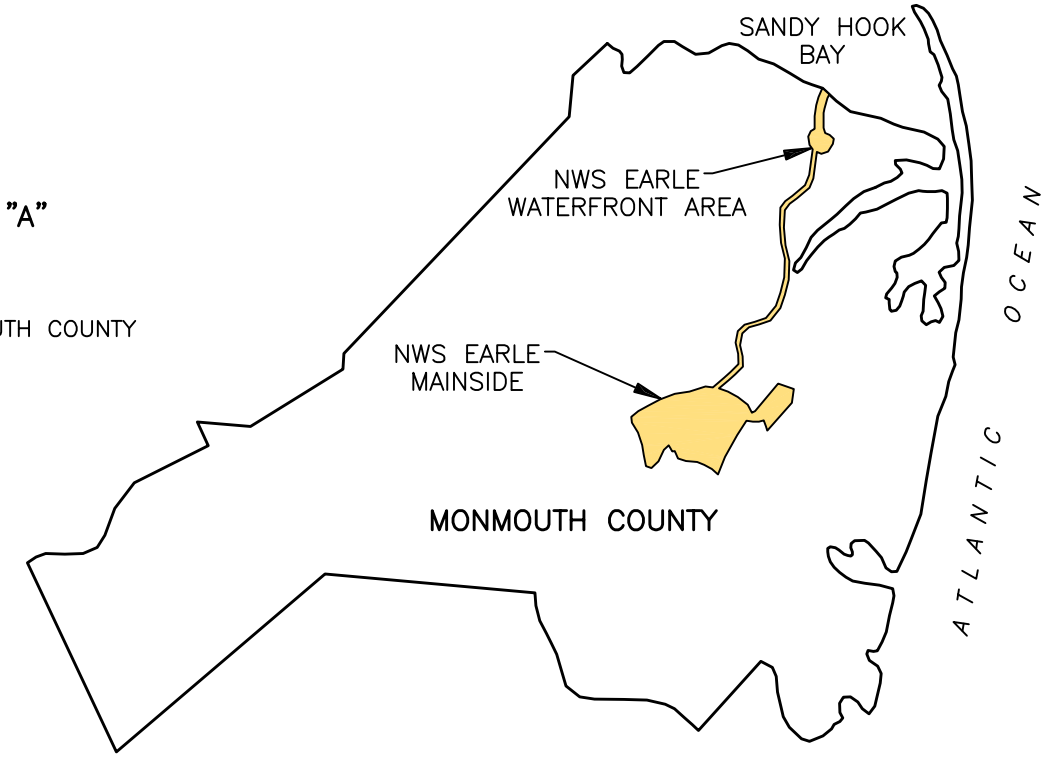


STATE OF NEW JERSEY



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REGIONAL SITE MAP
NAVAL WEAPONS STATION EARLE
COLTS NECK, NEW JERSEY

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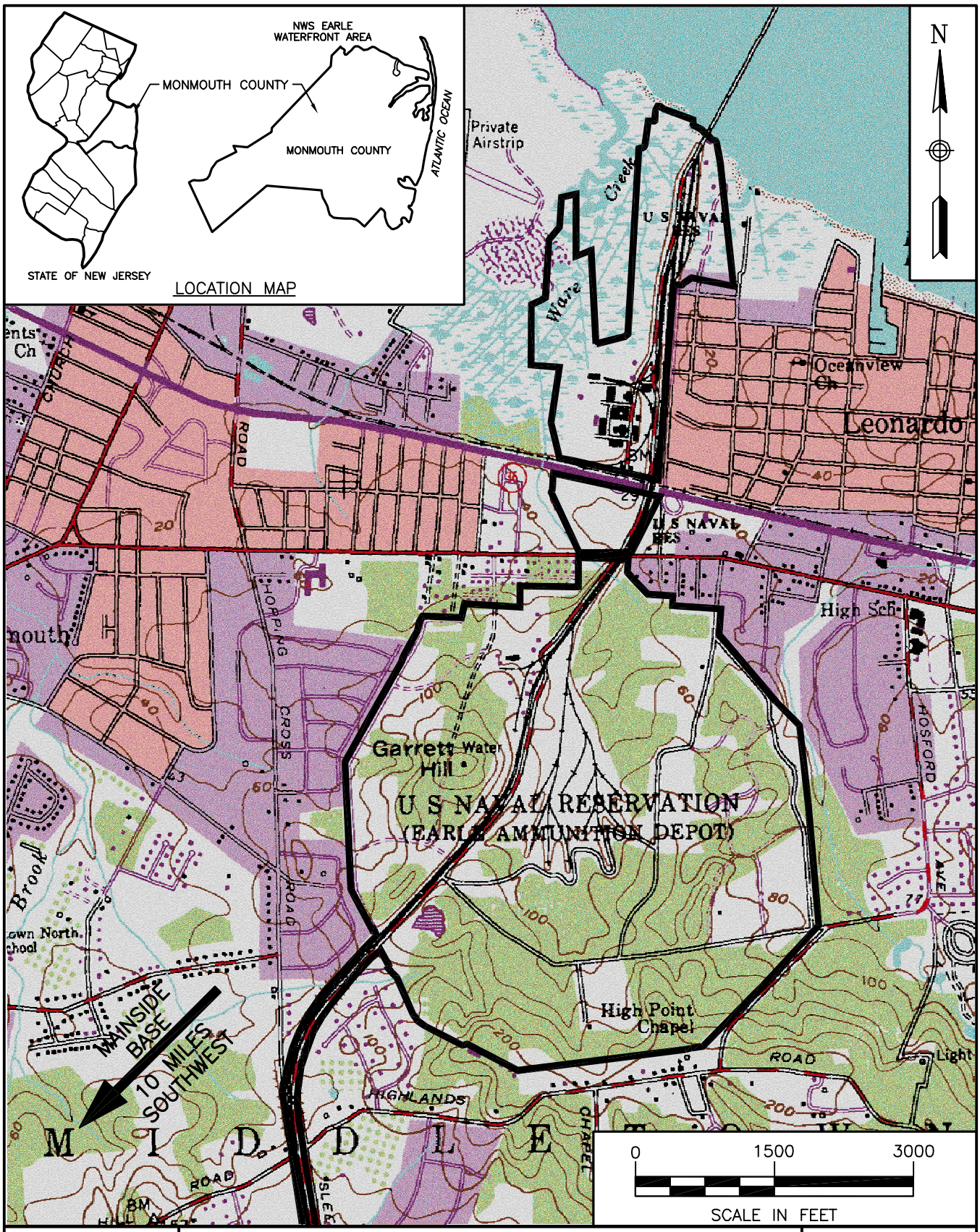

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GENERAL LOCATION MAP WATERFRONT AREA
NAVAL WEAPONS STATION
COLTS NECK, NEW JERSEY

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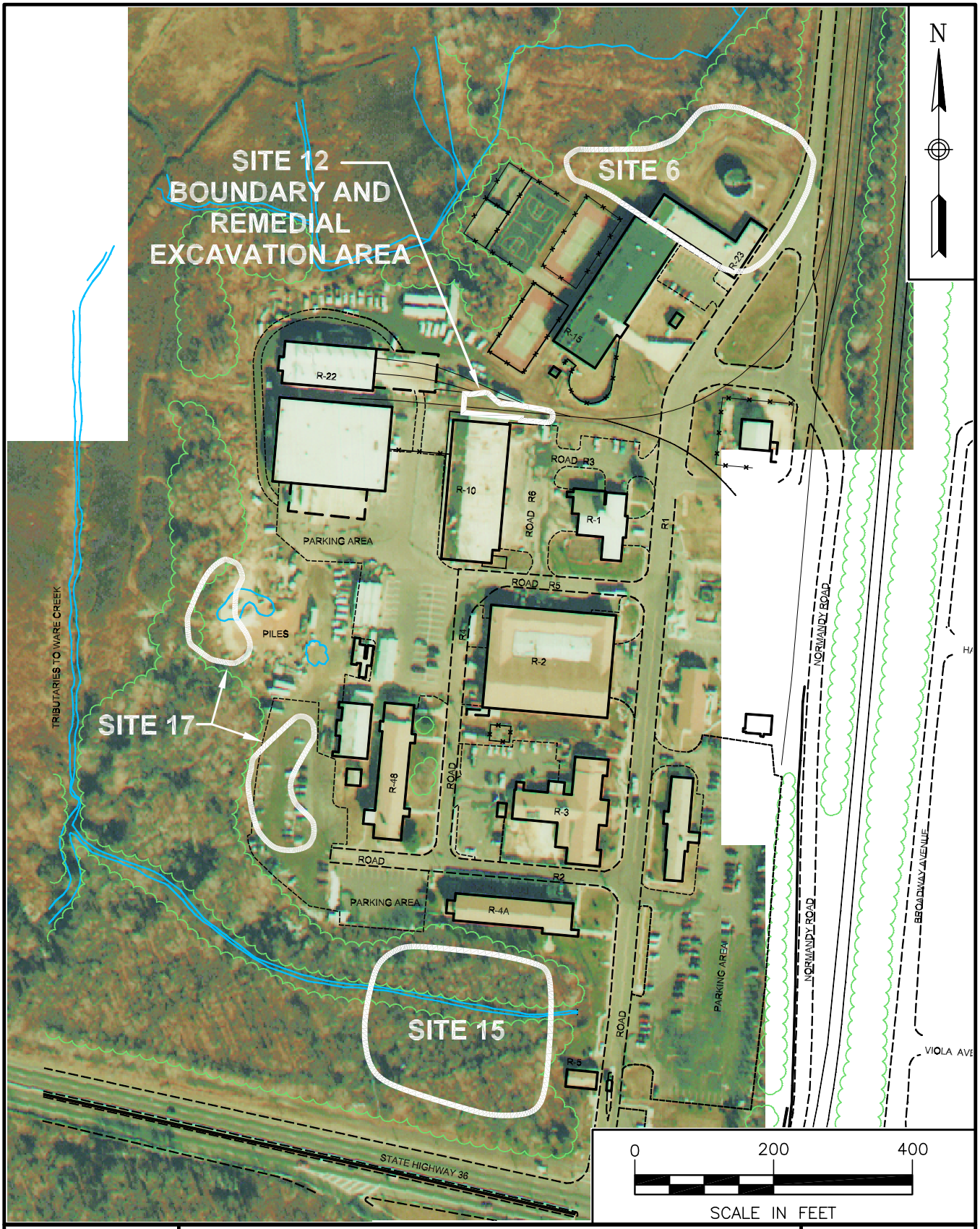

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LOCATION MAP
SITES 6, 12, 15, & 17
NAVAL WEAPONS STATION
COLTS NECK, NEW JERSEY

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FIGURE NUMBER	FIGURE 3

The New Jersey Department of Environmental Protection (NJDEP) has commented on the selected remedy and concurs. NJDEP comments have been incorporated into this ROD. A review of the public response to the Proposed Remedial Action Plan (PRAP) is included in the Responsiveness Summary (Part III) of this decision document. The state concurrence letter is included in Appendix A. Terms used in the ROD are presented in Appendix B.

III. ASSESSMENT OF THE SITE

Pursuant to duly delegated authority, I hereby determine, pursuant to Section 106 of CERCLA, 42 U.S.C. § 9606, that actual or threatened releases of hazardous substances from OU 9, as discussed in Part II, Section VI (Summary of Site Risks) of this ROD, if not addressed by implementing the remedial action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment. OU 9 Site 12, having been remediated by a soil removal action, does not require action to prevent immediate or substantial danger to public health, welfare, or the environment.

IV. DESCRIPTION OF THE SELECTED REMEDY

The Department of the Navy (Navy) and the United States Environmental Protection Agency (EPA), in consultation with NJDEP, have selected remedies for four sites which comprise OU 9, as described below. The selected remedies for Sites 6, 12, 15, and 17 include the following major components:

Site 6 – Landfill West of Normandy Road

The remedy includes land use controls and long-term groundwater monitoring to protect potential human receptors from contact with untreated groundwater until concentrations are at such levels to allow for unrestricted use and exposure.

1. Land Use Controls (LUCs) will be implemented by the Navy according to the document entitled, "Principles and Procedures for Specifying, Monitoring and Enforcement of Land Use Controls and Other Post-ROD Actions" as agreed between EPA and the Department of Defense (DoD). A LUC Remedial Design (RD) will be prepared as the land use component of the RD. Within 90 days of ROD signature, the Navy shall prepare and submit to EPA for review and approval a LUC remedial design that shall contain implementation and maintenance actions, including periodic inspections. The RD for LUCs will be incorporated into the Base Master Plan to prevent use of untreated groundwater from the aquifer beneath the site for purposes other than environmental monitoring and testing without Navy approval until groundwater is found to meet the New Jersey groundwater quality standards (GWQS) and EPA Safe Drinking Water Act (SDWA) maximum contaminant levels (MCLs). A Classification Exception Area (CEA) pursuant to New Jersey Administrative

Code (N.J.A.C.) 7:9-6 will be established to provide the state official notice that the constituent standards will not be met for a specified duration anticipated not to exceed 10 years and to ensure that use of the groundwater in the affected area is prohibited until two consecutive sampling events during bi-annual sampling result in no groundwater contaminant concentrations in excess of GWQS or MCLs. The Navy is responsible for implementing, maintaining, reporting on, and enforcing the LUCs described in the ROD in accordance with the RD for LUCs.

The LUC objectives are:

a. Maintain the integrity of any current or future remedial or monitoring system such as monitoring wells, fencing and the landfill cover;
b. Except for environmental monitoring, prevent access or use of untreated groundwater until cleanup levels are met; and
c. Prohibit the development and use of property for residential housing, elementary and secondary schools, child care facilities and playgrounds.

These objectives will be implemented through mechanisms, such as the RD for LUCs amended to the Base Master Plan, adequate fencing, establishment of the NJDEP-compliant CEA, and conduct of a site review every five years.

2. Long-term periodic groundwater monitoring will be conducted to assess contaminant status and potential threats to human health and the environment. Since wastes will be left in place, site conditions and risks will be reviewed every five years.

3. Current fencing at the site will be evaluated to determine if it can be used in lieu of new fencing for this remedial alternative.

Site 12 – Battery Storage Area

The Navy and the EPA, in consultation with NJDEP, have selected NFA as the preferred remedial alternative for OU 9 Site 12. As a result of previously conducted contaminated soil excavation/removal and confirmatory sampling, the Navy, EPA and NJDEP have determined that the remediation goals for protection of human health and the environment have been achieved.

Site 15 – Sludge Disposal Site

The remedy includes land use controls and long-term soil monitoring to protect potential human receptors from contact with contaminated soil, at concentrations above New Jersey residential direct contact soil cleanup criteria, until concentrations are reduced by natural attenuation mechanisms to such levels as to allow for unrestricted use and exposure.

1. LUCs will be implemented by the Navy according to the document entitled, "Principles and Procedures for Specifying, Monitoring and Enforcement of Land Use Controls and Other Post-ROD Actions" as agreed between EPA and the DoD. A LUC RD will be prepared as the land use component of the RD. Within 90 days of ROD signature, the Navy shall prepare and submit to EPA for review and approval a LUC remedial design that shall contain implementation and maintenance actions, including periodic inspections. The RD for LUCs will be incorporated into the Base Master Plan to restrict the future use of the site to its present security buffer use. Activities to be prohibited will include digging into or disturbing site soils and residential development on the site. The Navy is responsible for implementing, maintaining, reporting on, and enforcing the LUCs described in the ROD in accordance with the RD for LUCs.

The LUC objectives are:

a. Maintain the integrity of any current or future remedial or monitoring system such as soil sample locations, fencing and signage;
b. Except for environmental monitoring, prevent access to the site until regulatory levels are attained; and
c. Prohibit the development and use of property for residential housing, elementary and secondary schools, child care facilities and playgrounds or any use other than its current use as a security buffer zone.

These objectives will be implemented through mechanisms, such as the RD for LUCs amended to the Base Master Plan, fencing and signage, and conduct of a site review every five years.

2. Fencing will be erected to limit access to the site, to preclude excessive vehicular traffic, and to restrict human contact with contaminated surface and subsurface soil. Current fencing at the site will be evaluated to determine if it can be used in lieu of new fencing for this remedial alternative. Protection of human health is enhanced by the fact that the entire site is located within a red maple/sweet gum wetland that is fenced off from the Base by a double-fenced security buffer.

3. Long-term periodic soil monitoring will be conducted to assess contaminant status and potential threats to human health and the environment. Since soil contamination will be left in place at concentrations above New Jersey residential direct contact soil cleanup criteria, site conditions and risks will be reviewed every five years.

Site 17 – Landfill

The remedy includes land use controls and long-term groundwater monitoring to protect potential human receptors from contact with untreated groundwater until concentrations are at such levels to allow for unrestricted use and exposure.

1. LUCs will be implemented by the Navy according to the document entitled, "Principles and Procedures for Specifying, Monitoring and Enforcement of Land Use Controls and Other Post-ROD Actions" as agreed between EPA and the DoD. A LUC RD will be prepared as the land use component of the RD. Within 90 days of ROD signature, the Navy shall prepare and submit to EPA for review and approval a LUC remedial design that shall contain implementation and maintenance actions, including periodic inspections. The RD for LUCs will be incorporated into the Base Master Plan to prevent use of untreated groundwater from the aquifer beneath the site for purposes other than environmental monitoring and testing without Navy approval until groundwater is found to meet GWQS and SDWA MCLs. A CEA pursuant to N.J.A.C. 7:9-6 will be established to provide the state official notice that the constituent standards will not be met for a specified duration anticipated not to exceed 10 years and to ensure that use of the groundwater in the affected area is prohibited until two consecutive sampling events result in no groundwater contaminant concentrations in excess of GWQS or MCLs. The Navy is responsible for implementing, maintaining, reporting on, and enforcing the LUCs described in the ROD in accordance with the RD for LUCs.

The LUC objectives are:

   a. Maintain the integrity of any current or future remedial or monitoring system such as monitoring wells, fencing and landfill cover;
   b. Except for environmental monitoring, prevent access or use of untreated groundwater until cleanup levels are met; and
   c. Prohibit the development and use of property for residential housing, elementary and secondary schools, child care facilities and playgrounds.

These objectives will be implemented through mechanisms, such as the RD for LUCs amended to the Base Master Plan, adequate fencing, establishment of the NJDEP-compliant CEA, and conduct of a site review every five years.

2. Long-term periodic groundwater monitoring will be conducted to assess contaminant status and potential threats to human health and the environment. Since wastes will be left in place, site conditions and risks will be reviewed every five years.

3. Current fencing at the site will be evaluated to see if it can be used in lieu of new fencing for this remedial alternative.

V. STATUTORY DETERMINATION

The selected remedy is protective of human health and the environment and is cost effective. The Navy and EPA believe that the selected remedy will comply with all federal and state requirements that are legally applicable or relevant and appropriate (ARAR) to the remedial action. The selected remedy utilizes a permanent solution to the maximum extent practicable.

Because this remedy will result in hazardous substances remaining on site above health-based levels, a review by the Navy, EPA, and NJDEP will be conducted within five-years after initiation of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

No further remedial action is necessary to ensure protection of human health and the environment at Site 12.

RECORD OF DECISION
SITES 6, 12, 15, AND 17
OPERABLE UNIT 9 (OU 9)
NAVAL WEAPONS STATION EARLE
COLTS NECK, NEW JERSEY

The foregoing represents the selection of a remedial action by the U.S. Department of the Navy and the U.S. Environmental Protection Agency, with the concurrence of the New Jersey Department of Environmental Protection. Concur and recommend for immediate implementation:

George Pavlou
Director, ERRD
U.S. Environmental Protection Agency, Region II

9/28/07
Date

RECORD OF DECISION
SITES 6, 12, 15, AND 17
OPERABLE UNIT 9 (OU 9)
NAVAL WEAPONS STATION EARLE
COLTS NECK, NEW JERSEY

The foregoing represents the selection of a remedial action by the U.S. Department of the Navy and the U.S. Environmental Protection Agency, with the concurrence of the New Jersey Department of Environmental Protection. Concur and recommend for immediate implementation:

G. A. Maynard
Captain, U.S. Navy
Commanding Officer
Naval Weapons Station Earle

28 Sep 2007
Date

RECORD OF DECISION
NAVAL WEAPONS STATION EARLE
OPERABLE UNIT 9
SITES 6, 12, 15, AND 17

PART II - DECISION SUMMARY

I. SITE NAME, LOCATION, AND DESCRIPTION

A. General

NWS Earle is located in Monmouth County, New Jersey, approximately 47 miles south of New York City. The station consists of two areas, the 10,248-acre Main Base (Mainside area), located inland, and the 706-acre Waterfront area, located on the Sandy Hook Bay (Figure 1). The two areas are connected by a Navy-controlled right-of-way. The facility was commissioned in 1943, and its primary mission is to supply ammunition to the naval fleet. An estimated 2,500 people either work or live at NWS Earle.

The Mainside area is located approximately 10 miles inland from the Atlantic Ocean in Colts Neck, Howell and Wall Townships, and Tinton Falls Borough. The combined population of these municipalities is approximately 100,000 people. The surrounding area includes agricultural land, vacant land, and low-density housing. The Mainside area consists of a large, undeveloped portion associated with ordnance operations, production, and storage; this portion is encumbered by explosive safety quantity distance (ESQD) arcs. Other land use in the Mainside area consists of residences, offices, workshops, warehouses, recreational space, open space, and undeveloped land. The Waterfront area is located adjacent to Sandy Hook Bay in Middletown Township, which has a population of approximately 68,200 people. The Mainside and Waterfront areas are connected by a narrow strip of land that serves as a government-controlled right-of-way containing a road and railroad. OU 9 sites are located in the Waterfront Administration area (Figures 2 and 3). The Waterfront Administration area is not encumbered by ESQD arcs. Future land use is not expected to vary significantly from current land use unless a major base realignment was to occur.

B. Site 6 – Landfill West of Normandy Road

The Site 6 Landfill West of Normandy Road is a four-acre site located in the Waterfront area (Figure 3). From 1943 to 1965, the site was used to dispose of refuse from the Waterfront area consisting of dunnage lumber, glass, paper, packing material, and small amounts of paint and solvent. It was reported that wastes were burned before they were covered, and an estimated 2,500 tons of waste

were deposited annually at the landfill. The landfill area may have been part of a salt marsh before disposal began. Currently, the majority of the landfill surface is paved or covered with buildings. A site layout map is presented as Figure 4.

C. Site 12 – Battery Storage Area

Site 12 is a paved area adjacent to the loading dock east of Building R-10 located in the Waterfront area (Figure 3). The site was used as a temporary staging area for forklift batteries being sent off site to be reclaimed. The storage area occupied various portions of the paved area at different times but was generally limited to approximately 7,500 to 10,000 square feet at the northern end of the paved area adjacent to Building R-10. A site layout map is provided as Figure 5.

D. Site 15 – Sludge Disposal Area

The Site 15 sludge disposal area reportedly occupied a small area (approximately one-acre) along the former railroad tracks near the main entrance to the Waterfront area (Figure 3). In the early 1970s, the site was used for disposal of an unknown amount of oily bilge sludge. It is estimated that over 5,000 gallons of sludge, which may have ranged from one percent to 25 percent oil, may have been disposed at the site. The exact location of sludge disposal activities was not apparent during site inspections. The site is near an elevated railroad bed built approximately six feet above the surrounding ground surface. A site layout map is presented in Figure 6.

E. Site 17 – Landfill

The Site 17 former landfill occupies three acres in the Waterfront area, adjacent to a tidal marsh in the Ware Creek drainage basin (Figure 3). The site was reportedly used for the disposal of wood, heavy equipment, empty paint cans, and construction debris. Disposal at Site 17 reportedly occurred during the early 1940s. No slope stabilization work was performed at Site 17. However, grading, topsoil cover placement and seeding was conducted on the flat portion of the site. In addition, the Navy installed a wooden barricade to prevent any future deposition of soils or debris on the sloped area of Site 17. Currently, the landfill surface at Site 17 is paved or is covered with hard packed gravel and is currently utilized as a parking area for Waterfront personnel. The face of the landfill is 10 to 15 feet higher in elevation than the marsh area and is heavily vegetated. A site layout map is provided as Figure 7.

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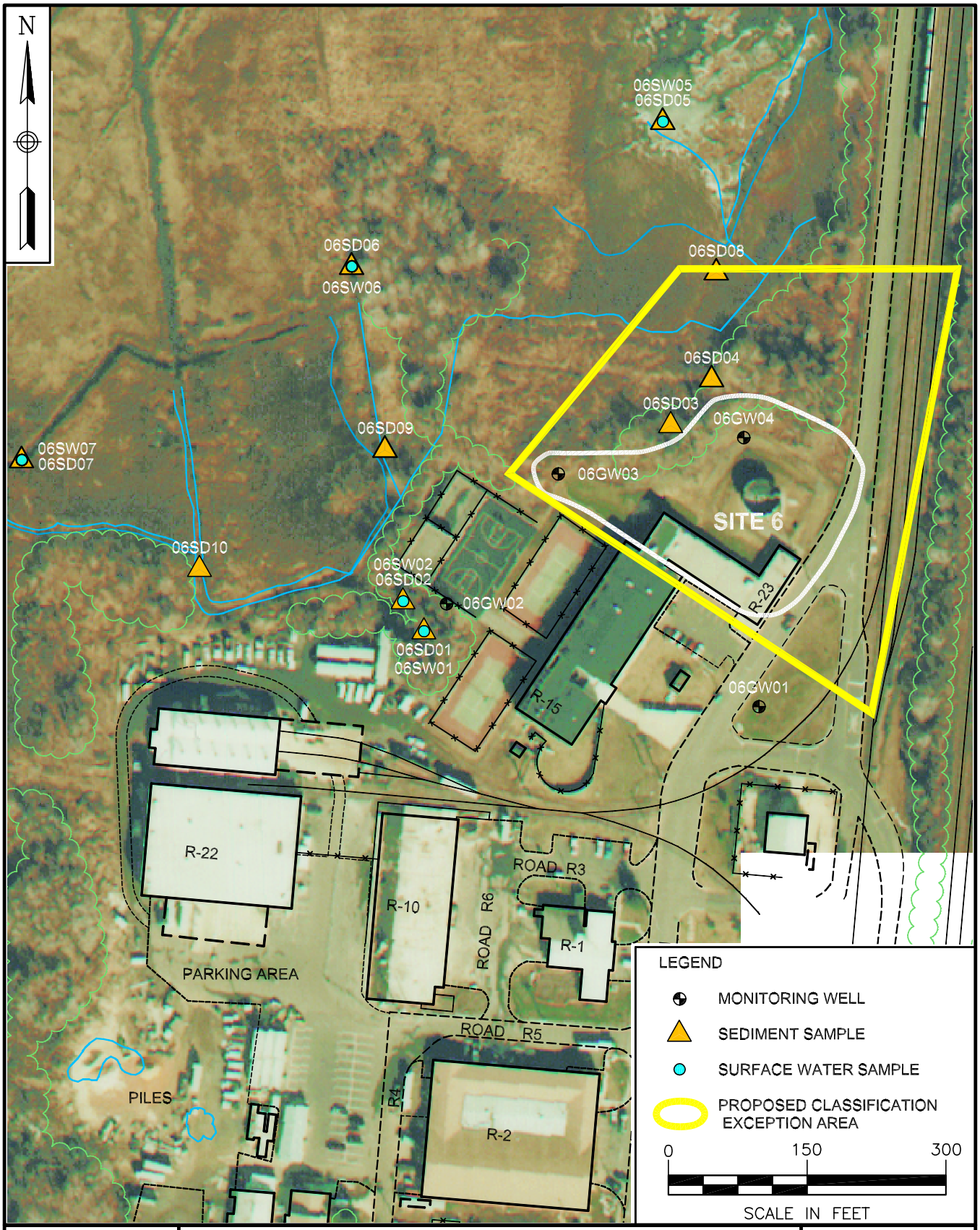

TETRA TECHNUS, INC.

SITE 6 LAYOUT MAP
NAVAL WEAPONS STATION
COLTS NECK, NEW JERSEY

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DATE	11/21/05
FIGURE NUMBER	FIGURE 4

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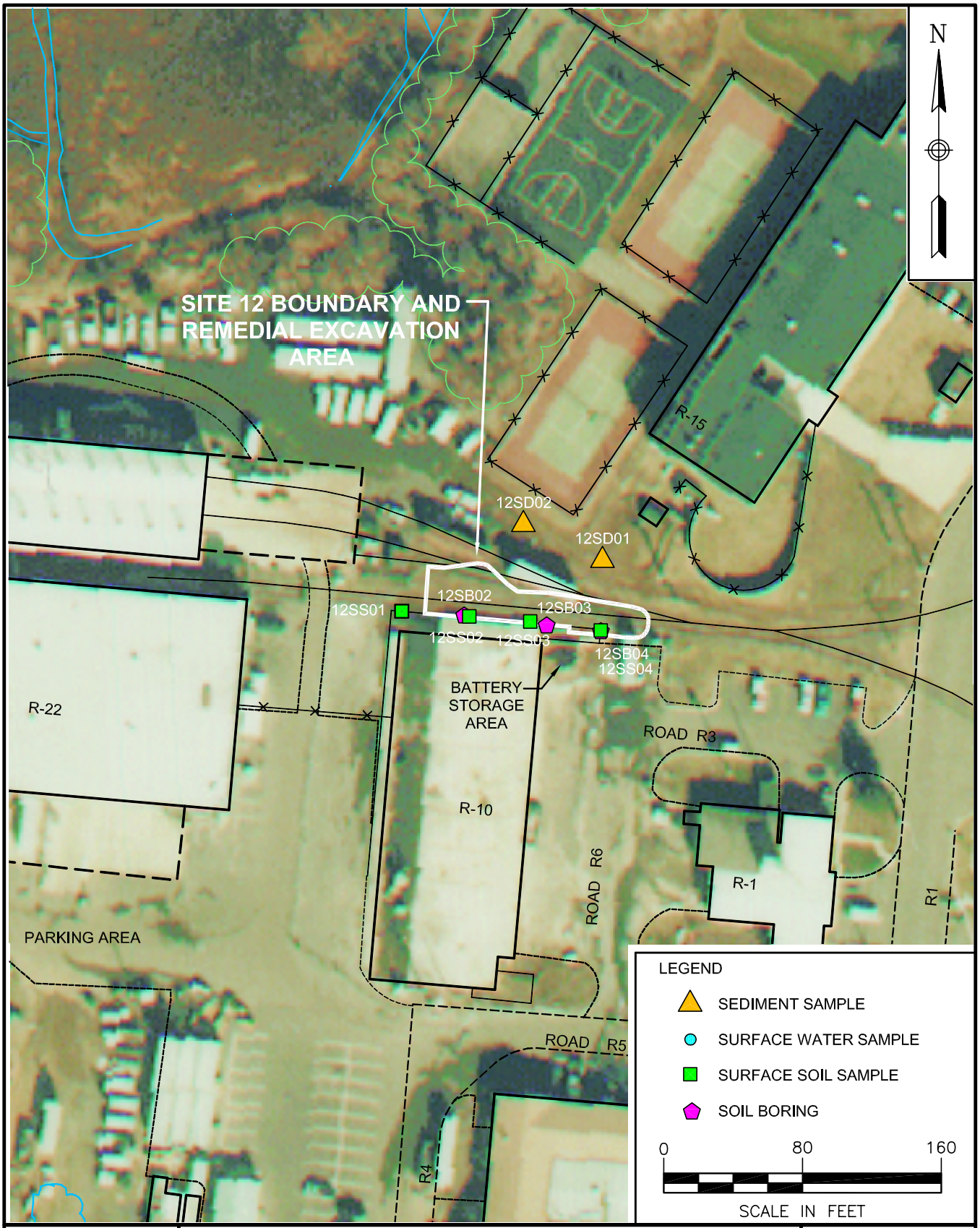

TETRA TECHNUS, INC.

SITE 12 LAYOUT MAP
NAVAL WEAPONS STATION
COLTS NECK, NEW JERSEY

SCALE	AS NOTED
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DATE	06/27/05
FIGURE NUMBER	FIGURE 5

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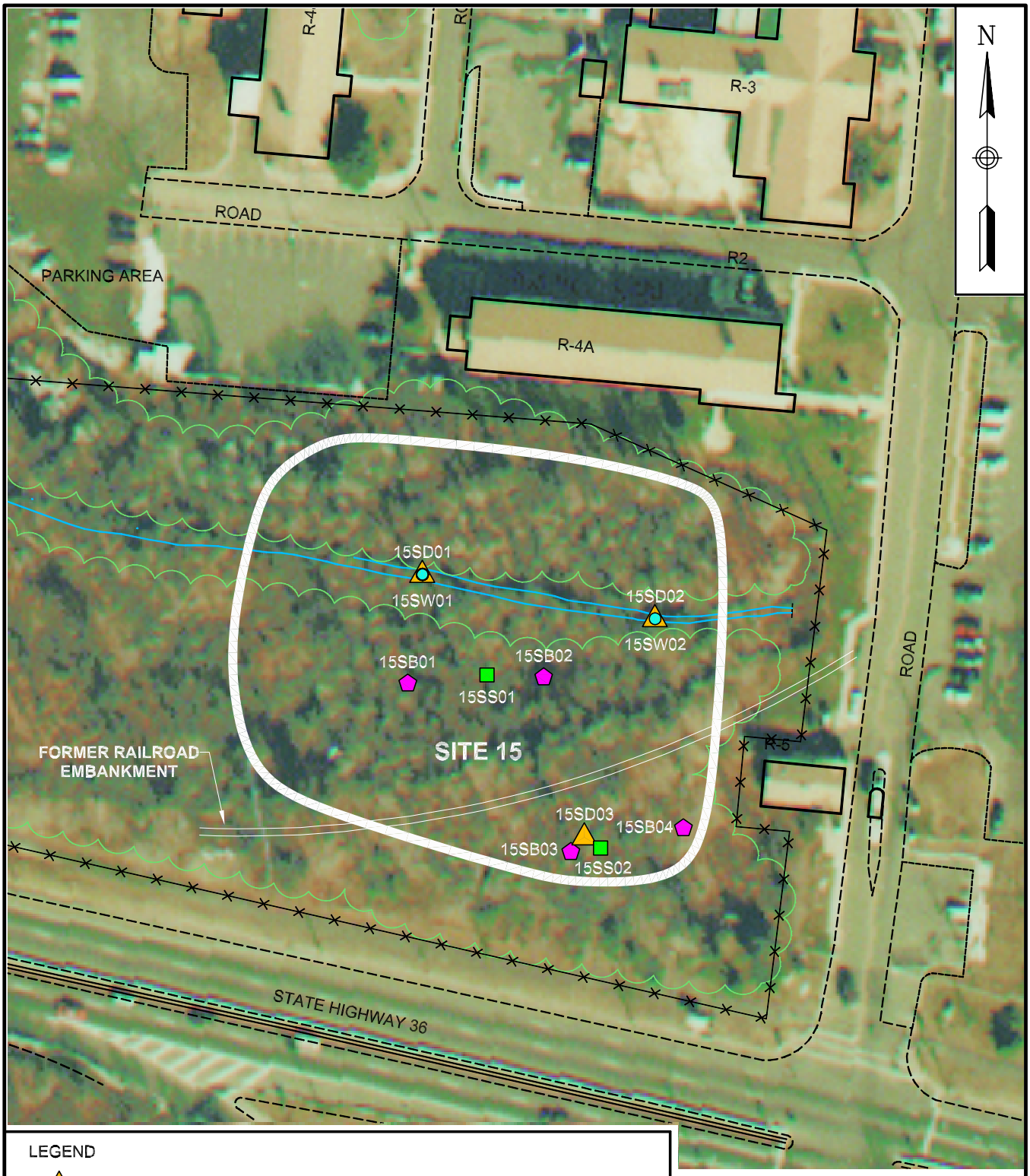

LEGEND

- SEDIMENT SAMPLE
- SURFACE WATER SAMPLE
- SURFACE SOIL SAMPLE
- SOIL BORING
- APPROXIMATE SECURITY FENCE LOCATION

0 80 160

SCALE IN FEET

TETRA TECHNUS, INC.

SITE 15 LAYOUT MAP
NAVAL WEAPONS STATION
COLTS NECK, NEW JERSEY

SCALE	AS NOTED
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REV	0
DATE	11/21/05
FIGURE NUMBER	FIGURE 6

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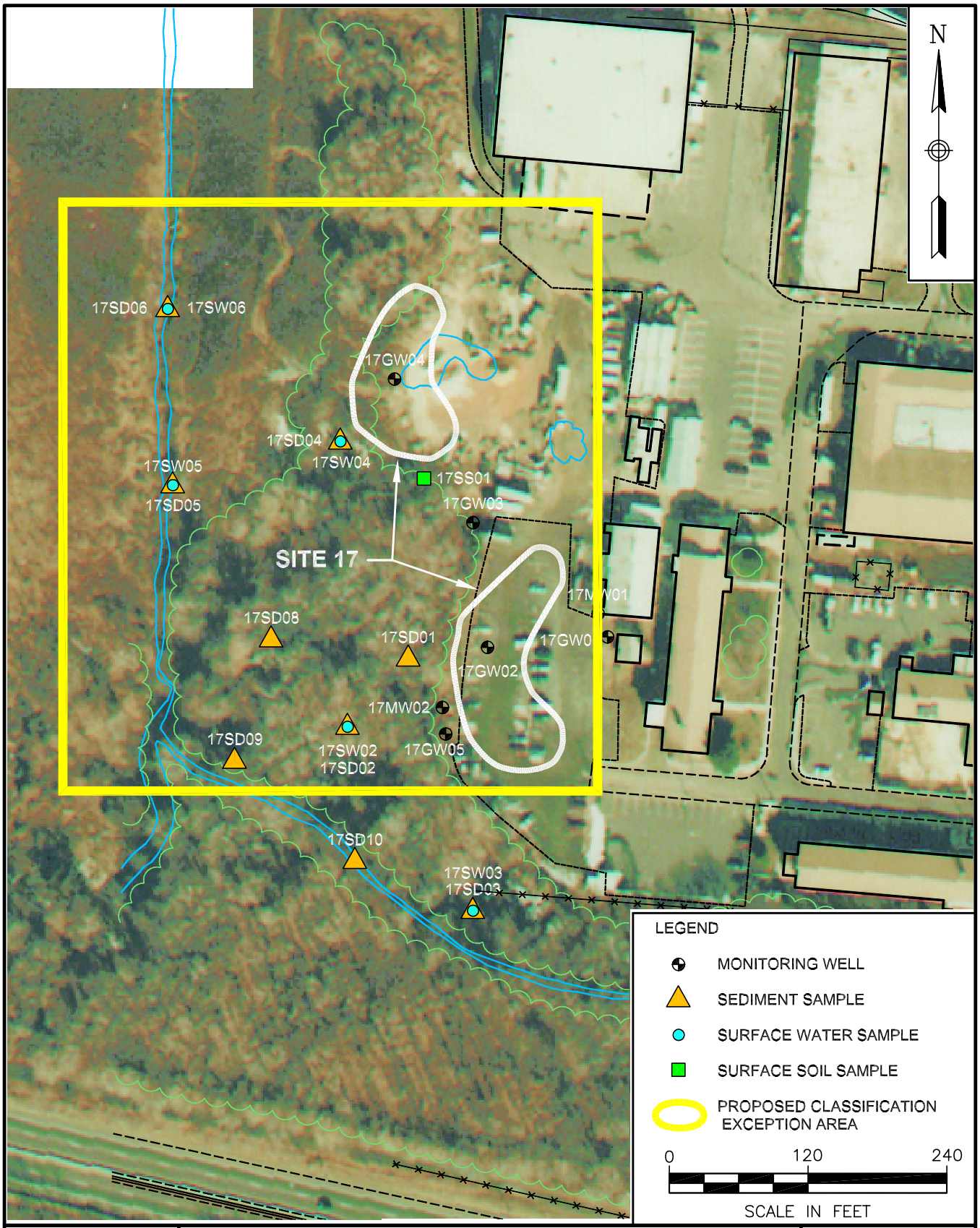

TETRA TECHNUS, INC.

SITE 17 LAYOUT MAP
NAVAL WEAPONS STATION
COLTS NECK, NEW JERSEY

SCALE	AS NOTED
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REV	0
DATE	11/21/05
FIGURE NUMBER	FIGURE 7

II. SITE HISTORY AND ENFORCEMENT ACTIVITY

Potential hazardous substance releases at NWS Earle were addressed in an Initial Assessment Study (IAS) in 1983 and a Site Inspection Study (SI) in 1986. These were preliminary investigations to determine the number of sources, compile histories of waste-handling and disposal practices at the sites, and acquire data on the types of contaminants present and potential human health and/or environmental receptors. In 1990, NWS Earle was placed on the National Priorities List (NPL), which is a list of sites where uncontrolled hazardous substance releases may potentially present serious threats to human health and the environment.

The sites at NWS Earle were then addressed by Phase I RI and Phase II RI activities to determine the nature and extent of contamination at these sites. The Phase I RI investigation was initiated in 1993 and provided data used to plan the more comprehensive Phase II RI investigation initiated in 1995 and completed in July 1996, when the final RI report was released. Addendum RI activities for these sites were performed in October and November 1996 and completed in January 1998. The RI and Addendum RI investigations at Sites 6 and 17 included the installation and sampling of monitoring wells, collection of surface water, and sediment samples. Site 17 also included the collection of surface soil samples. Site 12 and 15 included the collection of sediment, surface and subsurface soil samples. Site 15 also included the collection of surface water samples.

Results from the RI and Addendum RI report, including human health and ecological risk assessment, were used as the basis for performing a FS of potential remedial alternatives. The FS for OU 9 was submitted in November 2003. Based on the alternatives development from the FS, the Navy and EPA, in consultation with NJDEP, prepared the PRAP. The PRAP is the basis for the selected remedial alternatives presented in this ROD. The RI, FS, PRAP and community input are discussed in this ROD.

III. HIGHLIGHTS OF COMMUNITY PARTICIPATION

The documents that the Navy and EPA used to develop, evaluate, and select a remedial alternative for OU 9 have been maintained in the official Administrative Record repository at the Monmouth County Library (Eastern Branch), Route 35, Shrewsbury, New Jersey.

The PRAP for OU 9 was released to the public on September 22, 2004. The notice of availability of this document was published in the Asbury Park Press on September 29 and 30, 2004 and October 1, 2004. A public comment period was held from October 1, 2004 to October 30, 2004.

A public meeting was held during the public comment period on October 5, 2004. At this meeting, representatives from the Navy, EPA and NJDEP were available to answer questions about OU 9 and the remedial alternatives under consideration. The results of the public comment period are included in the Responsiveness Summary, which is included in Part III of this ROD.

IV. SCOPE AND ROLE OF RESPONSE ACTION FOR OPERABLE UNIT 9

The Navy completed an RI, FS, and PRAP for OU 9, addressing contamination associated with Sites 6, 12, 15 and 17 at NWS Earle. These studies showed that groundwater (metals contamination) at Site 6, surface and subsurface soil (metals contamination) at Site 15, and groundwater (metals contamination) at Site 17 pose hazards to potential human and ecological receptors. The selected remedial action to address site contamination at each site is described in this document. Site 12 does not require further remedial action.

V. SUMMARY OF SITE CHARACTERISTICS

A. General

NWS Earle is located within the Atlantic Coastal Plain Physiographic Province. The Waterfront area lies in an area known as the Bayshore Lowlands. The property and associated piers occupy a narrow strip of land running roughly perpendicular to the shoreline that serves as access from the ammunition depot (located one-mile inland). This thin strip of land consists primarily of tidal marsh and swamp with areas of fill and has an average elevation of approximately 10 feet above mean sea level (MSL). The New Jersey Coastal Plain is a seaward-dipping wedge of unconsolidated Cretaceous to Quaternary sediments that were deposited on a pre-Cretaceous basement-bedrock complex. The Coastal Plain sediments are primarily composed of clay, silt, sand, and gravel and were deposited in continental, coastal, and marine environments. The sediments generally strike northeast-southwest and dip to the southeast at a rate of 10 to 60 feet per mile. The approximate thickness of these sediments beneath NWS Earle is 900 feet. The pre-Cretaceous complex consists mainly of PreCambrian and lower Paleozoic crystalline rocks and metamorphic schists and gneisses. The Cretaceous to Miocene Coastal Plain Formations are either exposed at the surface or subcrop in a banded pattern that roughly parallels the shoreline. The outcrop pattern is caused by the erosion truncation of the dipping sedimentary wedge. Where these formations are not exposed, they are covered by essentially flat-lying post-Miocene surficial deposits.

The rivers and streams draining NWS Earle ultimately discharge to the Atlantic Ocean. Surface water drainage from the Waterfront area enters Sandy Hook Bay. Much of this area is under tidal influence.

Most of the surface drainage from the Chapel Hill area flows northward to Sandy Hook Bay via Compton, Ware, and Wagner Creeks.

Surface runoff follows topographic gradients to storm drains and drainage ditches or occurs as overland flow that discharges to local surface water bodies. The Waterfront is situated in the recharge area of the Wenonah-Mount Laurel aquifer system, the Englishtown aquifer, and the Red Bank Sand aquifer. The Englishtown aquifer is a significant source of water in Monmouth County and is developed in the sands of the Englishtown Formation. The four Waterfront sites that comprise OU 9 (Sites 6, 12, 15, and 17) are located in the recharge area of the Englishtown aquifer.

All facilities located in the Waterfront area are connected to a public water supply (New Jersey American Water Company). Water for the public supply network comes from surface water intakes, reservoirs, and deep wells. No public water supply wells or surface water intakes are located on the NWS Earle facility. A combination of private wells and public water supply from the New Jersey American Water Company serves businesses and residences in areas surrounding the Waterfront facilities.

B. Surface Water Hydrology

Site 6

The Site 6 landfill area may have been part of a salt marsh before disposal began. Currently, the majority of the landfill surface is paved or covered with buildings. Therefore, infiltration is limited across the site. Storm water runoff flows to the north into the salt marsh. The salt marsh discharges to Sandy Hook Bay via several tributary streams.

Site 12

Infiltration at Site 12 is limited. Surface runoff is directed to a storm water collection basin that discharges through a concrete culvert to a drainage swale and eventually to the salt marsh north of the site. The salt marsh discharges to Sandy Hook Bay via several tributary streams.

Site 15

Site 15 is located within a red maple/sweet gum wetland and is fenced off from the remainder of the Base by a double-fenced security buffer zone. A small drainage swale runs along the northern side of the site, and surface water from the site and the adjacent paved parking area flows toward this swale. This swale contains water only after precipitation. Wetlands are located both north and south of the site. The wetland in which Site 15 is located is connected to Ware Creek via a small drainage

way. Ware Creek is located in the salt marsh and is a tributary to Sandy Hook Bay. The Site 15 wetland is not tidally influenced.

Site 17

At Site 17 infiltration is limited by the hard packed, paved and built upon nature of the surface cover. Overland flow drains toward the salt marsh north and west of the site. The salt marsh discharges to the Sandy Hook Bay via several tributary streams.

C. Geology

Based on regional geological mapping, Sites 6, 12, 15 and 17 are part of the outcrop area of the Englishtown Formation. The Englishtown Formation ranges from 35 and 150 feet in thickness and consists of tan and gray, fine- to medium-grained quartz sand with local clay beds. In general, the borings at Waterfront sites encountered fill material, yellowish-brown clay, yellowish-brown, olive, and gray sand and silty sand, and gray silt. Based upon the boring log descriptions, the Waterfront monitoring wells penetrate fill material and the Englishtown Formation.

D. Hydrogeology

Groundwater in the fill material and Englishtown aquifer beneath all four OU 9 sites occurs under unconfined conditions, and the fill material and formation are interpreted to be hydraulically interconnected. Static water level measurements and water table elevations were obtained and plotted numerous times over the course of the RI/FS process. The direction of shallow groundwater flow in the aquifer is generally toward the north and northwest at each of the sites with a local groundwater flow pattern bias toward the northwest at Site 17 because of the salt marsh located to the west. There does not appear to be a significant seasonal variation in groundwater flow direction. Based on the boring log descriptions, all of the wells are screened across the contact between the fill material and the Englishtown Formation.

E. Nature and Extent of Contamination

1. Background Media Samples

In order to determine the background level of chemicals present in and around NWS Earle, the Navy collected samples from media at locations on the Station that were selected on the expectation that past or present operations have not impacted the media at these locations. The field team collected samples of surface soil, subsurface soil, sediment, surface water, and groundwater from areas throughout the Station. A total of four background samples were collected for each of the five media,

except at two locations where surface water and sediment media were not present. The samples were collected in areas hydraulically upgradient and, where possible, upwind of Station areas where industrial operations or other potential sources of contaminant accumulation in site media may have occurred.

2. Initial Assessment Study and Site Inspection Study Results

Site 6

The 1983 IAS consisted of interviews and on-site observations and did not recommend Site 6 for a confirmation study. However, the Navy followed the IAS with the 1993 Phase I RI and four soil borings were drilled and completed as monitoring wells at Site 6. Two soil samples were analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides, polychlorinated biphenyl (PCBs), and metals. Low levels of VOCs and two pesticides were detected in soil samples from the 06MW02 and 06MW03 well borings. Low levels of metals were also detected. No compounds exceeded the New Jersey Residential Direct Contact Soil Cleanup Criteria (RDCSCC). Four sediment samples were collected from the marsh area downgradient of the site. Elevated levels of metals, pesticides, SVOCs, and PCBs were detected above the lowest effects level (LEL) for the NJDEP Sediment Screening Values but well below the severe effects level (SEL). Groundwater samples were collected from the four monitoring wells and analyzed for metals, organics, and landfill parameters. Elevated levels of metals, one SVOC, and two miscellaneous parameters were detected. The following metals were detected above the GWQS: aluminum (up to 3110 ug/l), iron (up to 49800 ug/l), lead (up to 20.7 ug/l), manganese (up to 1650 ug/l), sodium (up to 60800 ug/l), and zinc(up to 216 ug/l). Concentrations of typical landfill parameter concentrations encountered in Site 6 groundwater samples were relatively low compared to typical groundwater concentrations found beneath active solid waste landfills.

Site 12

The 1983 IAS consisted of interviews and on-site inspection, and did not recommend Site 12 for a confirmation study based on the belief that any acids spilled would be buffered when they drained into the salt marsh. However, the Navy followed the IAS with the 1993 Phase I RI and one surface water sample and one sediment sample were collected from the downstream side of the storm water culvert outflow. No surface water or sediment was present at the upgradient portion of the drainage culvert at the time these samples were taken. The sediment sample was analyzed for VOCs, SVOCs, pesticides, PCBs, metals, and cyanide. Elevated levels of SVOCs, VOCs, pesticides, and metals were detected above the LEL for the NJDEP Sediment Screening Values but well below the SEL, except lead which was slightly above the SEL. The surface water sample was analyzed for VOCs, metals, and cyanide. Low levels of metals were detected in the surface water sample. Cyanide was not detected in either sample. An underground storage tank (UST) installed at the northeast corner of

building R-10 and located approximately adjacent to the former battery storage area was removed in 1994. Visual contamination of the soil was not observed during the tank removal. Upon removal, the tank and associated piping were examined and found in good condition, free of holes, and with minor rust and pitting. Four confirmation soil samples were obtained from the excavation sidewalls, and two samples were taken from the excavated soils. The excavation sidewall samples were analyzed for total petroleum hydrocarbons (TPH), and all had concentrations less than method detection limits of 56 to 61 mg/kg. The two soil pile samples had TPH concentrations of 460 mg/kg and 520 mg/kg. The soil was disposed as non-hazardous.

Site 15

The 1983 IAS consisted of interviews and visual inspection. Site 15 was not recommended for confirmation study because the exact location of disposal could not be determined and typical bilge water contained a low percentage of oil. However, the Navy followed the IAS with the 1993 Phase I RI and two subsurface soil samples, four sediment samples, and one groundwater (hydropunch) sample were collected and two soil borings were drilled at the site. The subsurface soil samples were collected at eight feet below ground surface (bgs) from soil boring 1 and at seven feet bgs from soil boring 2. The soil samples were analyzed for SVOCs; four SVOCs were detected at low concentrations below RDCSCC. The sediment samples were collected from 0 to 0.5 feet bgs from the drainage swale northeast of the site. The sediment samples were analyzed for SVOCs; four SVOCs were detected at low concentrations below the LEL for NJDEP Sediment Screening Values. One groundwater sample was collected from a hydropunch location between the two soil borings. The groundwater sample was analyzed for target analyte list (TAL) metals and target compound list (TCL) VOCs, SVOCs, pesticides, and PCBs. The hydropunch sample detected several metals above GWQS, including arsenic up to 20 ug/l, barium up to 2040 ug/l, beryllium up to 42.5 ug/l, chromium up to 1840 ug/l, lead up to 264 ug/l, nickel up to 557 ug/l, and silver up to 198 ug/l.

Site 17

The 1983 IAS, consisted of interviews and visual inspection. Site 17 was not recommended for a confirmation study because of the presence of largely inert and immobile materials. The IAS concluded minimal impact. However, the Navy followed the IAS with the 1993 Phase I RI and soil samples were collected from three soil borings and two of the four monitoring well borings. Soil borings were completed to the water table, and subsurface soil samples were collected between five and 11 feet bgs. Four monitoring wells were installed and screened in the upper water-bearing zone. In addition, four sediment samples were collected from the marsh area downgradient of the site. Soil samples were analyzed for metals and cyanide. Analytical results indicated that metals and cyanide were detected at low concentrations below RDCSCC, except for chromium in one sample, which was detected slightly above the RDCSCC (22.8 mg/kg). Elevated levels of SVOCs and pesticides were

detected in sediment samples. Three pesticides and one SVOC were detected above the LEL for the NJDEP Sediment Screening Values but well below the SEL. Groundwater samples were analyzed for TAL metals, TCL VOCs, SVOCs, pesticides, PCBs, and landfill parameters. Elevated levels of metals and landfill indicator parameters were present in groundwater above GWQS, including arsenic up to 16.5 ug/l, chromium up to 139 ug/l, and lead up to 80 ug/l.

3. Remedial Investigation Results

Site 6

Between June and October 1995, Brown and Root (B&R) Environmental conducted sampling and analysis of surface water, sediment, and groundwater at Site 6 and conducted a static water level survey. A land survey was conducted to establish the horizontal locations and vertical elevations of the sediment sample locations, the surface water sample locations, and new and existing monitoring wells.

Based on previous investigations including the 1996 RI, it was determined that further data were required to assess the ecological impacts on the adjacent wetlands. On October 29, 1996 and November 1, 1996, B&R Environmental conducted additional surface water and sediment sampling and analysis at Site 6. A survey was also conducted to establish horizontal locations and vertical elevations of these sampling locations.

Summary of Site 6 RI Results

Currently, the majority of the landfill surface is paved or covered with buildings. The landfill surface is three to 10 feet higher than the adjacent marsh and wetland areas, and the toe of the landfill is covered with vegetation. Infiltration is limited, and overland flow drains toward the salt marsh and eventually into Sandy Hook Bay. Groundwater flow is to the north and northwest based on measured groundwater levels.

Figures 8 and 9 present the RI sample locations and concentrations of compounds that exceeded screening levels in the 1996 RI and 1998 Addendum RI. Tables 1 through 5 present the occurrence and distribution of compounds found in Site 6 RI samples. Surface water and sediment sample analysis results were compared to NWS Earle site-wide background samples. Groundwater at Site 6, found in the fill and Englishtown Formation, was compared to samples taken from the fill and Englishtown Formation grouping of background groundwater samples taken at NWS Earle.

Slope stabilization work was performed by Foster Wheeler Environmental Corporation at Site 6 in 1999. The work included delineation of adjacent wetlands to determine boundaries for the

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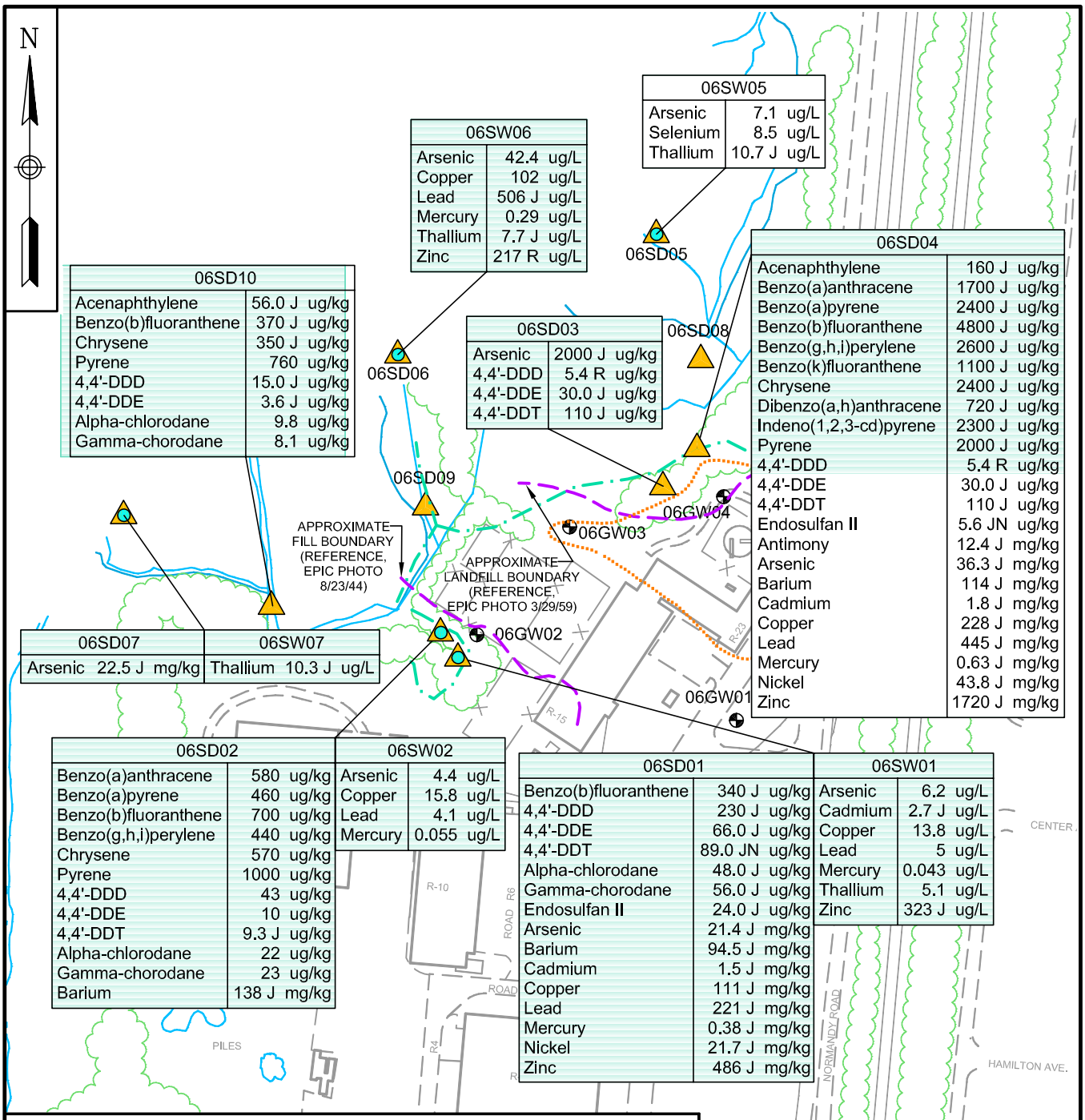
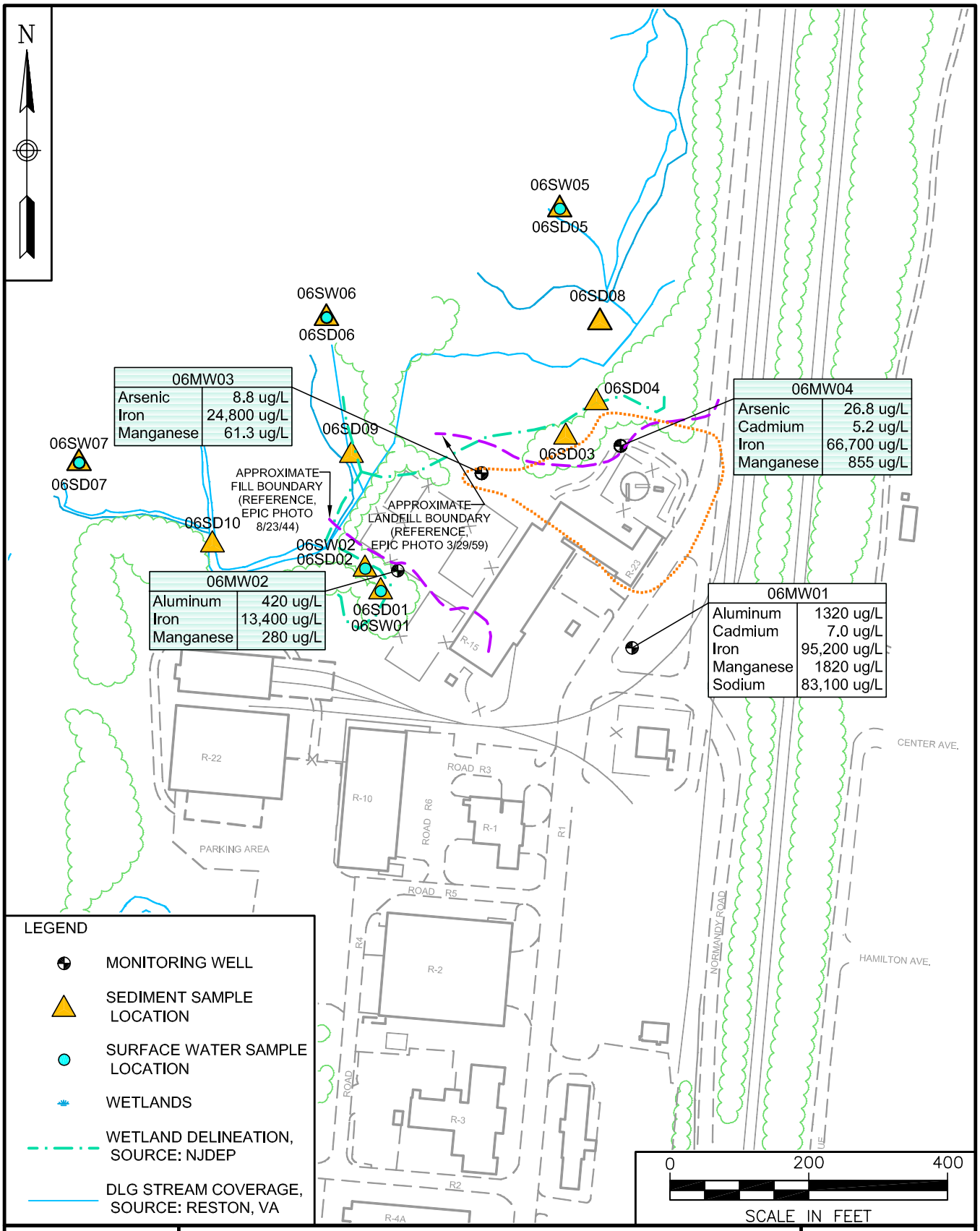


TETRA TECHNUS, INC.

SITE 6 SURFACE WATER AND SEDIMENT CONCENTRATIONS ABOVE SCREENING VALUES
NAVAL WEAPONS STATION
COLTS NECK, NEW JERSEY

SCALE	AS NOTED
FILE	2128CM05-1
REV	0
DATE	08/16/05
FIGURE NUMBER	FIGURE 8



TETRA TECHNUS, INC.

SITE 6 GROUNDWATER CONCENTRATIONS ABOVE SCREENING VALUES
NAVAL WEAPONS STATION
COLTS NECK, NEW JERSEY

SCALE	AS NOTED
FILE	2128CM05-2
REV	0
DATE	07/28/05
FIGURE NUMBER	FIGURE 9

TABLE 1
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN SEDIMENT AT SITE 6
OU-9 FEASIBILITY STUDY
NWS EARLE, COLTS NECK, NEW JERSEY
(mg/kg)

	BACKGROUND***				SITE-RELATED					
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	UTL**	2 X AVERAGE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > 2 X BKGD?	MEAN > BACK UTL?	REPRESENTATIVE CONCENTRATION
ALUMINUM	6 / 6	839 - 3940	8.1E+07	5459.67	10 / 10	2050 - 14500	5491.00	YES	NO	7578.17
ANTIMONY *	NOT DETECTED	-	-	-	2 / 10	0.51 - 12.4	2.42	YES	-	4.63
ARSENIC *	5 / 6	2.4 - 9.9	2.9E+02	11.23	10 / 10	1.9 - 36.3	13.93	YES	NO	21.60
BARIUM	6 / 6	3.2 - 15.8	2.9E+02	16.80	10 / 10	5 - 138	42.69	YES	NO	72.47
BERYLLIUM	4 / 6	0.34 0.57	3.3E-01	0.72	9 / 10	0.11 - 1.2	0.42	NO	YES	0.64
CADMIUM	2 6	0.44 - 0.46	1.1E+00	0.93	2 / 10	1.5 - 1.8	0.41	NO	NO	0.80
CALCIUM	6 / 6	179 - 518	6.7E+05	690.83	10 / 10	92.4 - 8820	1890.84	YES	NO	3522.28
CHROMIUM	6 / 6	4.3 - 56	2.8E+03	40.42	7 / 7	14.4 - 77.2	34.64	NO	NO	50.89
COBALT	4 / 6	0.51 2.1	6.4E+00	2.85	9 / 10	0.33 - 8.2	2.62	NO	NO	4.38
COPPER *	6 / 6	1 - 13	1.9E+01	9.08	10 / 10	0.75 - 228	39.85	YES	YES	82.70
IRON	6 / 6	228 - 21400	7.2E+09	23589	10 / 10	1790 - 52200	21524	NO	NO	32677
LEAD *	6 / 6	4 - 34.3	4.8E+01	21.07	10 / 10	3.8 - 445	80.28	YES	YES	163.62
MAGNESIUM	6 / 6	60.7 - 880	2.0E+06	809.90	9 / 10	401 - 2460	1185.04	YES	NO	2460.00
MANGANESE	6 / 6	3.9 - 63.1	8.9E+01	36.22	10 / 10	4.1 - 451	72.84	YES	NO	152.91
MERCURY *	1 / 6	0.068 0.068	8.5E-03	0.09	4 / 10	0.027 - 0.63	0.15	YES	YES	0.27
NICKEL	5 / 6	1.6 - 6	3.4E+01	6.90	10 / 10	0.93 - 43.8	9.09	YES	NO	17.03
POTASSIUM	5 / 6	86.1 - 2900	1.4E+07	1892.03	10 / 10	172 - 2630	1093.70	NO	NO	2411.68
SELENIUM	0 / 6	-	1.9E+00	-	4 / 10	1.2 - 3.4	1.22	YES	NO	1.88
SILVER	2 / 6	0.1125 0.15	2.8E+00	1.13	2 10	0.12 - 0.26	0.35	NO	NO	0.26
SODIUM	4 / 6	26.6 - 2280	2.9E+03	876.80	9 / 10	28.6 - 6960	1105.26	YES	NO	2320.44
THALLIUM *	NOT DETECTED	-	-	-	2 / 10	0.92 - 2.1	0.87	YES	-	0.98
VANADIUM	6 / 6	5.9 - 42.7	2.1E+03	39.42	10 / 10	3.9 - 104	37.67	NO	NO	104.00
ZINC	6 / 6	12.5 - 34.7	1.5E+03	41.23	10 / 10	4.5 - 1720	244.76	YES	NO	556.85

* - Selected as a COPC

** - Upper Tolerance Limit = UTL is the concentration that is estimated to contain a designated portion (95%) of all possible sample measurements.

*** - Background samples are as follows: BGSD01, BGSD02, BGSD04 through BGSD07

TABLE 2

OCCURRENCE AND DISTRIBUTION OF ORGANICS IN SEDIMENT AT SITE 6
OU-9 FEASIBILITY STUDY
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/kg)

SUBSTANCE	BACKGROUND**			SITE-RELATED		
	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION
4,4'-DDD *	2 / 6	4.9 - 21	11.98	4 / 9	2.4 - 230	80.01
4,4'-DDE *	1 / 6	1.7 - 1.7	1.7	5 / 10	3.6 - 66	24.62
4,4'-DDT *	1 / 6	19 - 19	10.64	4 / 10	9.3 - 110	47.12
ALPHA-CHLORDANE *	NOT DETECTED	-	-	3 / 9	9.8 - 48	19.64
DIELDRIN *	NOT DETECTED	-	-	2 / 10	0.31 - 1.6	1.6
ENDOSULFAN II *	NOT DETECTED	-	-	3 / 10	2.6 - 24	8.82
ENDRIN *	NOT DETECTED	-	-	1 / 10	1.6 - 1.6	1.6
ENDRIN KETONE *	1 / 5	1.6 - 1.6	1.6	1 / 10	7.3 - 7.3	7.3
GAMMA-CHLORDANE *	1 / 6	0.095 - 0.095	0.095	4 / 10	0.34 - 56	19.82
HEPTACHLOR *	NOT DETECTED	-	-	2 / 10	0.16 - 0.35	0.35
HEPTACHLOR EPOXIDE *	NOT DETECTED	-	-	4 / 10	0.2 - 2.3	2.30
ACENAPHTHYLENE *	NOT DETECTED	-	-	2 / 10	56 - 160	160.00
ANTHRACENE *	NOT DETECTED	-	-	3 / 10	88 - 260	260.00
BENZ(A)ANTHRACENE *	3 / 6	85 - 560	560	5 / 10	75 - 1700	676.58
BENZO(A)PYRENE *	3 / 6	110 - 590	393.60	6 / 10	100 - 2400	852.30
BENZO(B)FLUORANTHENE *	3 / 6	150 - 490	346.54	5 / 10	190 - 4800	1587.69
BENZO(G,H,I)PERYLENE *	3 / 6	51 - 380	380	4 / 10	150 - 2600	912.89
BENZO(K)FLUORANTHENE *	3 / 6	63 - 470	470	5 / 10	66 - 1100	451.37
BIS(2-ETHYLHEXYL)PHTHALATE	NOT DETECTED	-	-	2 / 10	96 - 880	521.76
BUTYLBENZYLPHTHALATE *	NOT DETECTED	-	-	1 / 10	300 - 300	300.00
CARBAZOLE *	NOT DETECTED	-	-	1 / 10	140 - 140	140
CHRYSENE *	3 / 6	130 - 940	577.87	5 / 10	130 - 2400	884.84
DIBENZ(A,H)ANTHRACENE *	NOT DETECTED	-	-	2 / 10	150 - 720	385.24
DIBENZOFURAN *	NOT DETECTED	-	-	1 / 10	78 - 78	78
FLUORANTHENE *	3 / 6	240 - 1800	1024.31	5 / 10	110 - 1600	819.64
FLUORENE *	1 / 6	190 - 190	190	2 / 10	65 - 83	83
INDENO(1,2,3-CD)PYRENE *	3 / 6	55 - 310	310	5 / 10	69 - 2300	800.89
NAPHTHALENE *	NOT DETECTED	-	-	1 / 10	90 - 90	90.00
PHENANTHRENE *	3 / 6	110 - 1900	1052.11	4 / 10	210 - 740	421.54
PYRENE *	3 / 6	200 - 1900	1076.74	5 / 10	130 - 2000	884.61
4-METHYL-2-PENTANONE *	NOT DETECTED	-	-	1 / 4	2 - 2	2
TOLUENE *	1 / 3	480 - 480	480	1 / 4	31 - 31	31
XYLENE (TOTAL) *	NOT DETECTED	-	-	1 / 4	3 - 3	3

* - Selected as a COPC
** - Background samples are as follows: BGSD01, BGSD02, BGSD04 through BGSD07

Background concentrations for any non-naturally occurring chemicals were not used as a basis for selection of COPCs. All organic compounds detected at the site were selected as COPCs.

TABLE 3
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN SURFACE WATER AT SITE 6
OU-9 FEASIBILITY STUDY
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/L)

	BACKGROUND***				SITE-RELATED					
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	UTL **	2 X AVERAGE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > 2 X BKGD?	MEAN > BACK UTL?	REPRESENTATIVE CONCENTRATION
ALUMINUM *	5 / 6	102 - 1540	2.2E+03	904.20	5 / 5	213 - 15100	3310.40	YES	YES	9594.70
ANTIMONY *	NOT DETECTED	-	-	-	1 / 5	3.3 - 3.3	2.99	YES	YES	3.30
ARSENIC *	1 / 6	9 - 9	1.3E+01	5.32	4 / 5	4.4 - 42.4	12.34	YES	NO	28.49
BARIUM	6 / 6	16.3 - 36.4	2.4E+03	55.05	5 / 5	30.1 - 468	127.78	YES	NO	309.61
BERYLLIUM	3 / 6	0.22 - 1.2	1.7E+00	0.70	4 / 5	0.14 - 2.4	0.81	YES	NO	2.40
CADMIUM *	1 / 6	0.18 - 0.18	3.2E-01	0.23	1 / 5	2.7 - 2.7	0.62	YES	YES	1.73
CALCIUM	6 / 6	462 - 177000	2.3E+05	71114	5 / 5	20000 - 159000	55140	NO	NO	111621
CHROMIUM	3 / 5	0.72 - 2.6	4.4E+00	1.78	1 / 4	1.1 - 1.1	1.44	NO	NO	1.10
COBALT	6 / 6	0.81 - 2	5.2E+00	3.10	4 / 5	0.79 - 6.6	2.51	NO	NO	4.73
COPPER	5 / 6	1.1 - 17.8	3.0E+02	11.92	5 / 5	6.6 - 102	29.18	YES	NO	68.16
IRON *	6 / 6	160 - 23100	3.0E+04	9576.67	5 / 5	2060 - 349000	75894	YES	YES	221526
LEAD *	2 / 6	4.4 - 16	2.2E+01	7.31	5 / 5	1.2 - 506	103.84	YES	YES	318.18
MAGNESIUM	6 / 6	369 - 559000	7.0E+05	190703	5 / 5	5360 - 447000	129810	NO	NO	447000
MANGANESE	6 / 6	14 - 203	3.8E+02	172.43	5 / 5	170 - 338	261.40	YES	NO	338.00
MERCURY	2 / 6	0.023 - 0.028	2.3E-01	0.12	3 / 5	0.043 - 0.29	0.12	NO	NO	0.29
NICKEL	6 / 6	2.1 - 7.9	8.2E+01	10.23	4 / 5	1.8 - 27.2	8.45	NO	NO	18.54
POTASSIUM	5 / 6	261 - 259000	3.2E+05	88923	5 / 5	3250 - 207000	60552	NO	NO	207000
SELENIUM	2 / 6	3.5 - 9.2	1.4E+01	6.27	3 / 5	3.9 - 8.5	4.08	NO	NO	8.50
SILVER	1 / 6	0.86 - 0.86	1.3E+00	0.75	1 / 5	0.74 - 0.74	0.46	NO	NO	0.71
SODIUM	3 / 3	11150 - 4340000	1.3E+07	2912233	5 / 5	53900 - 3480000	1043320	NO	NO	3480000
THALLIUM	3 / 6	3.5 - 5.5	2.8E+01	5.90	4 / 5	5.1 - 10.7	7.06	YES	NO	10.70
VANADIUM	4 / 6	0.225 - 9	1.2E+01	3.79	4 / 5	0.92 - 40.5	9.79	YES	NO	26.20
ZINC	5 / 5	7.6 - 29.4	1.5E+03	30.60	2 / 2	55.4 - 323	189.20	YES	NO	323.00

* - Selected as a COPC

** - Upper Tolerance Limit = UTL is the concentration that is estimated to contain a designated portion (95%) of all possible sample measurements.

*** - Background samples are as follows: BGSW01, BGSW02, BGSW04 through BGSW07

TABLE 4
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN GROUNDWATER AT SITE 6
OU-9 FEASIBILITY STUDY
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/L)

	BACKGROUND***				SITE-RELATED					
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	UTL**	2 X AVERAGE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > 2 X BKGD?	MEAN > BACK UTL?	REPRESENTATIVE CONCENTRATION
ALUMINUM	3 / 3	1320 - 2090	1.6E+11	3386.67	4 / 4	145 - 1320	518.75	NO	NO	1320.00
ARSENIC *	1 / 3	5.1 - 5.1	1.7E+02	5.60	3 / 4	5.1 - 26.8	10.59	YES	NO	26.80
BARIUM	3 / 3	30.4 - 78.1	2.5E+06	105.47	4 / 4	30.4 - 64.9	47.13	NO	NO	64.90
BERYLLIUM	2 / 3	0.23 - 4.5	7.7E+01	3.19	1 / 4	0.21 - 0.21	0.09	NO	NO	0.21
CADMIUM	3 / 3	0.43 - 7	2.2E+01	5.29	4 / 4	1.2 - 7	3.90	NO	NO	7.00
CALCIUM	3 / 3	11000 - 24100	9.4E+14	38087	4 / 4	5670 - 89800	31440	NO	NO	89800
CHROMIUM *	NOT DETECTED	-	-	-	1 / 4	1.2 - 1.2	0.66	YES	-	1.20
COBALT	3 / 3	3.2 - 24.7	4.2E+04	23.67	3 / 4	0.81 - 7.6	3.18	NO	NO	7.60
IRON	3 / 3	1400 - 95200	2.4E+16	66847	4 / 4	13400 - 95200	50025	NO	NO	95200
MAGNESIUM	3 / 3	8610 - 17300	2.5E+14	26940	4 / 4	3120 - 53000	19660	NO	NO	53000
MANGANESE	3 / 3	720 - 3040	7.3E+11	3720	4 / 4	61.3 - 1820	754.08	NO	NO	1820.00
NICKEL	3 / 3	3.7 - 43.2	2.7E+05	38.33	4 / 4	0.76 - 5	2.61	NO	NO	5.00
POTASSIUM	3 / 3	3000 - 3620	1.1E+12	6780	4 / 4	2250 - 9270	4395	NO	NO	9270
SODIUM	3 / 3	15800 - 92500	1.9E+17	127600	4 / 4	20800 - 83100	40925	NO	NO	83100
ZINC	2 / 2	18.9 - 30.9	7.3E+11	49.80	3 / 4	3.3 - 18.9	10.55	NO	NO	18.90

* - Selected as a COPC

** - Upper Tolerance Limit = UTL is the concentration that is estimated to contain a designated portion (95%) of all possible sample measurements.

*** - Background samples are as follows: MW4-04, BGMW-02, BGMW-01, MW28-03, MW3-06, MW5-02, MW5-03, MW19-01, MW1-03, MW5-08, MW11-03

TABLE 5
OCCURRENCE AND DISTRIBUTION OF ORGANICS IN GROUNDWATER AT SITE 6
OU-9 FEASIBILITY STUDY
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/L)

SUBSTANCE	BACKGROUND**			SITE-RELATED		
	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION
ENDOSULFAN I *	NOT DETECTED	-	-	1 / 4	0.0021	0.0021
GAMMA-BHC (LINDANE) *	NOT DETECTED	-	-	1 / 4	0.0008	0.0008

* - Selected as a COPC

** - Background samples are as follows: MW4-04, BGMW-02, BGMW-01, MW26-03, MW3-06, MW5-02, MW5-03, MW19-01, MW1-03, MW5-08, MW11-03

stabilization, clearing and grubbing of brush and trees, backfilling, and regrading and seeding of the area to stabilize the northern slope of the site.

Site 6 RI Sediment Results

Four site-related sediment samples (06SD01 through 06SD04) were collected at Site 6 during the 1995 RI and six additional sediment samples (06SD05 through 06SD10) were collected during the 1996 RI Addendum field activities. Tables 1 and 2 present the occurrence and distribution of inorganic and organic chemicals, respectively, detected in Site 6 sediment samples and compare them to background concentrations. Figure 8 shows sediment sample concentrations found above screening values.

Higher concentrations of metals in comparison to background were seen in site-related samples, particularly at sample locations 06SD01 and 06SD04 and, to a lesser extent, at sample locations 06SD02 and 06SD07. Samples contained aluminum (up to 14,500 mg/kg at 06SD07), arsenic (up to 36.3 mg/kg at 06SD04), barium (up to 138 mg/kg at 06SD02), cadmium (up to 1.8 mg/kg at 06SD04), cobalt (up to 8.2 mg/kg at 06SD01), copper (up to 228 mg/kg at 06SD04), iron (up to 52,200 mg/kg at 06SD01), lead (up to 445 mg/kg at 06SD04), magnesium (up to 2,460 mg/kg at 06SD01), manganese (up to 451 mg/kg at 06SD04), mercury (up to 0.63 mg/kg at 06SD04), nickel (up to 43.8 mg/kg at 06SD04), selenium (up to 3.4 mg/kg at 06SD04), vanadium (up to 104 mg/kg at 06SD07) and zinc (up to 1,720 mg/kg at 06SD04). Antimony and thallium were detected at two locations at levels up to 12.4 mg/kg and 2.1 mg/kg, respectively. These two compounds were not detected in background samples.

Polynuclear aromatic hydrocarbons (PAHs) including benz(a)anthracene, benzo(a)pyrene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene, fluoranthene, fluorene and pyrene were detected in background sediment samples at levels ranging from 110 to 1,900 ug/kg. The maximum concentrations of individual PAHs detected in the Site 6 sediment samples occurred in sample 06SD04 and ranged from one to 10 times higher than the concentrations in background sediment. Background samples contained the pesticide DDT and its analogs at the following concentrations: 19 ug/kg 4,4'-DDT, 1.7 ug/kg 4,4'-DDE and 21 ug/kg 4,4'-DDD. These pesticides were detected in the sediment samples at Site 6 with 4,4'-DDT ranging from 9.3 to 110 ug/kg, 4,4'-DDE ranging from 3.6 to 66 ug/kg and 4,4'-DDD ranging from 2.4 to 230 ug/kg. Several additional pesticides were detected in sediment samples that were not present in background sediments or were present at much lower levels. The highest levels of pesticides were at sample locations 06SD01, 06SD02 and 06SD04. Trace levels of xylene (3 ug/kg) and 4-methyl-2-pentanone (2 ug/kg) were each detected in one sediment sample, 06SD01, but were not found in background sediments. Bis(2-Ethylhexyl) phthalate was present in two sediment samples at concentrations up to 880 ug/kg. Butylbenzyl phthalate was detected in one sample, 06SD08, at 300 ug/kg but was not detected in background samples. Toluene was detected in one sediment sample at a level (31 ug/kg) considerably lower than the concentration detected in a background sediment sample (480 ug/kg).

Since organic compounds are not considered to be naturally occurring, all organic compounds noted in Table 2 were selected as compounds of potential concern (COPCs) for risk assessment evaluation purposes.

Site 6 RI Surface Water Results

Two surface water samples were collected at Site 6 in 1995 (06SW01 and 06SW02) and three surface water samples (06SW05 through 06SW07) were collected in 1996. Table 3 presents the occurrence and distribution of inorganic chemicals in Site 6 surface water samples and compares them to background. Figure 8 shows surface water sample concentrations found above screening values.

No organic chemicals were detected in Site 6 surface water samples.

The highest levels of metals were primarily at locations 06SW01 and 06SW06. Metals exceeding two times the background concentrations included aluminum (up to 15,100 ug/l), arsenic (up to 42.4 ug/l), barium (up to 468 ug/l), cadmium (2.7 ug/l at 06SW01), cobalt (up to 6.6 ug/l), copper (up to 102 ug/l), iron (up to 349,000 ug/l), lead (up to 506 ug/l), mercury (up to 0.29 ug/l, nickel (up to 27.2 ug/l), vanadium (up to 40.5 ug/l) and zinc (up to 323 ug/l). Antimony was also detected at location 06SW06 (3.3 ug/l), but was not detected in background samples.

Miscellaneous parameter analyses of the five surface water samples taken at Site 6 consisted of ammonia, biological oxygen demand (BOD), chemical oxygen demand (COD), chlorides, total water hardness (hardness), total organic compound (TOC), phosphate and turbidity. Although several surface water indicator parameters were detected at levels greater than background (chloride, phosphate, nitrate, and ammonia). Concentrations of typical landfill parameter concentrations encountered in Site 6 groundwater samples were relatively low compared to typical groundwater concentrations found beneath active solid waste landfills.

Site 6 RI Groundwater Results

Four groundwater samples (06GW01 through 06GW04) were collected from monitoring wells 06MW01 through 06MW04, respectively (Figure 8). Tables 4 and 5 present the occurrence and distribution of inorganic and organic chemicals detected in Site 6 groundwater samples and compares them to background. Concentrations of most metals in Site 6 groundwater were similar to the ranges detected in background samples. The following metals exhibited concentrations greater than background: arsenic (8.8 ug/l to 26.8 ug/l) in samples 06GW03 and 06GW04, cadmium (1.2 to 7.0 ug/l), iron (13,400 to 95,200 ug/l) in samples 06GW01, 06GW02, 06GW03 and 06GW04, and manganese (1820 ug/l) in sample 06GW01.

Endosulfan I and gamma-BHC were each detected in one groundwater sample collected at Site 6 at concentrations of 0.0021 and 0.0008 ug/l, respectively. Neither of these compounds was detected in background groundwater samples. Explosives and related degradation products were analyzed for but not detected in groundwater samples.

Miscellaneous parameter analyses of four groundwater samples at Site 6 consisted of ammonia, BOD, COD, chlorides, nitrates, sulfates, TOC, phosphates and turbidity. Most indicator parameters were found at lower concentrations in all downgradient wells than in upgradient well 06MW01. Downgradient concentrations were slightly greater than upgradient levels and greater than background ranges for ammonia and TOC in 06MW04 and for sulfate in 06MW03. Upgradient well 06MW01 revealed chloride, BOD, COD and TOC at concentrations greater than background.

Site 12

In August 1995, B&R Environmental conducted sampling and analysis of surface soil and sediment and surveyed to establish the horizontal locations and vertical elevations of the surface soil and sediment sample locations. No samples were taken in the area labeled "Battery Storage Area" (Figure 5) because the asphalt would have been a barrier to infiltration of the spilled battery electrolyte solution. The RI attempted to obtain the "worst case" sediment samples in known low-lying areas of likely sedimentation.

The RI Addendum field investigation was designed to provide further data on the aerial and vertical extent of metals contamination. On October 29, 1996, B&R Environmental conducted surface and subsurface soil sampling at Site 12 and surveyed to establish the horizontal locations and vertical elevations of the sample locations.

Following the RI, a remedial action consisting of excavation and removal of railroad tracks, ballast, surface soils, and subsurface soils in the vicinity of Site 12 was conducted by the Navy in 1999. The location of soil excavation and railroad track removal is presented on Figure 5. The objectives of the remedial action included minimizing potential migration and mobilization of contaminants to surface water, groundwater, and soils at the site. Approximately 262 tons of excavated soil was shipped off site for disposal and recycling. Three rounds of confirmatory sampling were conducted to demonstrate compliance with RDCSCC. The excavation of contaminated soils achieved the remedial action objective for protection of human health and the environment, including prevention of human exposure to contaminated surface and subsurface soils, and prevention of migration of contaminants to the adjacent marsh.

Based on EPA and NJDEP approval, Site 12 met all the applicable requirements for closure, and the remediation for which Foster Wheeler Environmental Corporation was contracted by the Navy was complete as documented in the Remedial Action Report for Soil Excavation at Site 12, Foster Wheeler Environmental Corporation, December 1999.

Site 15

Between June and July 1995, B&R Environmental conducted sampling and analysis of surface water, sediment, surface soil, and subsurface soil at Site 15 and conducted a survey to establish the horizontal locations and vertical elevations of the sample locations.

Summary of Site 15 RI Results

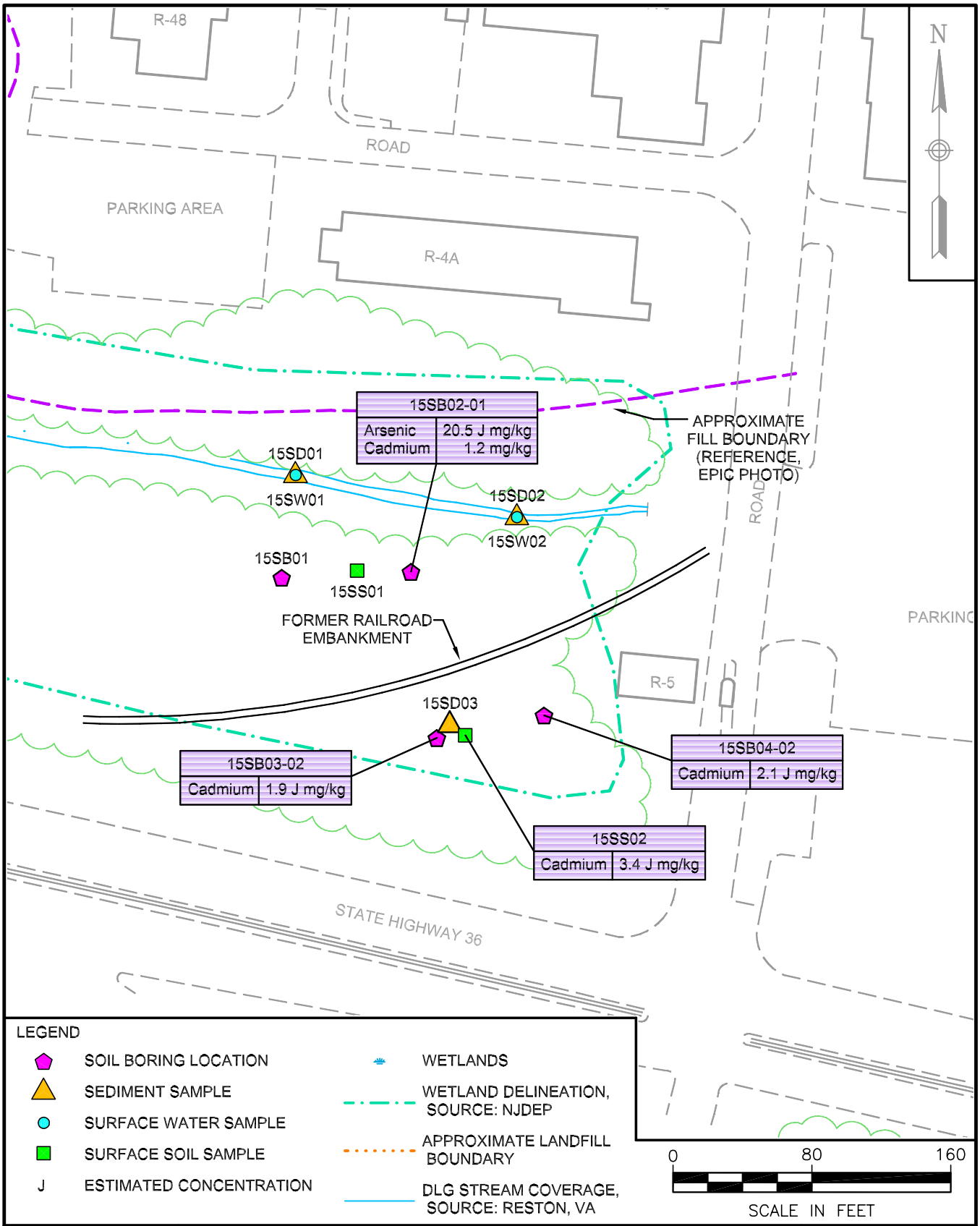
Figure 10 presents sample locations and concentrations of compounds that exceed surface soil and subsurface soil screening levels. Based on previous RI findings and the marsh-like nature of the site with groundwater close to the surface, no groundwater samples were collected in the 1995 RI. Figure 11 presents sample locations and concentrations of compounds that exceed surface water and sediment screening levels. Tables 6 through 13 present the occurrence and distribution of compounds found in Site 15 RI samples.

Site 15 RI Surface Soil Results

Two surface soil samples 15SS01 and 15SS02 were collected at Site 15 (see Figure 6). Tables 6 and 7 present the occurrence and distribution of inorganic and organic chemicals in Site 15 surface soil samples and compare them to background.

Concentrations of most metals in Site 15 samples were similar to background. Concentrations slightly greater than background were observed for cadmium (3.4 mg/kg) in sample 15SS02 and lead (110 mg/kg) in sample 15SS01. Antimony was detected in 15SS01 at a low level, near the instrument detection limit, but was not detected in background samples.

Site 15 surface soil samples exhibited low levels of PAHs including benz(a)anthracene (71 ug/kg), benzo(a)pyrene (58 to 69 ug/kg), benzo(b)fluoranthene (120 to 160 ug/kg), fluoranthene (130 to 180 ug/kg), phenanthrene (69 to 100 ug/kg) and pyrene (140 to 210 ug/kg). 4,4'-DDE (13 to 43 ug/kg) and 4,4'-DDT (12 ug/kg) were detected in Site 15 surface soils at levels within the lower range of background concentrations. Alpha-BHC was detected in one Site 15 surface soil sample at a concentration of 0.13 ug/kg but was not detected in background samples. The two surface soil samples collected at Site 15 were also analyzed for moisture, pH and TPH. TPH was detected at concentrations ranging from 120 to 200 mg/kg. TPH background surface soil results were 9.0 to 110 mg/kg.

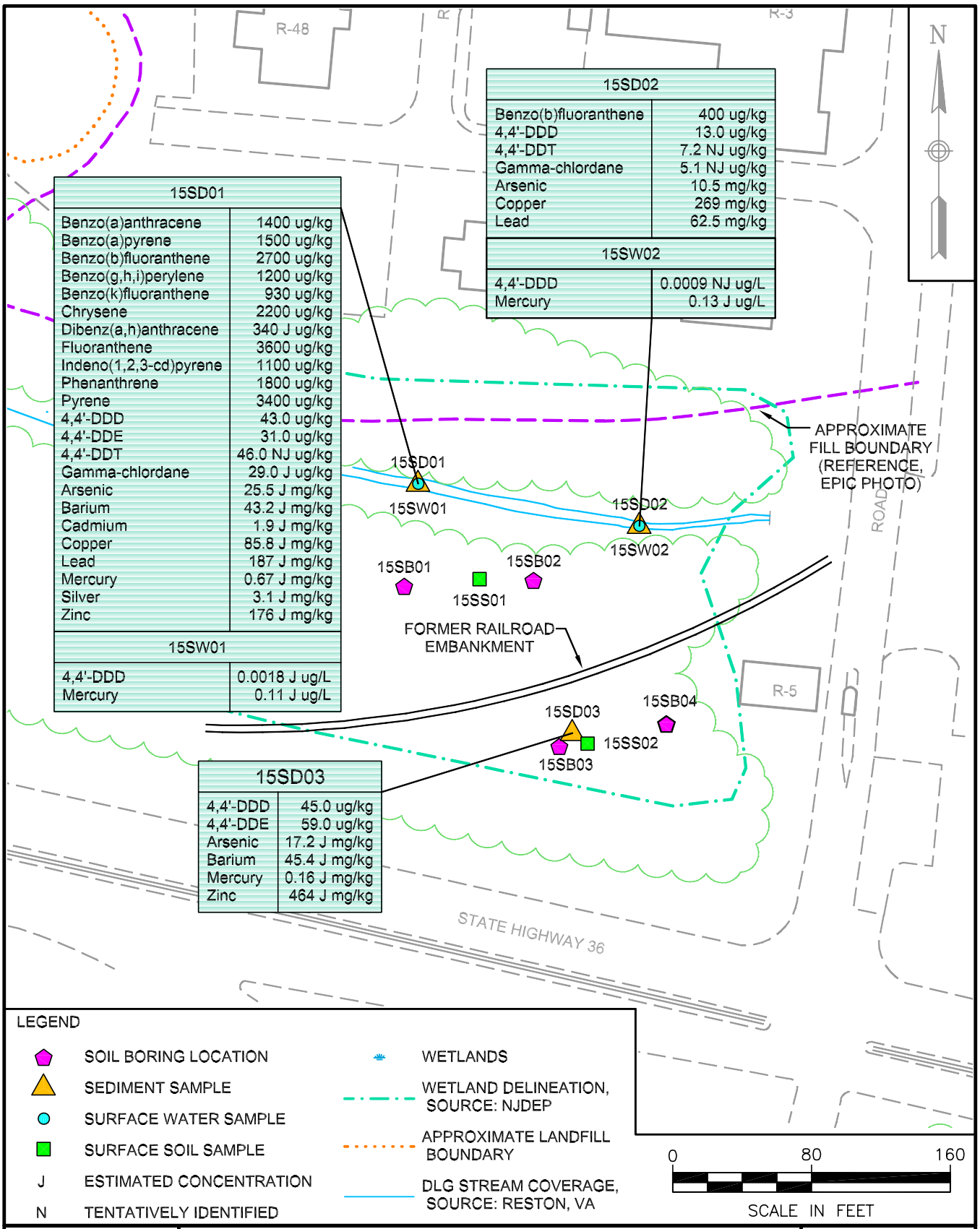


TETRA TECHNUS, INC.

SITE 15 SUBSURFACE AND SURFACE SOILS CONCENTRATIONS ABOVE SCREENING VALUES
NAVAL WEAPONS STATION
COLTS NECK, NEW JERSEY

SCALE	AS NOTED
FILE	2128CM07
REV	0
DATE	11/18/04
FIGURE NUMBER	FIGURE 10

2128\1230\2128CM06.DWG 12/29/04 DA



TETRA TECHNUS, INC.

SITE 15 SURFACE WATER AND SEDIMENT CONCENTRATIONS ABOVE SCREENING VALUES
NAVAL WEAPONS STATION
COLTS NECK, NEW JERSEY

SCALE	AS NOTED
FILE	2128GM06.DWG
REV	0
DATE	11/18/04
FIGURE NUMBER	FIGURE 11

TABLE 6
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN SURFACE SOIL AT SITE 15
NWS EARLE, COLTS NECK, NEW JERSEY
(mg/kg)

	BACKGROUND			SITE-RELATED				
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	2 X AVERAGE BKGD CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > 2 X BKGD	REPRESENTATIVE CONCENTRATION
ALUMINUM*	4 / 4	1710 - 5310	6152.5	2 / 2	897 - 9250	5073.5	NO	9250
ANTIMONY	Not Detected	-	-	1 / 2	1.8	1.11	YES	1.8
ARSENIC	4 / 4	1.35 - 14.4	13.43	2 / 2	10.1 - 19.2	14.65	YES	19.2
BARIUM	4 / 4	1.85 - 31	22.53	2 / 2	7.8 - 18	12.9	NO	18
BERYLLIUM	1 / 4	0.28	0.39	1 / 2	0.97	0.49375	YES	0.97
CADMIUM	1 / 4	0.57	0.67	2 / 2	0.85 - 3.4	2.125	YES	3.4
CALCIUM	4 / 4	40.1 - 519	551.8	2 / 2	407 - 828	617.5	YES	828
CHROMIUM*	4 / 4	7.8 - 59.5	69.05	2 / 2	3.7 - 37.7	20.7	NO	37.7
COBALT	2 / 4	0.75 - 5	3.15	2 / 2	1.1 - 2.8	1.95	NO	2.8
COPPER	4 / 4	0.97 - 8.4	10.06	2 / 2	14.3 - 33.2	23.75	YES	33.2
IRON	4 / 4	3745 - 62500	52402.5	2 / 2	10900 - 52300	31600	NO	52300
LEAD	4 / 4	1.8 - 39.4	37.3	2 / 2	56.8 - 110	83.4	YES	110
MAGNESIUM	4 / 4	71.7 - 619	578.85	2 / 2	118 - 2260	1189	YES	2260
MANGANESE	4 / 4	3.45 - 214	128.33	2 / 2	60.7 - 92.9	76.8	NO	92.9
MERCURY	4 / 4	0.035 - 0.17	0.18	2 / 2	0.051 - 0.16	0.1055	NO	0.16
NICKEL*	2 / 4	1.8 - 7.2	5.18	2 / 2	3 - 7.5	5.25	YES	7.5
POTASSIUM	4 / 4	95 - 792	912.5	2 / 2	122 - 6790	3456	YES	6790
SODIUM	4 / 4	17.5 - 86.2	78.3	2 / 2	47.4 - 195	121.2	YES	195
THALLIUM	2 / 4	0.7 - 1.9	1.64	1 / 2	1.5	1.025	NO	1.5
VANADIUM	4 / 4	11.05 - 64	70.13	2 / 2	14.9 - 36	25.45	NO	36
ZINC	3 / 4	1.1 - 27.6	22.8	2 / 2	7.2 - 52.4	29.8	YES	52.4

Note: Selected COPCs are indicated in boldface type.
* - Indicates COPCs eliminated based on amended risk assessment.

TABLE 7
OCCURRENCE AND DISTRIBUTION OF ORGANICS IN SURFACE SOIL AT SITE 15
OU-9 FEASIBILITY STUDY
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/kg)

SUBSTANCE	BACKGROUND			SITE-RELATED		
	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION
4,4'-DDE	2 / 4	16 - 330	277.86	2 / 2	13 - 43	43
4,4'-DDT	2 / 4	43 - 420	355.71	1 / 1	12	12
ALPHA-BHC	NOT DETECTED	-	-	1 / 2	0.13	0.13
BENZO(A)ANTHRACENE	NOT DETECTED	-	-	1 / 2	71	71
BENZO(A)PYRENE	NOT DETECTED	-	-	2 / 2	58 - 69	69
BENZO(B)FLUORANTHENE	NOT DETECTED	-	-	2 / 2	120 - 160	160
BIS(2-ETHYLHEXYL)PHTHALATE	NOT DETECTED	-	-	2 / 2	100 - 110	110
CHRYSENE	NOT DETECTED	-	-	2 / 2	68 - 90	90
FLUORANTHENE	2 / 4	40 - 84	84	2 / 2	130 - 180	180
PHENANTHRENE	NOT DETECTED	-	-	2 / 2	69 - 100	100
PYRENE	1 / 4	46	46	2 / 2	140 - 210	210

TABLE 8
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN SUBSURFACE SOIL AT SITE 15
OU-9 FEASIBILITY STUDY
NWS EARLE, COLTS NECK, NEW JERSEY
(mg/kg)

SUBSTANCE	BACKGROUND			SITE-RELATED				
	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	2 X AVERAGE BKGD CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > 2 X BKGD	REPRESENTATIVE CONCENTRATION
ALUMINUM*	8 / 8	675 - 5310	5370.00	4 / 4	890 - 7185	3288.75	NO	7185
ARSENIC	8 / 8	1.35 - 14.4	13.29	3 / 4	8.8 - 20.5	12.40	NO	20.5
BARIUM	8 / 8	0.92 - 31	17.92	4 / 4	3.9 - 11.25	6.96	NO	11.25
BERYLLIUM*	2 / 8	0.12 - 0.28	0.28	4 / 4	0.12 - 0.275	0.17	NO	0.275
CADMIUM	1 / 8	0.57	0.58	3 / 4	1.2 - 2.8	1.49	YES	2.8
CALCIUM	8 / 8	28.6 - 799	577.55	4 / 4	70.8 - 584	228.55	NO	584
CHROMIUM*	8 / 8	4.7 - 59.5	54.73	4 / 4	2.4 - 16.8	8.10	NO	16.8
COBALT	4 / 8	0.75 - 5	2.77	3 / 4	0.16 - 0.69	0.33	NO	0.69
COPPER	8 / 8	0.97 - 8.6	8.66	4 / 4	0.35 - 3.3	1.81	NO	3.3
IRON	8 / 8	3745 - 62500	40871.25	4 / 4	1600 - 43400	22525.00	NO	43400
LEAD*	8 / 8	1.4 - 39.4	24.33	4 / 4	1.9 - 6.65	4.49	NO	6.65
MAGNESIUM	8 / 8	18.5 - 619	504.05	4 / 4	68.8 - 464.5	210.53	NO	464.5
MANGANESE	8 / 8	2.6 - 214	92.51	4 / 4	1.9 - 7.35	4.19	NO	7.35
MERCURY	8 / 8	0.03 - 0.17	0.13	1 / 4	0.0054	0.00	NO	0.00
NICKEL	4 / 8	1.8 - 7.2	4.75	4 / 4	0.48 - 1.7	1.14	NO	1.7
POTASSIUM	7 / 8	95 - 792	793.35	4 / 4	55 - 553	297.00	NO	553
SELENIUM	2 / 8	0.57 - 0.93	0.79	2 / 4	1.3 - 1.6	1.01	YES	1.6
SODIUM	8 / 8	17.5 - 94.8	79.35	4 / 4	29.3 - 116.3	56.28	NO	116.3
THALLIUM	4 / 8	0.7 - 1.9	1.38	2 / 4	1.3 - 1.5	0.93	NO	1.5
VANADIUM	8 / 8	11.05 - 64	64.71	4 / 4	4.5 - 39.4	20.95	NO	39.4
ZINC	6 / 8	1.1 - 50.7	31.35	4 / 4	0.75 - 11.4	4.76	NO	11.4

Note: Selected COPCs are indicated in boldface type.
* - Indicates COPCs eliminated based on amended risk assessment.

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TABLE 9

OCCURRENCE AND DISTRIBUTION OF ORGANICS IN SUBSURFACE SOIL AT SITE 15
OU-9 FEASIBILITY STUDY
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/kg)

SUBSTANCE	BACKGROUND			SITE-RELATED		
	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION
BIS(2-ETHYLHEXYL)PHTHALATE	NOT DETECTED		-	4 / 4	59 - 260	260

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TABLE 10
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN SEDIMENT AT SITE 15
OU-9 FEASIBILITY STUDY
NWS EARLE, COLTS NECK, NEW JERSEY
(mg/kg)

SUBSTANCE	BACKGROUND			SITE-RELATED				
	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	2 X AVERAGE BKGD CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > 2 X BKGD	REPRESENTATIVE CONCENTRATION
ALUMINUM	3 / 3	839 - 3940	5492.67	3 / 3	2550 - 10600	6086.67	YES	10600
ARSENIC	2 / 3	2.4 - 6.2	5.95	3 / 3	10.5 - 25.5	17.73	YES	25.5
BARIUM	3 / 3	3.9 - 10.6	14.07	3 / 3	28.9 - 45.4	39.17	YES	45.4
BERYLLIUM	1 / 3	0.57	0.67	2 / 3	0.32 - 1.7	0.69	YES	1.7
CADMIUM	NOT DETECTED	-	-	1 / 3	1.9	0.92	YES	1.9
CALCIUM	3 / 3	179 - 518	685.33	3 / 3	282 - 5100	2144.00	YES	5100
CHROMIUM	3 / 3	4.3 - 56	43.13	3 / 3	8.6 - 58.7	33.27	NO	58.7
COBALT	1 / 3	2.1	3.30	2 / 3	5.6 - 7.1	4.47	YES	7.1
COPPER	3 / 3	1.5 - 13	12.47	3 / 3	11.3 - 269	122.03	YES	269
IRON	3 / 3	228 - 7650	6578.67	3 / 3	20800 - 84000	49833.33	YES	84000
LEAD	3 / 3	4.6 - 34.3	30.60	3 / 3	42.5 - 187	97.33	YES	187
MAGNESIUM	3 / 3	60.7 - 256	306.47	3 / 3	251 - 1530	970.33	YES	1530
MANGANESE	3 / 3	4.6 - 9.2	13.80	3 / 3	12 - 72.8	45.90	YES	72.8
MERCURY	1 / 3	0.068	0.05	3 / 3	0.11 - 0.67	0.31	YES	0.67
NICKEL	2 / 3	2.1 - 6	7.93	2 / 3	11.1 - 15.5	9.42	YES	15.5
POTASSIUM	2 / 3	86.1 - 681	589.40	3 / 3	395 - 576	476.33	NO	576
SELENIUM	NOT DETECTED	-	-	2 / 3	1.5 - 2.2	1.35	YES	2.2
SILVER	NOT DETECTED	-	-	2 / 3	0.52 - 3.1	1.34	YES	3.1
SODIUM	3 / 3	26.6 - 116	115.27	3 / 3	222 - 317	276.67	YES	317
THALLIUM	NOT DETECTED	-	-	3 / 3	1 - 2.8	2.07	YES	2.8
VANADIUM	3 / 3	5.9 - 42.7	36.93	3 / 3	20.1 - 48.7	34.67	NO	48.7
ZINC	3 / 3	14.2 - 26.9	37.33	3 / 3	136 - 464	258.67	YES	464

Note: Selected COPCs are indicated in boldface type.

TABLE 11

OCCURRENCE AND DISTRIBUTION OF ORGANICS IN SEDIMENT AT SITE 15
OU-9 FEASIBILITY STUDY
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/kg)

SUBSTANCE	BACKGROUND			SITE-RELATED		
	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION
2-BUTANONE	NOT DETECTED	-	-	1 / 3	86	86
2-METHYLNAPHTHALENE	NOT DETECTED	-	-	1 / 3	300	300
4,4'-DDD	2 / 3	4.9 - 21	21	3 / 3	13 - 45	45
4,4'-DDE	1 / 3	1.7	1.7	3 / 3	2.1 - 59	59
4,4'-DDT	1 / 3	19	19	2 / 3	7.2 - 46	46
ACENAPHTHENE	NOT DETECTED	-	-	1 / 3	140	140
ALPHA-CHLORDANE	NOT DETECTED	-	-	2 / 3	3.8 - 31	31
ANTHRACENE	NOT DETECTED	-	-	2 / 3	52 - 240	240
AROCLOR-1260	NOT DETECTED	-	-	2 / 3	16 - 100	100
BENZO(A)ANTHRACENE	2 / 3	140 - 560	560	2 / 3	270 - 1400	1400
BENZO(A)PYRENE	2 / 3	160 - 590	590	2 / 3	260 - 1500	1500
BENZO(B)FLUORANTHENE	2 / 3	150 - 490	490	3 / 3	130 - 2700	2700
BENZO(G,H,I)PERYLENE	2 / 3	130 - 380	380	2 / 3	170 - 1200	1200
BENZO(K)FLUORANTHENE	2 / 3	150 - 470	470	2 / 3	140 - 930	930
BUTYLBENZYLPHTHALATE	NOT DETECTED	-	-	1 / 3	910	910
CARBAZOLE	NOT DETECTED	-	-	1 / 3	250	250
CHRYSENE	2 / 3	250 - 940	940	3 / 3	120 - 2200	2200
DI-N-BUTYLPHTHALATE	NOT DETECTED	-	-	1 / 3	160	160
DIBENZ(A,H)ANTHRACENE	NOT DETECTED	-	-	1 / 3	340	340
DIBENZOFURAN	NOT DETECTED	-	-	1 / 3	130	130
ENDRIN	NOT DETECTED	-	-	1 / 3	10	10
FLUORANTHENE	2 / 3	300 - 1800	1800	3 / 3	200 - 3600	3600
FLUORENE	1 / 3	190	190	1 / 3	180	180
GAMMA-CHLORDANE	1 / 3	0.095	0.095	2 / 3	5.1 - 29	29
HEPTACHLOR EPOXIDE	NOT DETECTED	-	-	2 / 3	0.47 - 3.2	3.2
INDENO(1,2,3-CD)PYRENE	2 / 3	110 - 310	310	2 / 3	150 - 1100	1100
NAPHTHALENE	NOT DETECTED	-	-	1 / 3	140	140
PHENANTHRENE	2 / 3	200 - 1900	1900	3 / 3	120 - 1800	1800
PYRENE	2 / 3	350 - 1900	1900	3 / 3	180 - 3400	3400
STYRENE	NOT DETECTED	-	-	1 / 3	11	11

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TABLE 12
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN SURFACE WATER AT SITE 15
OU-9 FEASIBILITY STUDY
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/L)

SUBSTANCE	BACKGROUND			SITE-RELATED				
	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	2 X AVERAGE BKGD CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > 2 X BKGD	REPRESENTATIVE CONCENTRATION
ALUMINUM	3 / 3	265 - 409	705.33	2 / 2	104 - 338	221	NO	338
BARIUM	3 / 3	16.3 - 34	53.73	2 / 2	34.6 - 49.5	42.05	NO	49.5
BERYLLIUM	2 / 3	0.22 - 0.33	0.41	2 / 2	0.22 - 0.88	0.55	YES	0.88
CADMIUM	1 / 3	0.18	0.23	2 / 2	0.31 - 0.37	0.34	YES	0.37
CALCIUM	3 / 3	462 - 10100	9128.00	2 / 2	22200 - 26900	24550	YES	26900
COBALT	3 / 3	0.81 - 1.9	2.54	2 / 2	5 - 10.9	7.95	YES	10.9
COPPER	2 / 3	1.1 - 9.8	7.40	2 / 2	3.3 - 6.8	5.05	NO	6.8
IRON	3 / 3	160 - 702	1040.00	2 / 2	7460 - 7940	7700	YES	7940
LEAD	1 / 3	4.4	3.43	1 / 2	2	1.185	NO	2
MAGNESIUM	3 / 3	369 - 2770	2525.33	2 / 2	7300 - 9020	8160	YES	9020
MANGANESE	3 / 3	14 - 55.5	59.93	2 / 2	885 - 1120	1002.5	YES	1120
MERCURY	2 / 3	0.023 - 0.028	0.04	2 / 2	0.11 - 0.13	0.12	YES	0.13
NICKEL	3 / 3	2.1 - 7.1	8.60	2 / 2	5.6 - 12.5	9.05	YES	12.5
POTASSIUM	2 / 3	251 - 1850	1482.33	2 / 2	4180 - 4870	4525	YES	4870
SODIUM	NOT DETECTED	-	-	2 / 2	61400 - 80800	71100	YES	80800
ZINC	3 / 3	7.6 - 29.4	32.67	2 / 2	14.7 - 68.1	41.4	YES	68.1

Note: Selected COPCs are indicated in boldface type.

TABLE 13
OCCURRENCE AND DISTRIBUTION OF ORGANICS IN SURFACE WATER AT SITE 15
OU-9 FEASIBILITY STUDY
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/L)

	BACKGROUND			SITE-RELATED		
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION
4,4'-DDD	NOT DETECTED	-	-	1 / 1	0.0018	0.0018

Site 15 RI Subsurface Soil Results

Four subsurface soil samples 15SB01 through 15SB04 were collected at Site 15 (see Figure 6). Tables 8 and 9 present the occurrence and distribution of inorganic and organic chemicals in Site 15 subsurface soil samples and compare them to background. Concentrations of most metals in Site 15 subsurface soil samples were similar to background. Cadmium was present at levels slightly greater than background in one sample (15SB04-02). Bis(2-Ethylhexyl) phthalate (59 to 260 ug/kg) was detected in all four subsurface soil samples collected at Site 15. This compound was not detected in background subsurface soil samples.

The four subsurface soil samples collected at Site 15 were also analyzed for moisture, pH and TPH. TPH was detected at concentrations ranging from 20 to 110 mg/kg. TPH in background subsurface soil samples ranged from 12.0 to 220 mg/kg.

Site 15 RI Sediment Results

Three sediment samples 15SD01 through 15SD03 were collected at Site 15 (Figure 11). Tables 10 and 11 present the occurrence and distribution of inorganic and organic chemicals in Site 15 sediment samples and compare them to background. Arsenic, barium, cadmium, copper, lead, mercury, silver and zinc were detected at levels greater than background samples. The highest concentrations of arsenic (25.5 mg/kg), and lead (187 mg/kg) were seen in sample 15SD01. The highest concentration of copper (269 mg/kg) was in sample 15SD02. Zinc exhibited a maximum concentration (464 mg/kg) in sample 15SD03.

PAHs including benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, indeno(1,2,3-cd)pyrene, fluoranthene, fluorene, phenanthrene and pyrene were detected in background sediment samples. Similar PAHs were detected in sediment samples collected at Site 15. PAH levels in sample 15SD01 were generally two to five times higher than background ranges. Samples 15SD02 and 15SD03 exhibited concentrations within a range similar to background samples. Butylbenzyl phthalate (910 ug/kg) and di-n-butyl phthalate (160 ug/kg) were detected in one Site 15 sediment sample but were not detected in background sediment samples.

Background sediment samples exhibited the presence of 4,4'-DDD (4.9 to 21 ug/kg), 4,4'-DDE (1.7 ug/kg), and 4,4'-DDT (19 ug/kg). Pesticides detected at similar levels in Site 15 sediment samples included 4,4'-DDT (7.2 to 46 ug/kg), 4,4'-DDD (13 to 45 ug/kg) and 4,4'-DDE (31 to 59 ug/kg). Gamma-Chlordane (5.1 to 29 ug/kg) was detected at levels greater than background ranges. Alpha-Chlordane (3.8 to 31 ug/kg), endrin (10 ug/kg), and heptachlor epoxide (0.47 to 3.2 ug/kg) were also detected in sediment samples collected at Site 15, but were not observed in background samples. Site 15 sediment samples also contained Aroclor 1260 (16 ug/kg in 15SD02 and 100 ug/kg in 15SD01). Styrene (11 ug/kg) and 2-butanone (86 ug/kg) were each detected in one sediment sample (15SD03).

The three sediment samples collected at Site 15 were also analyzed for moisture, pH and TPH. TPH was detected at concentrations ranging from (370 to 3100 mg/kg). TPH levels in background subsurface soil samples ranged from 50.0 to 660 mg/kg.

Site 15 RI Surface Water Results

Two surface water samples 15SW01 and 15SW02 were collected at Site 15 (see Figure 11). Tables 12 and 13 present the occurrence and distribution of inorganic and organic chemicals detected in Site 15 surface water samples and compare them to background. TPH was analyzed for but not detected in surface water samples. Concentrations of most metals in the two Site 15 samples were similar or lower than background. Slightly higher levels of cobalt and manganese were detected in both Site 15 samples.

4,4'-DDD was detected in one surface water sample from Site 15 (15SW01) at a concentration of 0.0018 ug/l. This compound was not detected in background surface water samples.

Site 17

Between June and October 1995, B&R Environmental conducted sampling and analysis of surface water, sediment, surface soil, and groundwater at Site 17.

B&R Environmental conducted a survey to establish the horizontal locations and vertical elevations of the surface water and sediment samples, the surface soil sample and the newly installed and selected existing wells.

On October 28 and 30, 1996 B&R Environmental conducted additional surface water and sediment sampling at Site 17 followed by a survey.

Summary of Site 17 RI Results

The landfill surface is paved and is currently utilized as a parking area for Waterfront personnel. The face of the landfill is 10 to 15 feet higher in elevation than the marsh area and is heavily vegetated. Infiltration is limited by the nature of the hard packed and paved surface cover and overland flow drains toward the salt marsh north and west of the site. The groundwater flow direction is north-northwest and west toward the marsh, based on measured groundwater elevations. Results of the RI revealed slightly elevated levels of PAHs and pesticides in drainage pathway sediments and elevated levels of metals in drainage pathway surface water samples.

No slope stabilization work was performed at Site 17 as was performed at Site 6. However, Foster Wheeler Environmental Corporation conducted work on the flat portion of Site 17 including grading, topsoil cover and seeding, and installation of a wooden barricade to prevent any future deposition of soils or debris on the sloped area of Site 17.

Figure 12 shows sample locations and concentrations of compounds that exceed screening levels. Tables 14 through 20 compare the results of background samples to samples collected at Site 17.

Site 17 RI Surface Soil Results

One site-related surface soil sample (17SS01) was collected at Site 17. Tables 14 and 15 present the occurrence and distribution of inorganic chemicals detected in site-related surface soil samples and compare them to background. Concentrations of metals in 17SS01 were within the ranges found in background samples. 4,4'-DDT was detected in background surface soil samples in the concentration range of 43 ug/kg to 420 ug/kg. The pesticide compound was detected in the surface soil sample at Site 17 at a much lower concentration of 1.2 ug/kg.

Site 17 RI Sediment Results

Four site-related sediment samples (17SD01 through 17SD04) were collected during the 1995 RI, and an additional six sediment samples (17SD05 through 17SD10) were collected during the 1996 RI Addendum field work. Tables 16 and 17 present the occurrence and distribution of inorganic and organic chemicals in Site 17 samples and compare them to facility-wide background. Facility-wide background samples (BGSD01, BGSD02, and BGSD04 through BGSD07) were used for COPC selection for the human health risk assessment. Only those background samples obtained from this watershed (BGSD05 through BGSD07) were used for the ecological risk assessment.

Elevated levels of metals were detected in several site samples, notably sample locations 17SD02 and 17SD07. Metals detected at levels above background included aluminum (up to 19,300 mg/kg), arsenic (up to 41.9 mg/kg), barium (up to 71.9 mg/kg), beryllium (up to 1.9 mg/kg), cadmium (up to 3.1 mg/kg), cobalt (up to 21.1 mg/kg), copper (up to 99.1 mg/kg), iron (up to 66,400 mg/kg), lead (up to 236 mg/kg), magnesium (up to 4,800 mg/kg), manganese (up to 218 mg/kg), mercury (up to 0.32 mg/kg), nickel (up to 29.3 mg/kg), vanadium (up to 101 mg/kg) and zinc (up to 242 mg/kg). Sample 17SD03 also contained elevated levels of arsenic, cobalt, iron, lead, and mercury but at levels below 17SD01 and 17SD07.

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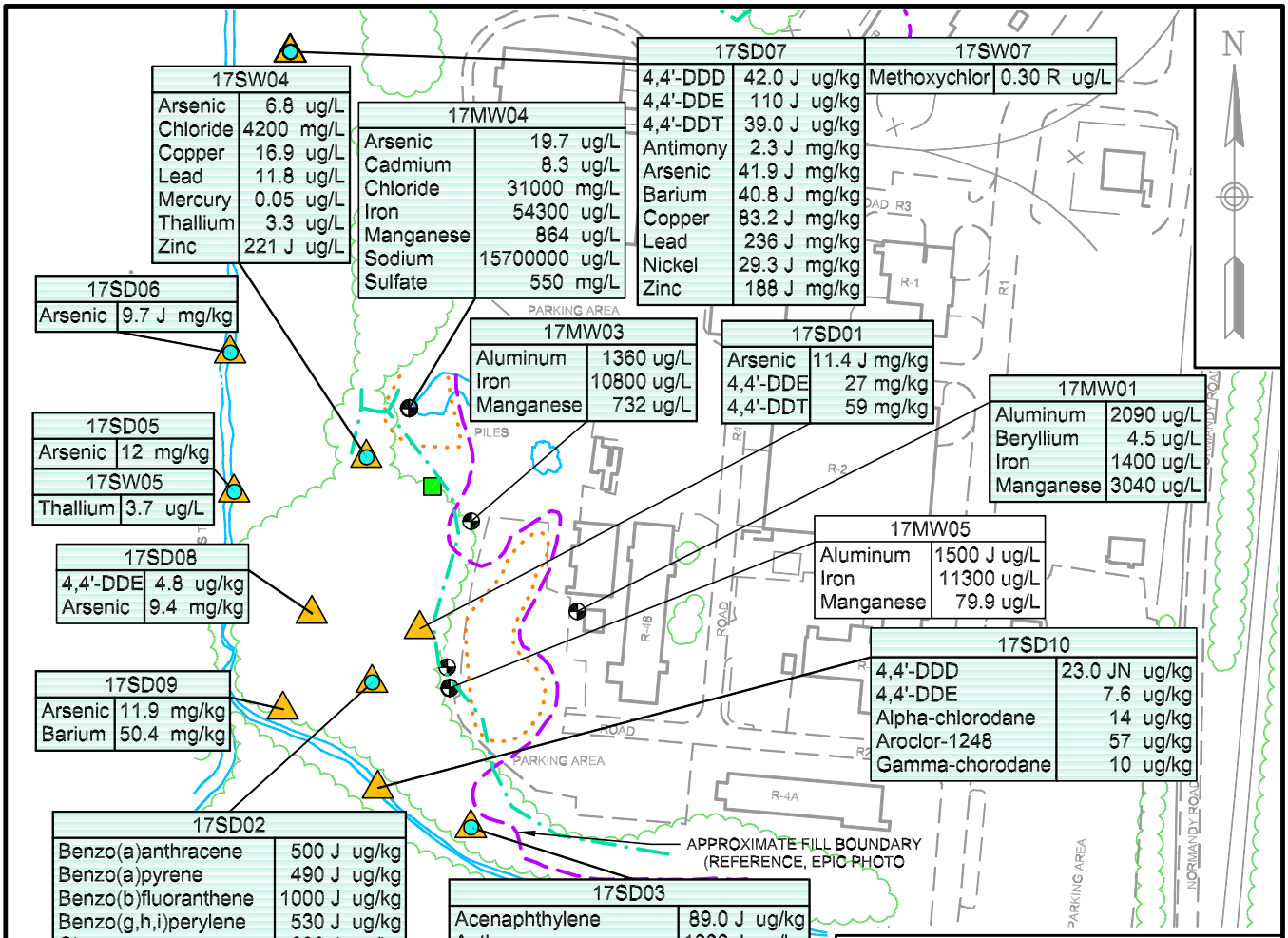

17SW04	
Arsenic	6.8 ug/L
Chloride	4200 mg/L
Copper	16.9 ug/L
Lead	11.8 ug/L
Mercury	0.05 ug/L
Thallium	3.3 ug/L
Zinc	221 J ug/L

17MW04	
Arsenic	19.7 ug/L
Cadmium	8.3 ug/L
Chloride	31000 mg/L
Iron	54300 ug/L
Manganese	864 ug/L
Sodium	15700000 ug/L
Sulfate	550 mg/L

17SD07	
4,4'-DDD	42.0 J ug/kg
4,4'-DDE	110 J ug/kg
4,4'-DDT	39.0 J ug/kg
Antimony	2.3 J mg/kg
Arsenic	41.9 J mg/kg
Barium	40.8 J mg/kg
Copper	83.2 J mg/kg
Lead	236 J mg/kg
Nickel	29.3 J mg/kg
Zinc	188 J mg/kg

17SW07	
Methoxychlor	0.30 R ug/L

17SD06	
Arsenic	9.7 J mg/kg

17MW03	
Aluminum	1360 ug/L
Iron	10800 ug/L
Manganese	732 ug/L

17SD01	
Arsenic	11.4 J mg/kg
4,4'-DDE	27 mg/kg
4,4'-DDT	59 mg/kg

17MW01	
Aluminum	2090 ug/L
Beryllium	4.5 ug/L
Iron	1400 ug/L
Manganese	3040 ug/L

17SD05	
Arsenic	12 mg/kg

17SW05	
Thallium	3.7 ug/L

17MW05	
Aluminum	1500 J ug/L
Iron	11300 ug/L
Manganese	79.9 ug/L

17SD08	
4,4'-DDE	4.8 ug/kg
Arsenic	9.4 mg/kg

17SD10	
4,4'-DDD	23.0 JN ug/kg
4,4'-DDE	7.6 ug/kg
Alpha-chlorodane	14 ug/kg
Aroclor-1248	57 ug/kg
Gamma-chorodane	10 ug/kg

17SD09	
Arsenic	11.9 mg/kg
Barium	50.4 mg/kg

17SD02	
Benzo(a)anthracene	500 J ug/kg
Benzo(a)pyrene	490 J ug/kg
Benzo(b)fluoranthene	1000 J ug/kg
Benzo(g,h,i)perylene	530 J ug/kg
Chrysene	690 J ug/kg
Indeno(1,2,3-cd)pyrene	420 J ug/kg
Pyrene	1100 J ug/kg
4,4'-DDD	58.0 J ug/kg
4,4'-DDE	98.0 J ug/kg
4,4'-DDT	30.0 J ug/kg
Alpha-chlorodane	8.1 JN ug/kg
Gamma-chorodane	7.8 JN ug/kg
Arsenic	36.3 J mg/kg
Barium	71.8 J mg/kg
Cadmium	3.1 J mg/kg
Copper	99.1 J mg/kg
Lead	126 J mg/kg
Mercury	0.32 J mg/kg
Nickel	27.6 J mg/kg
Zinc	242 J mg/kg

17SW02	
Arsenic	88.6 ug/L
Cadmium	3.2 J ug/L
Copper	65.1 ug/L
Lead	77.1 ug/L
Mercury	0.2 ug/L
Selenium	15.7 J ug/L
Thallium	12.5 ug/L
Zinc	290 J ug/L

17SD03	
Acenaphthylene	89.0 J ug/kg
Anthracene	1000 J ug/kg
Benzo(a)anthracene	2600 J ug/kg
Benzo(a)pyrene	2600 J ug/kg
Benzo(b)fluoranthene	5000 J ug/kg
Benzo(g,h,i)perylene	3100 J ug/kg
Benzo(k)fluoranthene	1300 J ug/kg
Carbazole	630 J ug/kg
Chrysene	3100 J ug/kg
Dibenzo(a,h)anthracene	820 J ug/kg
Fluoranthene	4700 J ug/kg
Fluorene	590 J ug/kg
Indeno(1,2,3-cd)pyrene	2200 J ug/kg
Phenanthrene	4200 J ug/kg
Pyrene	7000 J ug/kg
4,4'-DDD	26.0 J ug/kg
4,4'-DDE	98.0 J ug/kg
4,4'-DDT	13.0 J ug/kg
Arsenic	13.2 J mg/kg
Lead	75.9 J mg/kg
Mercury	0.16 J mg/kg

17SW03	
Arsenic	20 ug/L
Copper	24.5 ug/L
Lead	52.2 ug/L
Mercury	0.2 ug/L
Selenium	6.1 J ug/L
Thallium	5.1 ug/L
Zinc	202 J ug/L

LEGEND

- MONITORING WELL
- SEDIMENT SAMPLE
- SURFACE WATER SAMPLE
- SURFACE SOIL SAMPLE
- J ESTIMATED CONCENTRATION
- R REJECTED
- N TENTATIVELY IDENTIFIED
- WETLANDS
- WETLAND DELINEATION, SOURCE: NJDEP
- APPROXIMATE LANDFILL BOUNDARY
- DLG STREAM COVERAGE, SOURCE: RESTON, VA

0 200 400

SCALE IN FEET

TETRA TECHNUS, INC.

SITE 17
CONCENTRATIONS ABOVE
SCREENING LEVELS
NAVAL WEAPONS STATION
COLTS NECK, NEW JERSEY

SCALE
AS NOTED

FILE
2128CM03

REV 0 DATE 06/22/05

FIGURE NUMBER
FIGURE 12

TABLE 14

OCCURRENCE AND DISTRIBUTION OF INORGANICS IN SURFACE SOIL AT SITE 17
OU-9 FEASIBILITY STUDY
NWS EARLE, COLTS NECK, NEW JERSEY
(mg/kg)

SUBSTANCE	BACKGROUND***					SITE-RELATED					
	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	UTL**	2 X AVERAGE CONCENTRATION	EPRESENTATIV ONCENTRATIO	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > X BKGD	MEAN > ACK UTL	REPRESENTATIVE CONCENTRATION
ALUMINUM	4 / 4	1710 - 5310	7.5E+03	6153	5310	1 / 1	525 - 525	525	NO	NO	525
ARSENIC *	4 / 4	1.35 - 14.4	2.3E+01	13.43	14.4	1 / 1	2.3 - 2.3	2.30	NO	NO	2.3
BARIUM	4 / 4	1.85 - 31	4.7E+01	22.53	31	1 / 1	3.2 - 3.2	3.20	NO	NO	3.2
BERYLLIUM	1 / 4	0.28 - 0.28	5.6E+00	0.39	0.28	1 / 1	0.049 - 0.049	0.05	NO	NO	0.049
CADMIUM	1 / 4	0.57 - 0.57	7.5E-01	0.67	0.52	1 / 1	0.098 - 0.098	0.10	NO	NO	0.098
CALCIUM	4 / 4	40.1 - 519	6.8E+03	551.80	519	1 / 1	129 - 129	129	NO	NO	129
CHROMIUM	4 / 4	7.8 - 59.5	1.1E+02	69.05	59.5	1 / 1	5.4 - 5.4	5.40	NO	NO	5.4
COBALT	2 / 4	0.75 - 5	7.6E+00	3.15	4.27	1 / 1	0.27 - 0.27	0.27	NO	NO	0.27
COPPER	4 / 4	0.97 - 8.4	1.5E+01	10.06	8.4	1 / 1	2.2 - 2.2	2.20	NO	NO	2.2
IRON	4 / 4	3745 - 62500	9.6E+04	52403	62500	1 / 1	3060 - 3060	3060	NO	NO	3060
LEAD	4 / 4	1.8 - 39.4	4.0E+02	37.30	39.4	1 / 1	7.5 - 7.5	7.50	NO	NO	7.5
MAGNESIUM	4 / 4	71.7 - 619	9.0E+02	578.85	619	1 / 1	95.5 - 95.5	95.50	NO	NO	95.5
MANGANESE	4 / 4	3.45 - 214	3.3E+02	128.33	162.62	1 / 1	9.9 - 9.9	9.90	NO	NO	9.9
MERCURY	4 / 4	0.035 - 0.17	5.9E-01	0.18	0.17	1 / 1	0.019 - 0.019	0.02	NO	NO	0.019
NICKEL	2 / 4	1.8 - 7.2	1.1E+01	5.18	7.2	1 / 1	1.3 - 1.3	1.30	NO	NO	1.3
POTASSIUM	4 / 4	95 - 792	4.1E+03	912.50	792	1 / 1	104 - 104	104	NO	NO	104
SODIUM	4 / 4	17.5 - 86.2	1.2E+02	78.30	86.2	1 / 1	444 - 444	444	YES	YES	444
VANADIUM	4 / 4	11.05 - 64	2.0E+02	70.13	64	1 / 1	6 - 6	6.00	NO	NO	6
ZINC	3 / 4	1.1 - 27.6	4.6E+02	22.80	27.6	1 / 1	10.4 - 10.4	10.40	NO	NO	10.4

* - Selected as a COPC
** - Upper Tolerance Limit = UTL is the concentration that is estimated to contain a designated portion (95%) of all possible sample measurements.
*** - Background samples are as follows: BGSB0100, BGSB0200 (AND A DUPLICATE, DUP-4), BGSB0300, BGSB0400

TABLE 15

OCCURRENCE AND DISTRIBUTION OF ORGANICS IN SURFACE SOIL AT SITE 17
OU-9 FEASIBILITY STUDY
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/kg)

SUBSTANCE	BACKGROUND			SITE-RELATED		
	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION
4,4'-DDT*	2 / 4	43 - 420	355.71	1 / 1	1.2	1.2

* - Selected as a COPC

TABLE 16
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN SEDIMENT AT SITE 17
OU-9 FEASIBILITY STUDY
NWS EARLE, COLTS NECK, NEW JERSEY
(mg/kg)

	BACKGROUND***				SITE-RELATED					
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	UTL**	2 X AVERAGE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > 2 X BKGD?	MEAN > BACK UTL?	REPRESENTATIVE CONCENTRATION
ALUMINUM	6 / 6	839 - 3940	8.1E+07	5460	10 / 10	745 - 19300	7190	YES	NO	19300
ANTIMONY *	NOT DETECTED	-	-	-	1 / 10	2.3 - 2.3	2.19	YES	-	2.30
ARSENIC *	5 / 6	2.40 - 9.90	2.9E+02	11.23	10 / 10	4 - 41.9	15.10	YES	NO	21.77
BARIUM	6 / 6	3.20 - 15.80	2.9E+02	18.80	10 / 10	2.4 - 71.8	26.40	YES	NO	38.20
BERYLLIUM	4 / 6	0.34 - 0.57	3.3E-01	0.72	10 / 10	0.11 - 1.9	0.67	NO	YES	0.94
CADMIUM	2 / 6	0.44 - 0.48	1.1E+00	0.93	6 / 10	0.23 - 3.1	0.57	NO	NO	1.04
CALCIUM	6 / 6	179 - 518	6.7E+05	690.83	10 / 10	109 - 4660	1038	YES	NO	1870
CHROMIUM	6 / 6	4.30 - 56	2.6E+03	40.42	10 / 10	6.6 - 69	34.17	NO	NO	69
COBALT	4 / 6	0.51 - 2.10	6.4E+00	2.85	10 / 10	0.58 - 21.1	3.55	YES	NO	6.86
COPPER *	6 / 6	1 - 13	1.9E+01	9.08	10 / 10	2 - 99.1	24.07	YES	YES	42.63
IRON	6 / 6	228 - 21400	7.2E+09	23589	10 / 10	5640 - 66400	25035	YES	NO	49496
LEAD *	6 / 6	4.00 - 34.30	4.8E+01	21.07	10 / 10	5.2 - 236	50.69	YES	YES	89.83
MAGNESIUM	6 / 6	60.70 - 880	2.0E+06	609.90	10 / 10	117 - 4800	1171.18	YES	NO	1968
MANGANESE	6 / 6	3.90 - 63.10	8.9E+01	36.22	10 / 10	4 - 218	44.32	YES	NO	77.55
MERCURY *	1 / 6	0.07 - 0.07	8.5E-03	0.09	4 / 10	0.02 - 0.32	0.13	YES	YES	0.19
NICKEL	5 / 6	1.60 - 8	3.4E+01	6.90	9 / 10	2.7 - 29.3	8.30	YES	NO	13.82
POTASSIUM	5 / 6	86.10 - 2900	1.4E+07	1892	10 / 10	235 - 4000	1642	NO	NO	3536
SELENIUM *	NOT DETECTED	-	1.9E+00	-	5 / 10	0.93 - 7.4	1.78	YES	-	4.47
SILVER	2 / 6	0.11 - 0.15	2.8E+00	1.13	3 / 10	0.13 - 0.17	0.45	NO	NO	0.17
SODIUM	4 / 6	26.60 - 2280	2.9E+03	876.60	7 / 10	50.2 - 10600	1223	YES	NO	2965
THALLIUM*	NOT DETECTED	-	2.2E+00	-	1 / 10	1.5 - 1.5	0.78	YES	-	1.10
VANADIUM	6 / 6	5.90 - 42.70	2.1E+03	39.42	10 / 10	9.4 - 101	46.73	YES	NO	95.83
ZINC	6 / 6	12.50 - 34.70	1.5E+03	41.23	10 / 10	7.3 - 242	66.15	YES	NO	107.97

* - Selected as a COPC

** - Upper Tolerance Limit = UTL is the concentration that is estimated to contain a designated portion (95%) of all possible sample measurements.

*** - Background samples are as follows: BGSD01, BGSD02, BGSD04 through BGSD07

TABLE 17

OCCURRENCE AND DISTRIBUTION OF ORGANICS IN SEDIMENTAT SITE 17
OU-9 FEASIBILITY STUDY
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/kg)

SUBSTANCE	BACKGROUND**			SITE-RELATED		
	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION
4,4'-DDD *	2 / 6	4.9 -	11.98	4 / 9	23 - 58	58
4,4'-DDE *	1 / 6	1.7 - 1.7	1.70	6 / 9	4.8 - 110	110
4,4'-DDT *	1 / 6	19 - 19	10.64	4 / 10	13 - 59	59
ALPHA-CHLORDANE *	NOT DETECTED	-	-	3 / 9	4.5 - 14	13.90
AROCLOR-1248 *	1 / 6	5.8 - 5.8	5.80	1 / 9	57 - 57	57
AROCLOR-1254 *	NOT DETECTED	-	-	1 / 9	120 - 120	107.08
AROCLOR-1260 *	NOT DETECTED	-	-	2 / 9	31 - 80	60.54
ENDOSULFAN II *	NOT DETECTED	-	-	1 / 10	0.21 - 0.21	0.21
ENDRIN *	NOT DETECTED	-	-	1 / 10	10 - 10	8.56
GAMMA-CHLORDANE *	1 / 6	0.095 - 0.095	0.10	3 / 9	5 - 10	10
METHOXYCHLOR *	NOT DETECTED	-	-	2 / 10	1.6 - 3.9	3.90
2-METHYLNAPHTHALENE *	NOT DETECTED	-	-	1 / 9	170 - 170	170
4-METHYLPHENOL *	NOT DETECTED	-	-	2 / 8	420 - 820	766.58
ACENAPHTHENE *	NOT DETECTED	-	-	1 / 8	340 - 340	340
ACENAPHTHYLENE *	NOT DETECTED	-	-	1 / 8	89 - 89	89
ANTHRACENE *	NOT DETECTED	-	-	1 / 8	1000 - 1000	1000
BENZ(A)ANTHRACENE *	3 / 6	85 - 560	560	3 / 8	120 - 2600	2317
BENZO(A)PYRENE *	3 / 6	110 - 590	393.60	5 / 8	41 - 2600	2600
BENZO(B)FLUORANTHENE *	3 / 6	150 - 490	346.54	7 / 8	82 - 5000	5000
BENZO(G,H,I)PERYLENE *	3 / 6	51 - 380	380	3 / 8	66 - 3100	3100
BENZO(K)FLUORANTHENE *	3 / 6	63 - 470	470	3 / 8	92 - 1300	1197
BIS(2-ETHYLHEXYL)PHTHALATE *	NOT DETECTED	-	-	3 / 8	54 - 9400	9400
BUTYLBENZYLPHTHALATE *	NOT DETECTED	-	-	1 / 8	610 - 610	610
CARBAZOLE *	NOT DETECTED	-	-	1 / 8	630 - 630	630
CHRYSENE *	3 / 6	130 - 940	577.87	8 / 8	50 - 3100	3100
DI-N-BUTYLPHTHALATE *	1 / 6	97 - 97	97	1 / 8	140 - 140	140
DIBENZ(A,H)ANTHRACENE *	NOT DETECTED	-	-	1 / 8	820 - 820	820
DIBENZOFURAN *	NOT DETECTED	-	-	1 / 8	220 - 220	220
DIETHYLPHTHALATE *	1 / 6	44 - 44	44	2 / 8	43 - 100	100
FLUORANTHENE *	3 / 6	240 - 1800	1024.31	8 / 8	93 - 4700	4700
FLUORENE *	1 / 6	190 - 190	190	1 / 8	590 - 590	590
INDENO(1,2,3-CD)PYRENE *	3 / 6	55 - 310	310	3 / 8	68 - 2200	2200
ISOPHORONE *	NOT DETECTED	-	-	1 / 8	75 - 75	75
NAPHTHALENE *	NOT DETECTED	-	-	1 / 8	160 - 160	160
PHENANTHRENE *	3 / 6	110 - 1900	1052	5 / 8	63 - 4200	4131
PYRENE *	3 / 6	200 - 1900	1077	8 / 8	75 - 7000	7000
TOLUENE *	1 / 3	480 - 480	480	1 / 4	4 - 4	4

* - Selected as a COPC

** - Background samples are as follows: BGSD01, BGSD02, BGSD04 through BGSD07

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TABLE 18
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN GROUNDWATER AT SITE 17
OU-9 FEASIBILITY STUDY
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/L)

SUBSTANCE	BACKGROUND***				SITE-RELATED					
	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	UTL**	2 X AVERAGE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > 2 X BKGD?	MEAN > BACK UTL?	REPRESENTATIVE CONCENTRATION
ALUMINUM	3 / 3	1320 - 2090	1.6E+11	3387	4 / 4	96.8 - 2090	1262	NO	NO	2090
ARSENIC *	1 / 3	5.1 - 5.1	1.7E+02	5.80	3 / 4	4.2 - 19.7	8.14	YES	NO	19.70
BARIUM	3 / 3	30.4 - 78.1	2.5E+06	105.47	4 / 4	16 - 590	193.43	YES	NO	590
BERYLLIUM	2 / 3	0.23 - 4.5	7.7E+01	3.19	2 / 4	1.4 - 4.5	1.50	NO	NO	4.50
CADMIUM	3 / 3	0.43 - 7	2.2E+01	5.29	3 / 4	0.43 - 8.3	2.45	NO	NO	7.05
CALCIUM	3 / 3	11000 - 24100	9.4E+14	38067	4 / 4	1700 - 517000	134248	YES	NO	434535
CHROMIUM *	NOT DETECTED	-	1.1E+00	-	2 / 4	1.1 - 4.6	1.67	YES	YES	3.99
COBALT	3 / 3	3.2 - 24.7	4.2E+04	23.67	4 / 4	0.72 - 24.7	10.41	NO	NO	24.70
COPPER *	NOT DETECTED	-	4.0E-02	-	3 / 4	0.83 - 2.5	1.18	YES	YES	2.50
IRON	3 / 3	1400 - 95200	2.4E+16	66847	4 / 4	1400 - 54300	19450	NO	NO	54300
LEAD *	NOT DETECTED	-	3.8E-01	-	2 / 4	3.8 - 5.7	2.75	YES	YES	5.70
MAGNESIUM	3 / 3	8610 - 17300	2.5E+14	26940	4 / 4	1440 - 89900	28208	YES	NO	77011
MANGANESE	3 / 3	720 - 3040	7.3E+11	3720	4 / 4	79.9 - 3040	1179	NO	NO	3040
MERCURY	1 / 3	0.044 - 0.044	1.1E-05	0.03	1 / 4	0.054	0.02	NO	YES	0.05
NICKEL	3 / 3	3.7 - 43.2	2.7E+05	38.33	3 / 4	3.2 - 43.2	15.64	NO	NO	43.20
POTASSIUM	3 / 3	3000 - 3620	1.1E+12	6780	4 / 4	2460 - 92700	25300	YES	NO	78174
SODIUM	3 / 3	15800 - 92500	1.9E+17	127600	4 / 4	4780 - 15700000	3937370	YES	NO	13164690
VANADIUM *	1 / 3	1.1 - 1.1	8.4E-01	1.14	3 / 4	1.1 - 18.1	7.43	YES	YES	18.10
ZINC	2 / 2	18.9 - 30.9	7.3E+11	49.80	2 / 4	3.8 - 10.5	43.81	NO	NO	10.50

* - Selected as a COPC

** - Upper Tolerance Limit = UTL is the concentration that is estimated to contain a designated portion (95%) of all possible sample measurements.

*** - Background samples are as follows: MW4-04, BGMW-02, BGMW-01, MW28-03, MW3-06, MW5-02, MW5-03, MW19-01, MW1-03, MW5-08, MW11-03

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TABLE 19

OCCURRENCE AND DISTRIBUTION OF INORGANICS IN SURFACE WATER AT SITE 17
OU-9 FEASIBILITY STUDY
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/L)

	BACKGROUND***				SITE-RELATED					
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	UTL**	2 X AVERAGE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > 2 X BKGD?	MEAN > BACK UTL?	REPRESENTATIVE CONCENTRATION
ALUMINUM *	5 / 6	102 - 1540	2.2E+03	904.20	6 / 6	124 - 9680	3027	YES	YES	6348
ARSENIC *	1 / 6	9 - 9	1.3E+01	5.32	3 / 6	6.8 - 88.6	20.03	YES	YES	48.28
BARIUM	6 / 6	16.3 - 36.4	2.4E+03	55.05	6 / 6	17.2 - 331	165.65	YES	NO	290.13
CADMIUM	3 / 6	0.22 - 1.2	1.7E+00	0.70	1 / 6	1.3 - 1.3	0.31	NO	NO	0.71
CALCIUM	1 / 6	0.18 - 0.18	3.2E-01	0.23	1 / 6	3.2 - 3.2	0.96	YES	YES	1.94
CHROMIUM	6 / 6	462 - 177000	2.3E+05	71114	6 / 6	10200 - 52600	27000	NO	NO	52600
COBALT *	3 / 5	0.72 - 2.6	4.4E+00	1.78	2 / 4	13.9 - 20.4	9.69	YES	YES	20.40
COPPER	6 / 6	0.81 - 2	5.2E+00	3.10	5 / 6	0.87 - 6.2	2.79	NO	NO	6.20
IRON	5 / 6	1.1 - 17.8	3.0E+02	11.92	6 / 6	3.5 - 65.1	20.72	YES	NO	39.70
LEAD *	6 / 6	160 - 23100	3.0E+04	9577	6 / 6	2480 - 170000	42570	YES	YES	95730
MAGNESIUM	2 / 6	4.4 - 16	2.2E+01	7.31	5 / 6	1.6 - 77.1	24.18	YES	YES	50.98
MANGANESE	6 / 6	369 - 559000	7.0E+05	190703	6 / 6	4930 - 118000	26908	NO	NO	63886
MERCURY	6 / 6	14 - 203	3.8E+02	172.43	6 / 6	81.2 - 646	289.53	YES	NO	646
NICKEL	2 / 6	0.023 - 0.028	2.3E-01	0.12	3 / 6	0.05 - 0.2	0.13	YES	NO	0.20
POTASSIUM	6 / 6	2.1 - 7.9	8.2E+01	10.23	6 / 6	3.3 - 11	8.02	NO	NO	11
SODIUM	5 / 6	251 - 259000	3.2E+05	88923	6 / 6	3190 - 54700	13788	NO	NO	30456
THALLIUM	2 / 6	3.5 - 9.2	1.4E+01	6.27	3 / 6	4.6 - 15.7	5.21	NO	NO	9.72
VANADIUM	3 / 3	11150 - 4340000	1.3E+07	2912233	6 / 6	26500 - 3000000	701617	NO	NO	1685764
ZINC	3 / 6	3.5 - 5.5	2.8E+01	5.90	4 / 6	3.3 - 12.5	4.62	NO	NO	7.98

* - Selected as a COPC

** - Upper Tolerance Limit = UTL is the concentration that is estimated to contain a designated portion (95%) of all possible sample measurements.

*** - Background samples are as follows: BGSW01, BGSW02, BGSW04 through BGSW07

TABLE 20
OCCURRENCE AND DISTRIBUTION OF ORGANICS IN SURFACE WATER AT SITE 17
OU-9 FEASIBILITY STUDY
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/L)

SUBSTANCE	BACKGROUND**			SITE-RELATED		
	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION
PYRENE*	0 / 6	-	-	2 / 6	1 - 1	1

* - Selected as a COPC
** - Background samples are as follows: BGSW01, BGSW02, BGSW04 through BGSW07

Analytes detected in Site 17 samples, but not present in background samples, included antimony (17SD07), and selenium (17SD01 through 17SD04). The PAH compounds dibenz(a,h)anthracene, acenaphthene, acenaphthylene, naphthalene, and anthracene (concentration range 4 to 1,000 ug/kg) were found in at least one Site 17 sediment sample. The maximum concentrations of PAHs were observed in sample 17SD03 with levels greater than the range of background samples.

Bis (2-Ethylhexyl) phthalate, di-n-butyl phthalate, diethyl phthalate, and butylbenzyl phthalate were detected in Site 17 sediment samples. Bis (2-Ethylhexyl) phthalate was present at the highest concentrations (9,400 ug/kg in sample 17SD03 and 4,400 ug/kg in 17SD02). Aroclor 1260 was detected in 17SD02 at 80 ug/kg and in 17 SD 03 at 31 ug/kg. Aroclor 1248 was detected at 17SD10 at 57 ug/kg. Aroclor 1254 was also detected at 17SD10 at a concentration of 120 ug/kg. The Aroclor 1260 result for 17SD03 was qualified rejected (R) based on data validation and was not used for risk assessment. 4-Methylphenol (420 to 820 ug/kg), isophorone (75 ug/kg), endosulfan II (0.21ug/kg), alpha-chlordane (4.5 ug/kg to 14 ug/kg), and methoxychlor (1.6 to 3.9 ug/kg) were detected in at least one Site 17 sediment sample. The following pesticide compounds were detected in one or more Site 17 sediment samples: 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, and gamma-chlordane. The highest levels of pesticides were found primarily at sample locations 17SD01 through 17SD03 and 17SD07.

The 1995 RI sediment samples collected at Site 17 were also analyzed for moisture, pH, and TOC. Two sediment samples (17SD01 and 17SD04) contained pH levels exceeding maximum sediment background levels. The 1996 RI Addendum samples were also analyzed for TOC and percent solids. Sample 17SD07 showed TOC (149,000 mg/kg).

Site 17 RI Groundwater Results

Four groundwater samples (17GW01, 17GW03, 17GW04, and 17GW05) were collected at Site 17. Table 18 presents the occurrence and distribution of inorganic chemicals detected in Site 17 groundwater samples and compares them to background. No organic compounds were detected, and most metals were present in Site 17 samples at concentrations similar to background. Arsenic, barium, and cadmium were detected in sample 17GW04 at levels greater than the ranges of background samples. This sample had a very high sodium level (1.6 percent).

Miscellaneous parameter analyses of four groundwater samples at Site 17 consisted of ammonia, BOD, COD, chlorides, sulfates, TOC, phosphates, and turbidity. 17MW03 and 17MW01 (downgradient) along with 17MW05 (crossgradient and adjacent to the landfill) revealed greater concentrations of indicator parameters than 17MW01 (upgradient). COD, TOC, and phosphates were detected in 17MW04 and 17MW05 at concentrations greater than maximum background levels. 17MW04 also contained ammonia, chloride, and sulfate concentrations above background. Chloride concentrations in 17MW04 were very high

(31,000 mg/L). Sulfate was detected at levels exceeding maximum background levels in 17MW01, 17MW03 and 17MW04. With the exception of very high chloride concentrations in 17MW04, concentrations of typical landfill parameter concentrations encountered in Site 17 groundwater samples were relatively low compared to typical groundwater concentrations found beneath active solid waste landfills.

Site 17 RI Surface Water Results

Three surface water samples (17SW02 through 17SW04) were collected at Site 17 in 1995, and three surface water samples (17SW05 through 17SW07) were collected in 1996. Tables 19 and 20 present the occurrence and distribution of inorganic and organic chemicals detected in Site 17 surface water samples and compares them to background. Facility-wide background samples (BGSW01, BGSW02, and BGSW04 through BGSW07) were used for COPC selection for the human health risk assessment. Only those background samples obtained from this watershed (BGSW05 through BGSW07) however were used for the ecological risk assessment.

Higher concentrations of most metals were seen in sample 17SW02. Metals present in this sample at levels greater than two times background included aluminum, arsenic, barium, cadmium, chromium, cobalt, copper, iron, lead, mercury, thallium, vanadium, and zinc. Elevated levels were also observed for aluminum, arsenic, barium, iron, chromium, lead, manganese, mercury, vanadium, and zinc in 17SW03 and barium and zinc in 17SW03. The presence of elevated levels of aluminum in 17SW02 and 17SW03 suggested that a significant portion of the metals in these samples may have been present in a suspended rather than dissolved form. No elevated levels of metals were detected in the 1996 RI Addendum surface water samples.

The only organic compound detected in surface water samples was pyrene at a concentration of 1 ug/l at sample location 17SW06. This compound was not detected in background samples.

Miscellaneous parameter analyses for three surface water samples collected at Site 17 in 1995 consisted of ammonia, BOD, COD, chlorides, nitrates, hardness, TOC, phosphates, and turbidity. All the indicator parameters except for nitrates were detected above maximum surface water background concentrations in all samples. Nitrate concentrations in sample 17SW04 exceeded background levels. Concentrations of typical landfill parameter concentrations encountered in Site 17 groundwater samples were relatively low compared to typical groundwater concentrations found beneath active solid waste landfills.

1996 samples were analyzed for alkalinity, BOD, COD, total dissolved solids, hardness, and total suspended solids. Results indicated elevated levels of alkalinity, total dissolved solids (TDS), and hardness in sample 17SW07 when compared to the other Site 17 samples; however, no background samples were analyzed for these parameters.

VI. SUMMARY OF SITE RISKS

As part of the RI, a human health risk assessment and an ecological risk assessment were performed for OU 9 sites. A four-step process was used for assessing site-related human health risks for a reasonable maximum exposure (RME) scenario: Hazard Identification identifies the COPCs at the site based on several factors such as toxicity, frequency of occurrence, and concentration. Exposure Assessment estimates the magnitude of actual and/or potential human exposures, the frequency and duration of these exposures, and the pathways (e.g., ingesting contaminated well water) by which humans are potentially exposed. Toxicity Assessment determines the types of adverse health affects associated with chemical exposures and the relationship between the magnitude of exposure (dose) and severity of adverse effects (response). Risk Characterization summarizes and combines outputs of the exposure and toxicity assessments to provide a quantitative assessment of site-related risks.

Based on anticipated continuance of NWS Earle as a Navy ammunitions storage and handling station, reasonably anticipated future land use is expected to be the same as current use. In the case of three of the four Waterfront areas (Sites 6, 12, and 17), current (and anticipated future) use amounts to limited light commercial/industrial-type use of the surface with no involvement in subsurface or groundwater media. The Site 15 area of concern is located in a wetland that is isolated from the Base by a double-fenced security buffer zone that is anticipated to remain unchanged.

A. Human Health Risks

The human health risk assessment estimated the potential risks to human health posed by exposure to contaminated groundwater, surface water and sediment, and surface and subsurface soils at the sites. To assess these risks, the exposure scenarios listed below were assumed:

- Ingestion of groundwater as a drinking water source.
- Inhalation of contaminants in groundwater (i.e., volatile compounds emitted during showering).
- Dermal exposure to contaminants in groundwater (i.e., showering, hand washing, bathing).
- Dermal contact from contaminated soils.
- Inhalation or incidental ingestion of contaminants in soil (e.g., fugitive dusts).
- Incidental ingestion of surface water and sediment.
- Dermal contact with contaminated surface water or sediment.

Following EPA risk assessment guidance, these scenarios were applied to various site use categories, including future industrial, residential, and recreational receptors although reasonably anticipated land use would be limited to the future maintenance worker to periodically cut the grass and inspect the fencing and

landfill cover (Sites 6 and 17). NWS Earle is not expected to be included in Base closure or realignment in the foreseeable future, so the only anticipated land use at this time will be maintenance of the fencing and to protect the landfill cover (Sites 6 and 17).

Potential human health risks were categorized as carcinogenic or noncarcinogenic. A hypothetical carcinogenic risk increase from exposure should ideally fall below a risk range of 1×10^{-6} (an increase of one case of cancer for one million people exposed) to 1×10^{-4} (an increase of one case of cancer per 10,000 people exposed).

Noncarcinogenic risks were estimated using Hazard Indices (HI), where an HI exceeding one is considered an unacceptable health risk.

In addition, results were compared to MCLs for drinking water, GWQS, or other published lists of reference values.

A baseline human health risk assessment was conducted for OU 9. Analytical data collected prior to the RI was not included in the risk assessment based on incorrect sampling decontamination procedures, which made the analytical data questionable. Results of this assessment are discussed in the following paragraphs.

Site 6

Sediment, groundwater, and surface water were sampled at Site 6. The potential receptors considered for this site were future industrial, residential, and recreational receptors. Tables 21 and 22 present summaries of RME and central tendency exposure (CTE) cancer risks and noncarcinogenic HI for Site 6

The RME cancer risks associated with future residential groundwater exposure (6.1E-04) exceeded the upper end of EPA's target acceptable risk range. The RME cancer risks associated with future industrial groundwater exposure (1.4E-04) were at the upper bound of EPA's target risk range. In addition, CTE cancer risks for future residential receptor groundwater exposure (2.7E-04) were in the upper bound of EPA's target risk range. Arsenic (via ingestion of and dermal contact with groundwater) is the principal COPC that contributed to the cancer risks for these exposure scenarios.

TABLE 21
SUMMARY OF RME ESTIMATED CANCER RISKS AND NONCARCINOGENIC HAZARD INDICIES - SITE 6
NWS EARLE, COLTS NECK, NEW JERSEY

Medium	Exposure Routes	Estimated Incremental Cancer Risk				Estimated Hazard Index***				
		Current Industrial Employee	Future Industrial Employee	Future Lifetime Resident	Future Recreational Child	Current Industrial Employee	Future Industrial Employee	Future Resident		Future Recreational Child
								Child	Adult	
Surface Soil	Incidental Ingestion	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
	Dermal Contact	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
	Inhalation of Fugitive Dust	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
Subsurface Soil	Incidental Ingestion	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
	Dermal Contact	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
	Inhalation of Fugitive Dust	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
Sediment	Incidental Ingestion	N/A	N/A	N/A	5.7E-07	N/A	N/A	N/A	N/A	1.5E-02
	Dermal Contact	N/A	N/A	N/A	1.6E-06	N/A	N/A	N/A	N/A	4.2E-05
Groundwater	Ingestion	N/A	1.4E-04	6.0E-04	N/A	N/A	8.7E-01	5.7E+00@	N/A	N/A
	Dermal Contact	N/A	2.8E-07	7.3E-06	N/A	N/A	1.8E-03	7.2E-02	N/A	N/A
	Inhalation of Volatiles*	N/A	N/A	3.9E-08	N/A	N/A	N/A	N/A	N/A**	N/A
Surface Water	Incidental Ingestion	N/A	N/A	N/A	5.6E-07	N/A	N/A	N/A	N/A	1.3E-01
	Dermal Contact	N/A	N/A	N/A	1.7E-07	N/A	N/A	N/A	N/A	4.5E-03
TOTAL		-	1.4E-04	6.1E-04	2.9E-06	-	8.8E-01	5.8E+00	-	1.5E-01

N/A = Not applicable because this media is not associated with this potential receptor
N/S = Not sampled
* = During Showering, Adult Residents Only
** = No volatile noncarcinogens were detected in groundwater
*** = Hazard Indicies (i.e., summation of hazard quotients) are used only for comparison purposes and do not reflect actual additive noncarcinogenic effects
@ - Result is the maximum of the His among the affected target organs from the amended risk assessment.

TABLE 22
SUMMARY OF CENTRAL TENDENCY CANCER RISKS AND NONCARCINOGENIC HAZARD INDICIES - SITE 6
NWS EARLE, COLTS NECK, NEW JERSEY

Medium	Exposure Routes	Estimated Incremental Cancer Risk				Estimated Hazard Index***				
		Current Industrial Employee	Future Industrial Employee	Future Lifetime Resident	Future Recreational Child	Current Industrial Employee	Future Industrial Employee	Future Resident		Future Recreational Child
								Child	Adult	
Surface Soil	Incidental Ingestion	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
	Dermal Contact	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
	Inhalation of Fugitive Dust	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
Subsurface Soil	Incidental Ingestion	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
	Dermal Contact	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
	Inhalation of Fugitive Dust	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
Sediment	Incidental Ingestion	N/A	N/A	N/A	N/R	N/A	N/A	N/A	N/A	N/R
	Dermal Contact	N/A	N/A	N/A	N/R	N/A	N/A	N/A	N/A	N/R
Groundwater	Ingestion	N/A	1.6E-05	2.7E-04	N/A	N/A	N/R	2.7E+00@	N/A	N/A
	Dermal Contact	N/A	4.5E-08	7.5E-08	N/A	N/A	N/R	3.1E-03	N/A	N/A
	Inhalation of Volatiles*	N/A	N/A	2.2E-09	N/A	N/A	N/A	N/A	N/A**	N/A
Surface Water	Incidental Ingestion	N/A	N/A	N/A	N/R	N/A	N/A	N/A	N/A	N/R
	Dermal Contact	N/A	N/A	N/A	N/R	N/A	N/A	N/A	N/A	N/R
TOTAL		-	1.6E-05	2.7E-04	-	-	-	2.7E+00	-	-

N/A = Not applicable because this media is not associated with this potential receptor
N/R - Central Tendency calculation not required
N/S = Not sampled
* = During Showering, Adult Residents Only
** = No volatile noncarcinogens were detected in groundwater
*** = Hazard Indicies (i.e., summation of hazard quotients) are used only for comparison purposes and do not reflect actual additive noncarcinogenic effects
@ - Result is the maximum of the HIs among the affected target organs from the amended risk assessment.

RME estimates for non-carcinogenic HIs associated with future residential (groundwater) exposure scenario exceeded 1.0, the cutoff point below which adverse non-carcinogenic effects are not expected to occur. Arsenic is the COPC that exceeded 1.0 for this exposure scenario. In addition, CTE risk estimates for future residential exposure to groundwater yielded an HI greater than 1.0; the affected target organ is the skin.

The estimated RME cancer risk for the future industrial employee and the future residential receptor exceeded 1E-04, based mainly on ingestion of groundwater. The estimated CTE cancer risk for the future residential receptor exceeded 1E-04, based mainly on ingestion of groundwater. The estimated RME non-cancer HI for the future residential receptor exceeds 1.0, based mainly on ingestion of groundwater. The estimated CTE cancer risk for the future residential receptor exceeds 1.0, based mainly on ingestion of groundwater.

The maximum concentration of arsenic found in one groundwater sample, 26.8 ug/l, would result in calculated human health risk greater than the EPA acceptable risk range under the RME or CTE future residential exposure scenarios. Detected arsenic concentrations in the other Site 6 groundwater wells were 5.1 ug/l and 8.8 ug/l. These relatively low concentrations, as well as the average concentration in the four background groundwater samples, 10.6 ug/l, would also result in calculated risk levels within (at the upper end of) EPA's acceptable risk range.

Lead was found at concentrations exceeding the EPA action level (15 ug/l) in groundwater samples taken in previous investigations but not in groundwater samples collected using low-flow techniques during the 1995 RI/FS. Lead was not found at levels exceeding 400 mg/kg in subsurface soil samples from previous investigations.

Site 12

Based on the RI conclusion that Site 12 soils posed a potential risk to the future residential child (for antimony and lead) the Navy, in agreement with EPA and the NJDEP, decided to perform a soil removal action at Site 12. The remedial action, consisting of excavation and removal of surface and subsurface soil in the vicinity of Site 12, was conducted by the Navy in 1999. Approximately 262 tons of excavated soil was shipped off site for disposal and recycling. Three rounds of confirmatory sampling were conducted to demonstrate compliance with RDCSCC. Tables 23 and 24 contain the Site 12 second and third round confirmatory sample results. Restoration of the site after excavation included backfill using certified clean select fill. The excavation of contaminated soil achieved the remedial action objective for protection of human health and the environment, including prevention of migration of contaminants to the adjacent marsh.

Average lead concentration remaining in site related soil after remediation was 14.1 mg/kg. Lead was not found at levels exceeding 400 mg/kg in any samples collected from soil or sediment remaining at Site 12.

IEUBK lead model results indicate that less than five percent of the modeled population (resident child) would be expected to develop a blood lead concentration greater than 10 ug/dl.

Based on EPA and NJDEP approval, Site 12 has met all the applicable requirements for closure, and the remediation for which Foster Wheeler Environmental Corporation was contracted by the Navy was complete as documented in the Remedial Action Report for Soil Excavation at Site 12 prepared by Foster Wheeler (December 1999).

Site 15

Surface soil, subsurface soil, sediment, and surface water were sampled at Site 15. The potential receptors considered for this site were current industrial and future industrial, residential, and recreational receptors. Tables 25 and 26 present the summaries of the estimated RME and CTE human health risks for Site 15. The cancer risks associated with surface (8.6E-05) and subsurface (8.3E-05) soil exposure for the future residential exposure scenario were within the 1E-04 to 1E-06 target risk range. Arsenic (via ingestion and dermal contact with surface and subsurface soil) was the major COPC that contributed to the cancer risks for these exposure scenarios.

The future residential (surface soil (1.3) and subsurface soil (1.4) exposure scenario yielded total RME HIs (sum of HIs for ingestion, dermal, and inhalation of dusts) greater than 1.0, the cutoff point below which adverse effects are not expected to occur. These RME estimates are probably overly conservative because a central tendency calculation shows that non-cancer HIs are more likely to be below 1.0. Central tendency generates a lower risk estimate than RME because it assumes typical rather than upper range receptor behavior patterns related to the ingested dose. CTE risk estimates provide additional information but decisions are based on the RME.

Lead soil and surface water concentrations at the site were below the EPA guidelines and are not expected to be associated with a significant increase in blood-lead levels based on the results of the IEUBK Lead Model (v. 0.99).

Site 17

Surface soil, groundwater, sediment, and surface water were sampled at Site 17. The potential receptors considered for this site were current industrial and future industrial, residential, and recreational receptors. Tables 27 and 28 provide summaries of estimated RME and CTE human health carcinogenic and noncarcinogenic risks.

TABLE 23
NWS-EARLE
Site 12: 2nd Round Confirmatory Soil Sample Analytical Results
TAL Metals

SAMPLE ID		12SS08-99-02		12SS11-99-02		12SS12-99-02		12SS14-99-02	
LAB ID	**Residential**	92499		92500		92501		92502	
DATE COLLECTED	**Direct Contact**	11/2/1999		11/2/1999		11/2/1999		11/2/1999	
LOCATION	**Soil Cleanup**	SIDEWALL		BOTTOM		SIDEWALL		SIDEWALL	
MATRIX	**Criteria**	soil		soil		soil		soil	
UNITS	**mg/Kg**	mg/Kg		mg/Kg		mg/Kg		mg/Kg	
DEPTH BGS (ft)		2.5		4.0		4.0		2.0	
COMMENTS		POST-EX		POST-EX		POST-EX		POST-EX	
Aluminum	**NA**	N/A		N/A		N/A		N/A	
Antimony	**14**	N/A	U	N/A		N/A		N/A	
Arsenic	**20**	**25.69**		19.19		**27.67**		12.56	
Barium	**700**	26.05		ND		19.3		14.88	
Beryllium	**2**	N/A		N/A		N/A		N/A	
Cadmium	**39**	ND	U	ND	U	ND		N/A	
Calcium	**NA**	N/A		N/A		N/A		N/A	
Chromium	**240**	36.61		42.3		12.62		28.95	
Cobalt	**NA**	N/A		N/A		N/A		N/A	
Copper	**600**	3.6		7.58		10.44		29.07	
Iron	**NA**	N/A		N/A		N/A		N/A	
Lead	**400**	8.16		12.22		18.81		14.42	
Magnesium	**NA**	N/A		N/A		N/A		N/A	
Manganese	**NA**	N/A		N/A		N/A		N/A	
Mercury	**14**	0.048	U	0.073		0.073		0.07	
Nickel	**250**	7.2		7.58		5.2		4.07	
Potassium	**NA**	N/A		N/A		N/A		N/A	
Selenium	**63**	0.48		1.1		1.46		0.81	
Silver	**110**	ND	U	ND		ND		ND	
Sodium	**NA**	N/A		N/A		N/A		N/A	
Thallium	**2**	N/A	U	N/A		N/A		N/A	
Vanadium	**370**	N/A		N/A		N/A		N/A	
Zinc	**1500**	31.69		34.84		24.39		34.19	

U-concentration is less than detection limit.
NA-not applicable

TABLE 24
NWS-EARLE
Site 12: 3rd Round Confirmatory Soil Sample Analytical Results
TAL Metals

SAMPLE ID		12SS08-99-03		12SS12-99-03					
LAB ID	**Residential**	92499		92500					
DATE COLLECTED	**Direct Contact**	11/9/1999		11/2/1999					
LOCATION	**Soil Cleanup**	SIDEWALL		BOTTOM					
MATRIX	**Criteria**	soil		soil					
UNITS	**mg/Kg**	mg/Kg		mg/Kg					
DEPTH BGS (ft)		3.0		5.0					
COMMENTS		POST-EX		POST-EX					
Aluminum	NA	3350		3490					
Antimony	**14**	0.54	U	0.55	U				
Arsenic	**20**	16.8		8.1					
Barium	**700**	12.6		23					
Beryllium	**2**	0.4	B	0.3	B				
Cadmium	**39**	0.11	U	0.11	U				
Calcium	NA	545		1210					
Chromium	**240**	7.3		10.7					
Cobalt	NA	9.8		1.6	B				
Copper	**600**	6.1		10.8					
Iron	NA	26,600		12,900					
Lead	**400**	5.9		24.9					
Magnesium	NA	451		270	B				
Manganese	NA	172		21.6					
Mercury	**14**	0.11	U	0.11	U				
Nickel	**250**	3.2	B	4.2	B				
Potassium	NA	391		400	B				
Selenium	**63**	0.64		0.6	U				
Silver	**110**	0.11	U	0.11	U				
Sodium	NA	80.8	B	158	B				
Thallium	**2**	0.75	U	0.77	U				
Vanadium	**370**	32.2		21.2					
Zinc	**1500**	19		18.1					

U-concentration is less than detection limit.
NA-not applicable

TABLE 25

SUMMARY OF ESTIMATED RME CANCER RISKS AND NONCARCINOGENIC HAZARD INDICIES - SITE 15
NWS EARLE, COLTS NECK, NEW JERSEY

Medium	Exposure Routes	Estimated Incremental Cancer Risk					Estimated Hazard Index**						
		Current Industrial Employee	Future Industrial Employee	Future Lifetime Resident	Future Lifetime Resident	Future Recreational Child	Current Industrial Employee	Future Industrial Employee	Future Resident				Future Recreational Child
									Child	Adult	Child	Adult	
Surface Soil	Incidental Ingestion	1.2E-05	N/A	N/S	5.3E-05*	N/A	9.2E-02	N/A	N/S	N/A	8.2E-01@	N/A	N/A
	Dermal Contact	4.9E-05	N/A	N/S	3.3E-05*	N/A	2.1E-01	N/A	N/S	N/A	5.1E-01@	N/A	N/A
	Inhalation of Fugitive Dust	2.7E-08	N/A	N/S	3.8E-09*	N/A	1.9E-06	N/A	N/S	N/A	1.7E-05*	N/A	N/A
Subsurface Soil	Incidental Ingestion	N/A	1.1E-05	4.8E-05*	N/S	N/A	N/A	8.3E-02	8.8E-01@	N/A	N/S	N/A	N/A
	Dermal Contact	N/A	1.6E-05	3.5E-05*	N/S	N/A	N/A	1.2E-01	5.4E-01@	N/A	N/S	N/A	N/A
	Inhalation of Fugitive Dust	N/A	1.5E-08	3.8E-09*	N/S	N/A	N/A	1.7E-05	1.6E-05*	N/A	N/S	N/A	N/A
Sediment	Incidental Ingestion	N/A	N/A	N/A	N/A	7.0E-07	N/A	N/A	N/A	N/A	N/A	N/A	5.9E-02
	Dermal Contact	N/A	N/A	N/A	N/A	5.7E-07	N/A	N/A	N/A	N/A	N/A	N/A	4.3E-02
Groundwater	Ingestion	N/A	N/S	N/S	N/S	N/A	N/A	N/S	N/S	N/S	N/S	N/A	N/A
	Dermal Contact	N/A	N/S	N/S	N/S	N/A	N/A	N/S	N/S	N/S	N/S	N/A	N/A
	Inhalation of Volatiles*	N/A	N/S	N/S	N/S	N/A	N/A	N/S	N/S	N/S	N/S	N/S	N/A
Surface Water	Incidental Ingestion	N/A	N/A	N/A	N/A	4.1E-08	N/A	N/A	N/A	N/A	N/A	N/A	3.2E-02
	Dermal Contact	N/A	N/A	N/A	N/A	1.9E-07	N/A	N/A	N/A	N/A	N/A	N/A	4.8E-02
	TOTAL	6.1E-05	2.8E-05	8.3E-05	8.6E-05	1.5E-06	3.1E-01	2.0E-01	1.4E+00	-	1.3E+00	-	1.8E-01

N/A = Not applicable because this media is not associated with this potential receptor
N/S = Not sampled
* = During Showering, Adult Residents Only
** = Hazard Indicies (i.e., summation of hazard quotients) are used only for comparison purposes and do not reflect actual additive noncarcinogenic effects
* - Value from amended risk assessment.
@ - Result is the maximum of the HIs among the affected target organs from the amended risk assessment.

TABLE 26

SUMMARY OF CENTRAL TENDENCY CANCER RISKS AND NONCARCINOGENIC HAZARD INDICIES - SITE 15
NWS EARLE, COLTS NECK, NEW JERSEY

Medium	Exposure Routes	Estimated Incremental Cancer Risk					Estimated Hazard Index**						
		Current Industrial Employee	Future Industrial Employee	Future Lifetime Resident	Future Lifetime Resident	Future Recreational Child	Current Industrial Employee	Future Industrial Employee	Future Resident				Future Recreational Child
									Child	Adult	Child	Adult	
Surface Soil	Incidental Ingestion	N/R	N/A	N/S	N/R	N/A	N/R	N/A	N/S	N/A	3.1E-01@	N/A	N/A
	Dermal Contact	N/R	N/A	N/S	N/R	N/A	N/R	N/A	N/S	N/A	3.9E-01@	N/A	N/A
	Inhalation of Fugitive Dust	N/R	N/A	N/S	N/R	N/A	N/R	N/A	N/S	N/A	1.2E-05*	N/A	N/A
Subsurface Soil	Incidental Ingestion	N/A	N/R	N/R	N/S	N/A	N/A	N/R	2.7E-01@	N/A	N/S	N/A	N/A
	Dermal Contact	N/A	N/R	N/R	N/S	N/A	N/A	N/R	3.3E-01@	N/A	N/S	N/A	N/A
	Inhalation of Fugitive Dust	N/A	N/R	N/R	N/S	N/A	N/A	N/R	9.5E-06*	N/A	N/S	N/A	N/A
Sediment	Incidental Ingestion	N/A	N/A	N/A	N/A	N/R	N/A	N/A	N/A	N/A	N/A	N/A	N/R
	Dermal Contact	N/A	N/A	N/A	N/A	N/R	N/A	N/A	N/A	N/A	N/A	N/A	N/R
Groundwater	Ingestion	N/A	N/S	N/S	N/S	N/A	N/A	N/S	N/S	N/S	N/S	N/A	N/A
	Dermal Contact	N/A	N/S	N/S	N/S	N/A	N/A	N/S	N/S	N/S	N/S	N/A	N/A
	Inhalation of Volatiles*	N/A	N/S	N/S	N/S	N/A	N/A	N/S	N/S	N/S	N/S	N/S	N/A
Surface Water	Incidental Ingestion	N/A	N/A	N/A	N/A	N/R	N/A	N/A	N/A	N/A	N/A	N/A	N/R
	Dermal Contact	N/A	N/A	N/A	N/A	N/R	N/A	N/A	N/A	N/A	N/A	N/A	N/R
TOTAL		-	-	-	-	-	-	-	6.0E-01	-	7.0E-01	-	-

N/A = Not applicable because this media is not associated with this potential receptor
N/R - Central Tendency calculation not required
N/S = Not sampled
* = During Showering, Adult Residents Only
** = Hazard Indicies (i.e., summation of hazard quotients) are used only for comparison purposes and do not reflect actual additive noncarcinogenic effects
* - Value from amended risk assessment.
@ - Result is the maximum of the HIs among the affected target organs from the amended risk assessment.

TABLE 27
SUMMARY OF RME ESTIMATED CANCER RISKS AND NONCARCINOGENIC HAZARD INDICIES - SITE 17
NWS EARLE, COLTS NECK, NEW JERSEY

Medium	Exposure Routes	Estimated Incremental Cancer Risk				Estimated Hazard Index***				
		Current Industrial Employee	Future Industrial Employee	Future Lifetime Resident	Future Recreational Child	Current Industrial Employee	Future Industrial Employee	Future Resident		Future Recreational Child
								Child	Adult	
Surface Soil	Incidental Ingestion	1.2E-06	N/A	5.4E-06	N/A	7.5E-03	N/A	9.8E-02	N/A	N/A
	Dermal Contact	4.0E-07	N/A	1.3E-06	N/A	2.4E-03	N/A	2.0E-02	N/A	N/A
	Inhalation of Fugitive Dust	6.7E-10	N/A	4.1E-10	N/A	1.0E-06	N/A	1.0E-06	N/A	N/A
Subsurface Soil	Incidental Ingestion	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
	Dermal Contact	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
	Inhalation of Fugitive Dust	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
Sediment	Incidental Ingestion	N/A	N/A	N/A	2.5E-07	N/A	N/A	N/A	N/A	1.3E-02
	Dermal Contact	N/A	N/A	N/A	1.8E-06	N/A	N/A	N/A	N/A	4.8E-02
Groundwater	Ingestion	N/A	1.0E-04	4.4E-04	N/A	N/A	6.7E-01	4.2E+00@	N/A	N/A
	Dermal Contact	N/A	2.1E-07	5.4E-06	N/A	N/A	1.3E-03	5.3E-02	N/A	N/A
	Inhalation of Volatiles*	N/A	N/A	N/A**	N/A	N/A	N/A	N/A	N/A**	N/A
Surface Water	Incidental Ingestion	N/A	N/A	N/A	9.5E-07	N/A	N/A	N/A	N/A	2.7E-02
	Dermal Contact	N/A	N/A	N/A	2.9E-07	N/A	N/A	N/A	N/A	7.6E-03
TOTAL		1.6E-06	1.0E-04	4.5E-04	3.3E-06	9.9E-03	6.7E-01	4.4E+00	-	9.5E-02

N/A = Not applicable because this media is not associated with this potential receptor
N/S = Not sampled
* = During Showering, Adult Residents Only
** = No volatiles were detected in groundwater
*** = Hazard Indicies (i.e., summation of hazard quotients) are used only for comparison purposes and do not reflect actual additive noncarcinogenic effects
@ - Result is the maximum of the His among the affected target organs from the amended risk assessment.

TABLE 28

SUMMARY OF CENTRAL TENDENCY CANCER RISKS AND NONCARCINOGENIC HAZARD INDICIES - SITE 17
NWS EARLE, COLTS NECK, NEW JERSEY

Medium	Exposure Routes	Estimated Incremental Cancer Risk				Estimated Hazard Index***				
		Current Industrial Employee	Future Industrial Employee	Future Lifetime Resident	Future Recreational Child	Current Industrial Employee	Future Industrial Employee	Future Resident		Future Recreational Child
								Child	Adult	
Surface Soil	Incidental Ingestion	N/R	N/A	N/R	N/A	N/R	N/A	N/R	N/A	N/A
	Dermal Contact	N/R	N/A	N/R	N/A	N/R	N/A	N/R	N/A	N/A
	Inhalation of Fugitive Dust	N/R	N/A	N/R	N/A	N/R	N/A	N/R	N/A	N/A
Subsurface Soil	Incidental Ingestion	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
	Dermal Contact	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
	Inhalation of Fugitive Dust	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
Sediment	Incidental Ingestion	N/A	N/A	N/A	N/R	N/A	N/A	N/A	N/A	N/R
	Dermal Contact	N/A	N/A	N/A	N/R	N/A	N/A	N/A	N/A	N/R
Groundwater	Ingestion	N/A	N/R	2.0E-04	N/A	N/A	N/R	2.0E+00@	N/A	N/A
	Dermal Contact	N/A	N/R	1.7E-08	N/A	N/A	N/R	2.2E-02	N/A	N/A
	Inhalation of Volatiles*	N/A	N/A	N/A**	N/A	N/A	N/A	N/A	N/A**	N/A
Surface Water	Incidental Ingestion	N/A	N/A	N/A	N/R	N/A	N/A	N/A	N/A	N/R
	Dermal Contact	N/A	N/A	N/A	N/R	N/A	N/A	N/A	N/A	N/R
	TOTAL	-	-	2.0E-04	-	-	-	2.0E+00	-	-

N/A = Not applicable because this media is not associated with this potential receptor
N/R - Central Tendencies calculation not required
N/S = Not sampled
* = During Showering, Adult Residents Only
** = No volatiles were detected in groundwater
*** = Hazard Indicies (i.e., summation of hazard quotients) are used only for comparison purposes and do not reflect actual additive noncarcinogenic effects
@ - Result is the maximum of the His among the affected target organs from the amended risk assessment.

The RME cancer risks associated with a future residential (groundwater) exposure scenario were at the upper end of the target risk range of 1E-04 to 1E-06. The CTE cancer risks for the future residential receptor were also at the upper end of the target acceptable risk range of 1E-04 to 1E-06.

Arsenic (via ingestion) is the principal COPC that contributed to the cancer risks for this exposure scenario. The RME cancer risks associated with future industrial (groundwater) exposure were at the upper end of the target acceptable risk range of 1E-04 to 1E-06. Arsenic (via ingestion) is the principal COPC that contributed to the cancer risks for this exposure scenario.

RME estimates for non-carcinogenic HIs associated with a future residential (groundwater) exposure scenario exceeded 1.0, the cutoff point below which adverse non-carcinogenic effects are not expected to occur. Arsenic is the COPC that exceeded 1.0 for this exposure scenario. In addition, CTE risk estimates for future residential exposure to groundwater yielded an HI greater than 1.0; the affected target organ is the skin.

The estimated RME cancer risk for the future industrial employee is at the upper end of the target acceptable risk range, based mainly on ingestion of groundwater. The estimated RME cancer risk for the future residential receptor is at the upper end of the target risk range, based mainly on ingestion of groundwater. The estimated CTE cancer risk for the future residential receptor is also at the upper end of the target risk range, based mainly on ingestion of groundwater. The estimated RME non-cancer HI for the future residential receptor exceeds 1.0, based mainly on ingestion of groundwater. The estimated CTE cancer risk for the future residential receptor exceeds 1.0, based mainly on ingestion of groundwater.

Lead concentrations detected at the site during the RI were below the EPA guidelines and are not expected to be associated with a significant increase in blood-lead levels based on the results of the IEUBK Lead Model (v. 0.99). IEUBK lead model results indicate that less than five percent of the modeled population (resident child) would be expected to develop a blood lead concentration greater than 10 ug/dl.

Arsenic was detected in three of four Site 17 groundwater samples at concentrations of 4.2 ug/l, 7.0 ug/l, and 19.7 ug/l. Arsenic was detected in one of three background groundwater samples at a concentration of 5.1 ug/l. One of the Site 17 concentrations, 19.7 ug/l, is clearly elevated above background. The other two concentrations are similar to the background concentration. The Site 17 average groundwater concentration for arsenic is greater than the average background concentration (5.6 ug/l versus 8.14 ug/l).

B. Ecological Risk Assessment

The ecological risk assessment estimates the risk posed to ecological receptors, such as aquatic and terrestrial biota, from contamination at the NWS Earle sites. Using the procedures described in the 1996 RI report, and following EPA ecological risk assessment guidance, ecological COPCs were selected and

compared to a set of **ecological toxicity threshold (ET)** values that have been found to be protective of a wide variety of sensitive species. ETs selected for surface water, sediment and surface soil were used in the ecological exposure assessment and risk characterization for each site. A summary of the results of the ecological risk assessment for the OU 9 sites is presented below.

Site 6

The results of the RI ecological risk assessment showed that several inorganics and organics, primarily PAH compounds were present in surface water and sediment near the site in excess of screening values. Concentrations of lead, zinc, and several PAHs in sediment collected near the Site 6 landfill toe were significantly elevated. Because data from the 1994 SI and 1996 RI indicated minimal impacts to groundwater, erosion and overland runoff from the landfill toe were considered possible contaminant migration pathways. However, surface water and sediment samples had not been collected farther away from the site in the marsh. As a result, additional surface water and sediment samples were collected farther into the marsh at the site to determine the extent of the impacts of landfill-related contaminants on the marsh.

In Site 6 surface water and sediments, only a few contaminants that had high frequencies of detection exceeded screening levels. Of these, the most significant exceedances in surface water were for aluminum, iron, lead, and vanadium. The high concentrations were confined to sample 06SW06, which was one of the samples collected farthest from the former landfill. Sediment concentrations at this location were not significantly elevated, and sediment contaminant concentrations in sample 06SD09, which was collected in the same area as 06SW06 but closer to the landfill, were also relatively low. In Site 6 sediments, the average concentrations of all metals were below threshold values. Concentrations of some inorganics for which no screening values were available were significantly elevated in sediment sample 06SD07. However, surface water concentrations at that location were not elevated, and sediment concentrations in sample 06SD10, which was taken in the same general area as sample 06SD07 but closer to the landfill, were not significantly elevated. Frequencies of detection and hazard quotient (HQ) values for organics in Site 6 sediments were all low.

In summary, significantly elevated contaminant concentrations and exceedances of threshold values from the 1995 RI samples and 1996 RI were not prevalent in surface water and sediment samples collected farther into the marsh from Site 6. Therefore, impacts of contaminants from Site 6 on the marsh were considered to be minimal. Elevated concentrations of some inorganics were present but were confined primarily to ubiquitous metals in only a few samples collected relatively far from the landfill. This indicated that these elevated concentrations were most likely indicative of contaminant sources that were not related to the landfill. Additive impacts on the watershed and cumulative effects from contaminants from the site on marsh receptors are unlikely. Concentrations of contaminants that bioaccumulate and biomagnify were also relatively low. Thus, potential risks to organisms from exposure via the food chain (e.g., wading birds)

appeared to be highly unlikely. Concentrations of contaminants in surface water and sediments in the two samples collected upstream from the marsh were low and, as a result, impacts to the marsh from upstream sources appeared to be negligible.

The data indicate that the assessment endpoint chosen, the maintenance of receptor populations in the marsh, does not appear to be compromised from Site 6 or upstream contaminants; therefore, ecological risks to the marsh from Navy-related areas appear to be insignificant. Remedial action based on ecological risk concerns or additional, more focused ecological studies are therefore unwarranted.

Site 12

The ecological risk assessment for Site 12 concluded that there was little potential for ecological impacts due to the site's highly developed status and the lack of significant migration pathways. Subsequently, ecological risks were further reduced by the soil removal carried out by the Navy to remove soils containing antimony and lead.

Site 15

Site 15 is located in the Waterfront complex and occupies an estimated one-acre area. Excellent habitat exists at and near Site 15, mainly for terrestrial receptors that use the site proper and terrestrial and wetland receptors that use the marsh to the northwest. For the most part, runoff and erosion are the main contaminant migration pathways. It is unclear exactly where activities at the site took place, and runoff from an adjacent parking lot drains into a storm water sewer that empties into the drainage swale. As a result, runoff from and to the site is not confined to discrete sources. Limited groundwater to surface water contaminant migration may be possible, but the small area of the site and of the potentially contaminated area at the site minimizes the impact of this pathway.

Subsurface soil, sediment, and groundwater samples were taken as part of 1994 SI activities at the site. Phthalates were the only contaminants detected in subsurface soil, all at low concentrations. Four sediment samples were taken from the drainage ditch. A few phthalates and some PAHs including phenanthrene, anthracene, flouranthene, and pyrene were detected, all at relatively low concentrations. In groundwater, no organics were detected, although elevated levels of some metals were present.

Surface water, sediment, and surface soil samples were taken as part of 1995 RI activities at Site 15 to more fully characterize the nature and extent of contamination in those media and to investigate potential off-site migration. Data from these samples were used for quantitative assessment. HQs for constituents in surface water were indicative of relatively low potential risk. HQs for inorganics in sediment were indicative of relatively low risk, with the exception of zinc. This metal slightly exceeded a less conservative ecological screening value (ESV). This zinc concentration may be naturally elevated. Some inorganics were retained as final COPCs in sediments because no suitable ESVs were available. Of these, only aluminum was detected

significantly above background. Most HQ values for inorganics were indicative of low potential risk, although the pesticides 4,4'-DDE and 4,4'-DDT and the PAHs benzo(b)fluoranthene, phenanthrene, and pyrene slightly exceeded less conservative ESVs. The pesticides detected may have been the result of intense past seashore vector control programs not due to Site 15 activities and were not detected at relatively high concentrations. Styrene and 2-butanone were conservatively retained as final COPCs because no suitable ESVs were available, but these compounds were only detected in one sample and at low concentrations.

HQ values for inorganics in surface soils were indicative of low potential risk, with the exception of chromium. Chromium had an HQ value indicative of moderately high risk, but the associated surface soil concentration was less than background. The elevated HQ value for this inorganic was probably due to the very conservative ESV used. HQs for organics were also indicative of low potential risk. A phthalate compound was conservatively retained as a final COPC because no ESV was available, but it was detected at a low concentration. Phthalates are ubiquitous in the environment and are common laboratory contaminants. For terrestrial plants, HQs were reflective of low potential risk, with the exception of aluminum, chromium, and vanadium, but these metals were detected at concentrations below or only slightly above background. No suitable terrestrial plant ESVs were available for organics detected in surface soils, but terrestrial plants generally do not significantly translocate organics into root tissue, and no evidence of stressed vegetation is apparent at the site.

In summary, HQ values for most concentrations in most media at Site 15 were indicative of low potential risk. Most elevated HQs were mitigated by various factors including concentrations below background. Previous studies indicated relatively low concentrations of contaminants in sediments. Only a few inorganics exceeded ESVs in surface water, and the HQ values were mostly indicative of low risk. Some constituents had HQ values greater than one but did not exceed background; this was mainly a function of extremely conservative ESVs rather than excessively high background values. Potential risks from inorganics in sediments were also low. A suite of organic contaminants in sediments exceeded ESVs, but most of these exceedances were low. However, a few HQ values were indicative of moderate risk. Some contaminants were present in sediments for which no suitable ESVs were available, but concentrations of these contaminants were fairly low. As a result, they are not likely to pose significant potential risk. In addition, organic contaminants in sediments have a low tendency to migrate because they bind to organic fractions in sediments.

In Site 15 surface soils, no inorganics exceeded ESVs or were retained as final COPCs. Aluminum was retained because no ESV was available, but concentrations were only slightly above background. Potential risks from organics in surface soils were also minimal. In addition, potential risk to terrestrial plants from inorganic contaminants in surface soils was low. No suitable terrestrial plant ESVs were available for organics. Most terrestrial plants do not absorb organic contaminants to the same degree as inorganics. Several organics were detected in site sediments, mainly PAHs, and a few of these slightly exceeded less conservative ESVs, indicating moderate potential risk. However, these compounds could as likely have resulted from runoff

from a nearby road and parking lot because surface drainage from those areas empties into the drainageway next to the site.

Site 15 is small and the contaminant source is not discrete. Moreover, the concentrations of contaminants are relatively low. The PAHs detected have strong affinities for organic fractions in sediments; as a result, they do not tend to migrate significantly. For these reasons, additional investigation does not appear to be necessary, nor does remediation at the site based on ecological concerns.

Site 17

Site 17 is a former landfill located a few hundred feet from Site 6, at the edge of the marsh. The results of the RI ecological risk assessment showed that several inorganics and organics, primarily PAH compounds were present in surface water and sediment near the site in excess of screening values. Concentrations of several metals in surface water and several PAHs in sediments collected near the Site 17 landfill toe were significantly elevated. Because data from the 1994 SI and 1996 RI indicated minimal impacts to groundwater, erosion and overland runoff from the landfill toe contaminant migration pathways were considered possible. However, surface water and sediment samples had not been collected farther away from the site in the marsh. As a result, additional surface water and sediment samples were collected to determine the extent of the impacts of landfill-related contaminants on the marsh.

In Site 17 surface water, only barium (up to 37.9 ug/l) significantly exceeded its ET value (3.9 ug/l), but the background concentration of this inorganic (31.5 ug/l) was higher than the average Site 17 concentration (28.6 ug/l). HQ values for inorganics in marsh sediments near Site 17 were all low. Sediment concentrations of aluminum, cobalt, and vanadium, which had no suitable ESVs, were significantly elevated in sample 17SD07, but surface water concentrations of these metals at the same location were not elevated and surface water and sediment concentrations of these contaminants in samples collected in the same general area as 17SD07 but closer to the landfill were all much lower. Only one organic, bis (2ethylhexyl) phthalate, found in Site 17 sediments exceeded its corresponding background concentration, and the HQ value was low.

In summary, significantly elevated contaminant concentrations and exceedances of threshold values from the 1995 RI report ecological risk assessment were not prevalent in surface water and sediment samples collected farther into the marsh from Site 17. Therefore, impacts of contaminants from Site 17 on the marsh are minimal. Elevated concentrations of some inorganics were present but were confined primarily to ubiquitous metals in only a few samples collected relatively far from the landfill. This indicates that these elevated concentrations are most likely only indicative of contaminant "hot spots" that do not stem from landfill-related releases. Additive impacts on the watershed and cumulative effects from contaminants from other sites on marsh receptors are also unlikely. Concentrations of contaminants that bioaccumulate and biomagnify were relatively low. Thus, potential risks to organisms from exposure via the food chain (e.g.,

wading birds) appear to be highly unlikely. Concentrations of contaminants in surface water and sediments in the two samples collected upstream from the marsh were low and, as a result, impacts to the marsh from upstream sources appear to be negligible.

The data indicate that the assessment endpoint chosen, the maintenance of receptor populations in the marsh, does not appear to be compromised from Site 17 or upstream contaminants; therefore, ecological risks to the marsh from Navy-related areas appear to be insignificant. Remedial action based on ecological risk concerns or additional, more focused ecological studies are therefore unwarranted.

VII. REMEDIAL ACTION OBJECTIVES AND PRELIMINARY REMEDIATION GOALS

The overall objective for the remedy at OU 9 sites 6, 12, 15, and 17 is to protect human health and the environment. Based on the baseline human health risk assessment, the ecological risk assessment, and the RI results, remedial action objectives (RAOs) were developed to address environmental media status at OU 9 sites.

A. Site 6

Protection of Human Health RAO

- Prevent potential human exposure to metals in groundwater at concentrations above GWQS and/or MCLs.

Protection of the Environment RAOs

- No RAO for protection of the environment is necessary.

Preliminary remediation goals (PRGs) for Site 6 groundwater are presented in Table 29.

B. Site 12

There are no RAO's or PRGs because Site 12 has already been remediated and documented in a Remedial Action Report for Soil Excavation at Site 12, Foster Wheeler Environmental Corporation, December 1999.

TABLE 29

PROPOSED PRGs
OPERABLE UNIT 9 RECORD OF DECISION
NAVAL WEAPONS STATION EARLE
COLTS NECK, NEW JERSEY

Contaminant of Concern	Proposed PRG	Basis of Selection
Site 6 – Landfill West of Normandy Road (ug/L)		
Aluminum	2,090	Background
Arsenic	8.0	GWQS
Cadmium	7	Background
Chromium	100	GWQS
Iron	95,200	Background
Manganese	3,040	Background
Site 15 – Sludge Disposal Site (mg/kg)		
Arsenic	20	RDCSCC
Cadmium	1	RDCSCC
Site 17 – Landfill (ug/L)		
Arsenic	8.0	GWQS
Cadmium	7	Background

New Jersey groundwater quality standards (GWQS) (N.J.A.C. 7:9-6) are ARARs.
New Jersey residential direct contact soil cleanup criteria (RDCSCC) are TBCs.

C. Site 15

Protection of Human Health RAO

Prevent potential human exposure to metals at concentrations greater than NJDEP clean up criteria in surface and subsurface soils.

Protection of the Environment RAOs

- No RAO for protection of the environment is necessary.

PRGs for Site 15 surface and subsurface soil are presented in Table 29.

D. Site 17

Protection of Human Health RAO

- Prevent potential human exposure to metals at concentrations above GWQS and/or MCLs in Site 17 groundwater.

Protection of the Environment RAOs

- No RAO for protection of the environment is necessary.

PRGs for Site 17 groundwater are presented in Table 29.

VIII. DESCRIPTION OF REMEDIAL ACTION ALTERNATIVES

The purpose of developing alternatives and the alternative screening process is to assemble an appropriate range of possible remedial options to achieve the RAOs identified for the site. In this process, technically feasible technologies are combined to form remedial alternatives that provide varying levels of risk reduction that comply with federal (EPA) and state (NJDEP) guidelines for site remediation.

Engineering technologies capable of eliminating the unacceptable risks associated with exposure to site-related soils or groundwater were identified, and those alternatives determined to best meet RAOs after screening were evaluated in detail. Summaries of the remedial alternatives developed for OU 9 Sites 6, 12, 15, and 17 are presented in the following sections.

A. Site 6

Summaries of the remedial alternatives that passed the screening step for Site 6 are presented in the following sections. Each of the alternatives will benefit from existing conditions. Currently, existing Site 6 features offer some limited protection of human health and the environment. Slope stabilization work that included removal of debris, additional soil cover, regrading, and seeding was completed at the site in 1999. As a result of the recent landfill stabilization work and existing structures (buildings, parking lot, etc.), there is currently no pathway for human exposure to contaminated groundwater. Groundwater underlying Site 6 is not currently used as a potable water supply.

1. Alternative 1: No Action

The no-action alternative is required by the NCP to be used as a baseline to which other alternatives may be compared. No remedial actions would be taken to protect human health or the environment. The purpose of this alternative is to evaluate the overall human health and environmental protection provided by the site in its present state. No measures would be implemented to prevent potential receptors from being exposed to groundwater contaminated at levels that exceed MCLs or GWQS. This alternative does not monitor for attainment of MCLs or GWQS over time.

2. Alternative 2: Land use Controls and Long Term Monitoring

Alternative 2 relies on land use controls to limit potential exposure to site risks. This alternative does not employ engineered treatment or containment to address groundwater contamination. Land use controls would be enacted to prohibit use of impacted groundwater. A remedial design for additional well installation, implementation of a CEA, and long term monitoring has been prepared. Long-term periodic monitoring would be conducted to assess the alternative's effectiveness and potential threats to human health and the environment. Site conditions and risks would be reviewed every five years because contaminants would be left in place. The major components of this alternative include;

Land use Controls - Under Alternative 2, LUCs would be incorporated into the Base Master Plan to restrict future use of Site 6 groundwater. In addition, a CEA pursuant to N.J.A.C 7:9-6 would be established to prohibit the use of untreated groundwater as drinking water. Long-term, periodic monitoring and five-year reviews would assess contaminant status and potential threats to human health and the environment. Both the restrictions in the Base Master Plan and the CEA would remain in place until contaminant concentrations are reduced to acceptable levels (GWQS or MCLs).

Security Fencing - Security fencing has been installed to deter human and animal entry into the landfill area to protect the integrity of the existing cover. Current fencing at the site would be evaluated to see if it could be used in lieu of new fencing for this remedial alternative.

Long-Term Monitoring - Under Alternative 2, the groundwater would be sampled annually to monitor the migration of contaminants from the site and the potential for impacts to downgradient areas. Background well data would be used for evaluation of site contaminant status. The data would be evaluated during the five-year review period.

Five-Year Reviews - Since contaminants remain on the site, a review of site conditions and risks would be conducted every five years, as required by CERCLA. The reviews would consist of evaluating analytical and hydrogeologic data, assessing whether contaminant migration has increased, and determining whether human or ecological receptors or natural resources are at risk.

B. Site 12

The baseline risk assessment for Site 12, prepared for the 1995 RI report, indicated that low-level risks might exist for future residential child receptors, based on antimony and lead in surface soil. Soil remediation performed by the Navy in 1999 included excavation, removal and disposal of the railroad tracks, ties and cinder bedding in the area as well as contaminated soils. Confirmatory soil sample collection and analysis demonstrated that NJDEP residential clean-up standards were achieved. Restoration of the site after excavation/removal included backfill using certified clean select fill. Based on EPA and NJDEP approval, Site 12 met the applicable requirements for closure and the remediation of Site 12 soil was considered complete.

C. Site 15

Summaries of the remedial alternatives that passed the screening step for Site 15 are presented in the following sections. Each of the alternatives will benefit from existing conditions. Currently, the entire site is located within a red maple/sweet gum wetland that is fenced off from the remainder of the Base by a double-fenced security buffer zone. This existing Site 15 feature offers some limited protection of human health and the environment.

1. Alternative 1: No Action

The no-action alternative is required by the NCP to be used as a baseline to which other alternatives may be compared. No remedial actions would be taken to protect human health or the environment. The purpose of this alternative is to evaluate the overall human health and environmental protection provided by the site in its present state. This alternative does not prevent potential receptors from being exposed to surface soil and subsurface soil contaminated at levels that exceed RDCSCC and Non-Residential Direct Contact Soil Cleanup Criteria (NRDCSCC). This alternative does not monitor for attainment of the RDCSCC.

2. Alternative 2: Land use Controls and Long Term Monitoring

Alternative 2 relies on land use controls to limit exposures to metals concentrations greater than the RDCSCC in contaminated soil. This alternative does not employ engineered treatment or containment to address soil contamination. Land use controls would be enacted to prohibit use of impacted soil. Long-term, periodic monitoring and five-year reviews would assess contaminant status and potential threats to human health and the environment. Site conditions and risks would be reviewed every five-years because contaminants would be left in place. Key components of Alternative 2 are described below.

Land use Controls - Under Alternative 2, LUCs would be incorporated into the Base Master Plan to restrict the future use of Site 15 to its present security buffer use.

Security Fencing – The existing security fencing would be inspected for integrity. Where required, 8-foot-high chain-link fence, with galvanized steel posts at 8-foot intervals would be installed. A locking gate would also be installed to allow controlled access to the site.

Five-Year Reviews - Because contaminants would remain in Site 15 soils, a review of site conditions and risks would be conducted every five years, as required by CERCLA. For the purpose of the five-year review, surface and subsurface soil samples would be collected every five years for metals concentration analysis. Analytical data from the soil sampling activity will be assessed to determine if human receptors or natural resources are at risk.

D. Site 17

Summaries of the remedial alternatives that passed the screening step for Site 17 are presented in the following sections. Each of the alternatives will benefit from existing conditions. Currently existing site 17 features offer limited protection of human health and the environment. The primary protective feature is that groundwater underlying Site 17 is not currently used as a potable water supply. There is currently no

pathway for human exposure to metals-contaminated groundwater.

Work performed by Foster Wheeler Environmental Corporation in 1999 included grading of the flat portion of the site, topsoil cover, and seeding. A wooden barricade was installed on the flat upper portion of the site to prevent any future deposition of soils or debris on the sloped area of Site 17.

1. Alternative 1: No Action

The no-action alternative is required by the NCP to be used as a baseline to which other alternatives may be compared. No remedial actions would be taken to protect human health or the environment. The purpose of this alternative is to evaluate the overall human health and environmental protection provided by the site in its present state. No measures would be implemented to prevent potential receptors from being exposed to groundwater contaminated at levels that exceed MCLs or GWQS. This alternative does not monitor for attainment of MCLs or GWQS over time.

2. Alternative 2: Land use Controls and Long Term Monitoring

Alternative 2 relies on land use controls to limit potential exposure to contaminated groundwater. This alternative does not employ engineered treatment or containment to address groundwater contamination. Land use controls would be enacted to prohibit use of impacted groundwater. Long-term periodic monitoring would be conducted to assess the alternative's effectiveness and potential threats to human health and the environment. Site conditions and risks would be reviewed every five years because contaminants would be left in place. The major components of this alternative include:

Land use Controls - Under Alternative 2, LUCs would be incorporated into the Base Master Plan to restrict the future use of Site 17 groundwater. In addition, a CEA pursuant to N.J.A.C. 7:9-6 would be established to prohibit the use of untreated groundwater as drinking water. Long-term, periodic monitoring and five-year reviews would assess contaminant status and potential threats to human health and the environment. Both the restrictions in the Base Master Plan and the CEA would remain in place until contaminant concentrations are reduced to acceptable levels (GWQS or MCLs).

Security Fencing - Security fencing was installed in 1999 to protect the integrity of the existing cover. The existing fence is expected to be sufficient for the purposes of this remedial alternative. However, for cost estimating purposes, installation of fencing has been included in the cost estimate for this Alternative.

Long-Term Monitoring - Under Alternative 2, one new well will be installed downgradient of Site 17. Groundwater would be sampled periodically from three existing monitoring wells and the new downgradient well on an annual basis. All samples will be analyzed for site-specific contaminants (metals). The analytical

results will be used to monitor the migration of contaminants from Site 17 and assess the potential impacts to downgradient receptors. The collected data would be evaluated during the five-year review period.

Five-Year Reviews - Because contaminants would remain in Site 17 groundwater, a review of site conditions and risks would be conducted every five years, as required by CERCLA. The reviews would consist of evaluating analytical and hydrogeologic data and assessing whether contaminant migration has increased to determine whether human receptors or natural resources are at risk.

IX. SUMMARY AND COMPARATIVE ANALYSIS OF ALTERNATIVES

Evaluation Criteria

The remedial action alternatives described in Section VIII were evaluated using the following criteria, established by the NCP:

Threshold Criteria: Statutory requirements that each alternative must satisfy in order to be eligible for selection.

1. Overall protection of human health and the environment - draws on the assessments conducted under other evaluation criteria and considers how the alternative addresses site risks through treatment, engineering, or land use controls.

2. Compliance with ARARs - evaluates the ability of an alternative to meet ARARs established through federal and state statutes and/or provides the basis for invoking a waiver.

Primary Balancing Criteria: Technical criteria upon which the detailed analysis is primarily based.

3. Long-term effectiveness and permanence - evaluates the ability of an alternative to provide long-term protection of human health and the environment and the magnitude of residual risk posed by untreated wastes or treatment residuals.

4. Reduction of mobility, toxicity, or volume through treatment - evaluates an alternative's ability to reduce risks through treatment technology.

5. Short-term effectiveness - addresses the cleanup timeframe and any adverse impacts posed by the alternative during the construction and implementation phase, until cleanup goals are achieved.

6. Implementability - evaluates technical feasibility, administrative feasibility, and availability of services and material required to implement the alternative.

7. Cost - includes an evaluation of capital costs and annual O&M costs.

Modifying Criteria: Criteria considered throughout the development of the preferred remedial alternative and formally assessed after the public comment period, which may modify the preferred alternative.

8. Agency acceptance - indicates EPA's and the state's response to the alternatives in terms of technical and administrative issues and concerns.

9. Community acceptance - evaluates the issues and concerns the public may have regarding the alternatives.

The remedial alternatives were compared to one another based on the nine selection criteria, to identify differences among the alternatives and discuss how site contaminant threats are addressed.

A. Site 6

Based on the initial screening of remedial alternatives, Alternatives 1 and 2 were retained for further consideration. A detailed review of Alternatives 1 and 2 is included in this section and summarized in Table 30.

1. Overall Protection of Human Health and the Environment

Alternative 1 would not be protective of human health because no measures would be taken to prevent potential exposure to the contaminated groundwater at Site 6. Alternative 2 would be protective of human health because measures would be taken to prevent human exposure to the contaminated groundwater until monitoring indicates natural processes have resulted in groundwater contaminant levels below GWQS or MCLs.

2. Compliance with ARARs

Alternative 1 would not comply with MCLs and GWQS. Alternative 2 would eventually comply with MCLs and GWQS and would be in compliance with ARARs because a temporary exemption (CEA) from these requirements will be obtained until the GWQS or MCLs are achieved.

TABLE 30

COMPARATIVE ANALYSIS OF SITE 6 REMEDIAL ACTION ALTERNATIVES
OU 9 RECORD OF DECISION
NWS EARLE, COLTS NECK, NEW JERSEY

CRITERION:	ALTERNATIVE 1: NO ACTION	ALTERNATIVE 2: INSTITUTIONAL CONTROLS AND LONG-TERM MONITOIRING
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT		
Prevent Human Exposure to Contaminants in Groundwater	No action taken to prevent human exposure to contaminated groundwater. Carcinogenic and non-carcinogenic risks exceeding EPA guidelines would remain. No institutional controls implemented to prohibit use of untreated groundwater.	Institutional controls would minimize potential exposure to site groundwater by prohibiting its use. In time, contaminants would gradually decrease until reaching levels that would not pose excess risk.
Minimize Contaminant Migration	This alternative does not provide any actions to reduce contaminant migration to downgradient receptors.	This alternative does not provide any actions to reduce contaminant migration to downgradient receptors.
COMPLIANCE WITH ARARS		
Chemical-Specific ARARs	Would not comply with GWQS and MCLs.	A CEA would be established to provide the state notification that standards (GWQS and MCLs) would not be met for a specified duration, anticipated not to exceed 10 years.
Location-Specific ARARs	Not applicable.	Would comply with Federal and state ARARs for wetlands, floodplains, and other sensitive receptors.
Action-Specific ARARs	Would comply with all action-specific ARARs. Federal or State ARARs for post-closure maintenance of municipal landfills may not be met.	Would comply with all action-specific ARARs. Five-year review process would ensure Federal or state ARARs for post-closure maintenance of municipal landfills will be met.
LONG-TERM EFFECTIVENESS AND PERMANENCE		
Magnitude of Residual Risk	Existing risks would remain: approximately 6E-04 cancer risk and HI > 1 non-carcinogenic risk from exposure to site groundwater assuming future residential land use and consumption of contaminated groundwater.	Existing risks would remain: approximately 6E-04 cancer risk and HI > 1 non-carcinogenic risk from exposure to site groundwater. Implementation and enforcement of institutional controls would block exposure to site groundwater. Fencing would reduce potential contact with shallow groundwater.

TABLE 30

COMPARATIVE ANALYSIS OF SITE 6 REMEDIAL ACTION ALTERNATIVES
OU 9 RECORD OF DECISION
NWS EARLE, COLTS NECK, NEW JERSEY

CRITERION:	ALTERNATIVE 1: NO ACTION	ALTERNATIVE 2: INSTITUTIONAL CONTROLS AND LONG-TERM MONITOIRING
LONG-TERM EFFECTIVENESS AND PERMANENCE (Continued)		
Adequacy and Reliability of Controls	No new controls implemented. Existing site features provide limited controls.	If implemented and enforced, institutional controls could prevent contact with and use of contaminated groundwater.
Need for 5-Year Reviews	Not applicable.	Review would be required because groundwater contaminants would be left in place.
REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT		
Reduction of Toxicity, Mobility, or Volume Through Treatment	No reduction, because no treatment would be employed.	No reduction, because no treatment would be employed.
SHORT-TERM EFFECTIVENESS		
Community Protection	No additional risk to community anticipated.	Provided that derived waste is handled appropriately, no significant risk to community anticipated. Engineering controls would be used during implementation to mitigate risks.
Worker Protection	No risk to workers anticipated.	No significant risk to workers anticipated if proper PPE is used and derived waste is handled properly during well and fence installation and long-term monitoring.
Environmental Impacts	No adverse impacts to the environment anticipated.	Provided derived waste material is handled appropriately, no environmental impacts are anticipated during the implementation of long-term monitoring.
Time Until Action is Complete	Not applicable.	Approximately one-year to institute CEA.
IMPLEMENTABILITY		
Ability to Construct and Operate	No construction or operation involved.	No difficulties anticipated. Monitoring well and fencing installation are readily implementable technologies.

TABLE 30

COMPARATIVE ANALYSIS OF SITE 6 REMEDIAL ACTION ALTERNATIVES
OU 9 RECORD OF DECISION
NWS EARLE, COLTS NECK, NEW JERSEY

CRITERION:	ALTERNATIVE 1: NO ACTION	ALTERNATIVE 2: INSTITUTIONAL CONTROLS AND LONG-TERM MONITOIRING
IMPLEMENTABILITY (Continued)		
Ease of Doing More Action if Needed	Additional actions would be easily implemented if required.	Additional actions would be easily implemented if required.
Ability to Monitor Effectiveness	Not applicable.	Monitoring would provide assessment of potential exposures, contaminant presence and migration or changes in site conditions.
Ability to Obtain Approvals and Coordinate with Other Agencies.	Not applicable.	Coordination for five-year reviews may be required and would be obtainable. Coordination with the state would be required to establish a CEA and would be obtainable.
Availability of Treatment, Storage Capacities, and Disposal Services	None required.	None required.
Availability of Equipment, Specialists, and Materials	Not applicable.	Ample availability of equipment and personnel to install monitoring well/fencing and perform long-term maintenance, monitoring, and five-year reviews.
Availability of Technology	Not required.	Common construction techniques and materials required for construction.
COST		
Capital Cost	$0	$44,360
First-Year Annual O&M Cost	$0	$11,000
Five-Year Reviews	$0	$15,500
Present Worth Cost (30 years with 7% interest rate)	$0	$214,280

3. Long-Term Effectiveness and Permanence

Potential future users of site groundwater may be at risk under Alternative 1 because of the lack of land use controls that would prohibit use of untreated contaminated groundwater.

Alternative 2 would mitigate risks due to ingestion of site groundwater by implementing land use controls to prohibit use of untreated, contaminated groundwater. Therefore, Alternative 2 offers a more effective remedy for the long term.

For Alternative 2, no difficulties or uncertainties are anticipated in performing the long-term monitoring. Groundwater monitoring wells may require replacement if damage occurs, but wells would be readily replaceable.

4. Reduction of Toxicity, Mobility, or Volume through Treatment

Neither alternative contains any proposed action that would provide additional treatment. These alternatives would not reduce the toxicity, mobility, or volume through treatment.

5. Short-Term Effectiveness

Since Alternative 1 contains no response actions, implementation of this alternative would not pose additional short-term risks to Station personnel or the local community. The implementation of Alternative 2 is not expected to pose significant risks to Station personnel or the local community. Workers who implement these alternatives would be adequately safeguarded by using appropriate personal protective equipment (PPE) to prevent exposure to contaminated media. Occupational Safety and Health Administration (OSHA) standards would be followed and proper PPE would be used during all monitoring activities under these alternatives.

No permanent adverse impacts to the environment are anticipated to result from implementing either of the alternatives.

6. Implementability

Since no response activities would occur under Alternative 1, the alternative is readily implementable and no permits are required. The technical feasibility criteria, including constructability, operability, and reliability, are not relevant to this alternative.

Alternative 2 is implementable. Long-term monitoring (sampling and analyses) requires readily available resources. The alternative allows for assessing contaminant presence, migration, and changes in media quality that may indicate potential impacts to downgradient receptors. Permits (with the exception of well installation permits) would not be required for this alternative; however approval for implementation of the CEA would be needed from NJDEP. There is ample availability of companies with trained personnel, equipment, and materials to implement this alternative. Regulatory personnel and environmental specialists are readily available to perform five-year reviews associated with this alternative.

Since no treatment or off site disposal is proposed under either alternative, the criterion of availability of treatment technologies, treatment and disposal (TSD) facilities, and capacity is not applicable.

Lastly, under these alternatives, additional actions can be easily implemented in the future, if warranted.

7. Cost

Capital costs associated with Alternative 2 of $44,360 have been included in the first-year O&M cost. The average annual O&M cost for long-term monitoring is $11,000 and five-year reviews are $15,500 per event. Over a 30-year period, the net present-worth cost is $214,280 (at a seven percent discount rate). There are no costs associated with Alternative 1 since no actions would be taken under this alternative.

8. Agency Acceptance

NJDEP has had the opportunity to review and comment on all the documents in the Administrative Record and has had the opportunity to comment on the draft ROD. Comments received from the NJDEP have been incorporated into the ROD.

9. Community Acceptance

The community has had the opportunity to review and comment on documents in the Administrative Record, to participate in regularly scheduled Restoration Advisory Board (RAB) meetings convened to encourage community involvement, and attend a public meeting held to provide the community an opportunity to learn about the PRAP. The community has not indicated objections to the alternative selected in this ROD. Part III, Responsiveness Summary, of this ROD presents an overview of community involvement and input to the selected alternative.

B. Site 12

The Navy, with EPA and NJDEP, has determined that NFA needs to be performed at Site 12. The

previously conducted excavation of contaminated soil at Site 12 achieved the remediation goal for protection of human health and the environment, including prevention of human exposure to contaminated surface and subsurface soil (removed) and migration of contaminants to the adjacent marsh. Site 12 no longer poses an excess risk to human health or the environment. Based on EPA and NJDEP approval, Site 12 has met all the applicable requirements for closure.

C. Site 15

Based on the initial screening of remedial alternatives, Alternatives 1 and 2 were retained for further consideration. A detailed review of Alternatives 1 and 2 is included in this section and summarized in Table 31.

1. Overall Protection of Human Health and the Environment

Alternative 1 would not be protective of human health because no measures would be taken to prevent potential exposure to the contaminated soil at Site 15. Alternative 2 would be protective of human health because measures would be taken to prevent human exposure to the contaminated soil until monitoring indicates natural processes have resulted in soil contaminant levels below NJDEP soil guidelines.

2. Compliance with ARARs

Alternative 1 would not comply with RDCSCC. Alternative 2 would comply with Federal and NJ guidelines and would be in compliance with ARARs because LUCs, including fencing and restricted access, applied to the area will limit contact with contaminated soil until concentrations in soil decrease to a level to allow unrestricted use.

3. Long-Term Effectiveness and Permanence

Potential future users of the site may be at risk under Alternative 1 because of the lack of formalized land use controls that would limit contact with site soil.

Alternative 2 would mitigate risks due to contact with contaminated surface soil and subsurface soil by implementing land use controls to limit contact with contaminated soil. Therefore, Alternative 2 offers a more effective remedy for the long term.

For Alternative 2, no difficulties or uncertainties are anticipated in performing the long-term monitoring.

TABLE 31

COMPARATIVE ANALYSIS OF SITE 15 REMEDIAL ACTION ALTERNATIVES
OU 9 RECORD OF DECISION
NWS EARLE, COLTS NECK, NEW JERSEY

CRITERION:	ALTERNATIVE 1: NO ACTION	ALTERNATIVE 2: INSTITUTIONAL CONTROLS AND LONG-TERM MONITOIRING
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT		
Prevent Human Exposure to Contaminants in Soil	No action taken to prevent human exposure to contaminated soils. Carcinogenic and non-carcinogenic risks would remain. No institutional controls implemented to prohibit exposure to contaminated soils.	Institutional controls would minimize potential exposure to site soil by prohibiting use and access. In time, contaminants would gradually decrease until reaching levels that would not exceed NJDEP soil criteria.
Minimize Contaminant Migration	No actions taken to reduce contaminant migration.	No actions taken to reduce contaminant migration.
COMPLIANCE WITH ARARS		
Chemical-Specific ARARs	Would not comply with RDCSCC.	Land use controls and long term monitoring will ensure that potential human receptors are not exposed to contaminants in Site 15 soil.
Location-Specific ARARs	Would comply with Federal and state ARARs for wetlands, floodplains, and other sensitive receptors.	Would comply with Federal and state ARARs for wetlands, floodplains, and other sensitive receptors.
Action-Specific ARARs	Not applicable.	Would comply with those ARARs pertaining to the proposed construction, maintenance, and monitoring activities.
LONG-TERM EFFECTIVENESS AND PERMANENCE		
Magnitude of Residual Risk	Existing risks would remain: cancer risk within EPA's target range and sum of HIs > 1 for non-carcinogenic risks from exposure to site soils assuming future residential land use and ingestion, inhalation, or dermal contact with contaminated soils.	Existing risks would remain: cancer risk within EPA's target range and sum of HIs > 1 for non-carcinogenic risks from exposure to site soils. Implementation and enforcement of fencing/institutional controls would block exposure to site soils.

TABLE 31

COMPARATIVE ANALYSIS OF SITE 15 REMEDIAL ACTION ALTERNATIVES
OU 9 RECORD OF DECISION
NWS EARLE, COLTS NECK, NEW JERSEY

CRITERION:	ALTERNATIVE 1: NO ACTION	ALTERNATIVE 2: INSTITUTIONAL CONTROLS AND LONG-TERM MONITOIRING
LONG-TERM EFFECTIVENESS AND PERMANENCE (Continued)		
Adequacy and Reliability of Controls	No new controls implemented. Existing site features provide limited controls.	If implemented and enforced, institutional controls could prevent contact with contaminated soils.
Need for 5-Year Reviews	Not applicable.	Review would be required because soil contaminants would be left in place at levels above NJDEP guidelines.
REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT		
Reduction of Toxicity, Mobility, or Volume Through Treatment	No reduction, because no treatment would be employed.	No reduction, because no treatment would be employed.
SHORT-TERM EFFECTIVENESS		
Community Protection	No risk to community anticipated.	No significant risk to community anticipated. Engineering controls would be used during implementation to mitigate risks.
Worker Protection	No risk to workers anticipated.	No risk to workers anticipated if proper PPE is used during fence installation, maintenance, and long-term monitoring.
Environmental Impacts	No adverse impacts to the environment anticipated.	No adverse impacts to the environment anticipated.
Time Until Action is Complete	Not applicable.	Nearly immediate if existing fence is deemed sufficient for the purposes.
IMPLEMENTABILITY		
Ability to Construct and Operate	No construction or operation involved.	No difficulties anticipated. Fencing is a readily implementable technology.
Ease of Doing More Action if Needed	Additional actions would be easily implemented if required.	Additional actions would be easily implemented if required.

TABLE 31

COMPARATIVE ANALYSIS OF SITE 15 REMEDIAL ACTION ALTERNATIVES
OU 9 RECORD OF DECISION
NWS EARLE, COLTS NECK, NEW JERSEY

CRITERION:	ALTERNATIVE 1: NO ACTION	ALTERNATIVE 2: INSTITUTIONAL CONTROLS AND LONG-TERM MONITOIRING
IMPLEMENTABILITY (Continued)		
Ability to Monitor Effectiveness	Not applicable.	Monitoring would provide assessment of potential exposures, contaminant presence of, migration, or changes in site conditions.
Ability to Obtain Approvals and Coordinate with Other Agencies.	Not applicable.	Coordination for five-year reviews may be required and would be obtainable.
Availability of Treatment, Storage Capacities, and Disposal Services	None required.	None required.
Availability of Equipment, Specialists, and Materials	Not applicable.	Ample availability of equipment and personnel to install fencing and perform long-term monitoring, maintenance, and five-year reviews.
Availability of Technology	Not required.	Common techniques and materials required for implementation.
COST		
Capital Cost	$0	$19,490
First-Year Annual O&M Cost	$0	$0
Five-Year Reviews	$0	$14,500
Present Worth Cost (30 years with 7% interest rate)	$0	$50,760

4. Reduction of Toxicity, Mobility, or Volume through Treatment

Neither alternative contains any proposed action that would provide additional treatment. These alternatives would not reduce the toxicity, mobility, or volume through treatment.

5. Short-Term Effectiveness

Since Alternative 1 contains no response actions, implementation of this alternative would not pose additional short-term risks to Station personnel or the local community. Implementation of Alternative 2 is not expected to pose significant risks to Station personnel or the local community. Workers who implement this alternative would be adequately safeguarded by using appropriate PPE to prevent exposure to contaminated media. OSHA standards would be followed and proper PPE would be used during fence installation/maintenance and soil sampling activities. No permanent adverse impacts to the environment are anticipated to result from implementing either of the alternatives.

6. Implementability

Since no response activities would occur under Alternative 1, the alternative is readily implementable and no permits are required. The technical feasibility criteria, including constructibility, operability, and reliability, are not relevant to this alternative.

Alternative 2 is implementable. Installation of a fence and long-term monitoring (sampling and analyses) requires readily available resources. The alternative allows for assessing contaminant presence, migration, and changes in media quality that may indicate potential impacts to downgradient receptors. Permits would not be required for this alternative. There is ample availability of companies with trained personnel, equipment, and materials to implement this alternative. Additionally, regulatory personnel and environmental specialists are readily available to perform five-year reviews associated with this alternative. Since no treatment is proposed in either of the alternatives, the criterion of availability of treatment technologies, TSD facilities, and capacity is not applicable.

Lastly, under these alternatives, additional actions can be easily implemented in the future, if warranted.

7. Cost

Capital costs associated with Alternative 2 of $19,490 have been included in the first-year O&M cost. The average annual O&M cost for long-term monitoring is $0 (monitoring costs for this alternative appear in the five-year review cost), and five-year reviews (including sampling costs) are $14,500 per event. Over a 30-

year period, the net present-worth cost is $50,760 (at a seven percent discount rate). There are no costs associated with Alternative 1 since no actions would be taken under this alternative.

8. Agency Acceptance

NJDEP has had the opportunity to review and comment on all the documents in the Administrative Record and has had the opportunity to comment on the draft ROD. Comments received from the NJDEP have been incorporated into the ROD.

9. Community Acceptance

The community has had the opportunity to review and comment on documents in the Administrative Record, to participate in regularly scheduled RAB meetings convened to encourage community involvement, and attend a public meeting held to provide the community an opportunity to learn about the PRAP. The community has not indicated objections to the alternative selected in this ROD. Part III, Responsiveness Summary, of this ROD presents an overview of community involvement and input to the selected alternative.

D. Site 17

Based on the initial screening of remedial alternatives, Alternatives 1 and 2 were retained for further consideration. A detailed review of Alternatives 1 and 2 is included in this section and summarized in Table 32.

1. Overall Protection of Human Health and the Environment

Alternative 1 would not be protective of human health because no measures would be taken to prevent potential exposure to the contaminated groundwater at Site 17. Alternative 2 would be protective of human health because measures would be taken to prevent human exposure to the contaminated groundwater until monitoring indicates natural processes have resulted in groundwater contaminant levels below GWQS or MCLs.

2. Compliance with ARARs

Alternative 1 would not comply with MCLs and GWQS. Alternative 2 would eventually comply with MCLs and GWQS and would be in compliance with ARARs because a temporary exemption (CEA) from these requirements will be obtained until the GWQS or MCLs are achieved.

TABLE 32

COMPARATIVE ANALYSIS OF SITE 17 REMEDIAL ACTION ALTERNATIVES
OU 9 RECORD OF DECISION
NWS EARLE, COLTS NECK, NEW JERSEY

CRITERION:	ALTERNATIVE 1: NO ACTION	ALTERNATIVE 2: INSTITUTIONAL CONTROLS AND LONG-TERM MONITOIRING
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT		
Prevent Human Exposure to Contaminants in Groundwater	No action taken to prevent human exposure to contaminated groundwater. Carcinogenic and non-carcinogenic risks exceeding EPA's guideline would remain. No institutional controls implemented to prohibit use of untreated groundwater.	Institutional controls would minimize potential exposure to site groundwater by prohibiting its use. In time, contaminants would gradually decrease until reaching levels that would not pose excess risk.
Minimize Contaminant Migration	No actions taken to reduce contaminant migration.	No actions taken to reduce contaminant migration.
COMPLIANCE WITH ARARS		
Chemical-Specific ARARs	Would not comply with GWQS and MCLs.	Groundwater contaminant concentrations would initially exceed GWQS and MCLs. A CEA would be established to provide the state official notification that standards would not be met for a specified duration, anticipated not to exceed 10 years.
Location-Specific ARARs	Not applicable.	Would comply with Federal and state ARARs for wetlands, floodplains, and other sensitive receptors.
Action-Specific ARARs	Would comply with all action-specific ARARs. Federal or state ARARs for post-closure maintenance of municipal landfills may not be met.	Would comply with all action-specific ARARs. Five-year review process would ensure Federal or State ARARs for post-closure maintenance of municipal landfills will be met.
LONG-TERM EFFECTIVENESS AND PERMANENCE		
Magnitude of Residual Risk	Existing risks would remain: approximately 6E-04 cancer risk and HI > 1 non-carcinogenic risk from exposure to site groundwater assuming future residential land use and consumption of contaminated groundwater.	Existing risks would remain: approximately 6E-04 cancer risk and HI > 1 non-carcinogenic risks from exposure to site groundwater. Implementation and enforcement of institutional controls would block exposure to site groundwater. Fencing would reduce potential contact with shallow groundwater.

TABLE 32

COMPARATIVE ANALYSIS OF SITE 17 REMEDIAL ACTION ALTERNATIVES
OU 9 RECORD OF DECISION
NWS EARLE, COLTS NECK, NEW JERSEY

CRITERION:	ALTERNATIVE 1: NO ACTION	ALTERNATIVE 2: INSTITUTIONAL CONTROLS AND LONG-TERM MONITOIRING
LONG-TERM EFFECTIVENESS AND PERMANENCE (Continued)		
Adequacy and Reliability of Controls	No new controls implemented. Existing site features provide limited controls.	If implemented and enforced, institutional controls could prevent contact with and use of contaminated groundwater.
Need for 5-Year Reviews	Not applicable.	Review would be required because groundwater contaminants would be left in place.
REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT		
Reduction of Toxicity, Mobility, or Volume Through Treatment	No reduction, because no treatment would be employed.	No reduction, because no treatment would be employed.
SHORT-TERM EFFECTIVENESS		
Community Protection	No additional risk to community anticipated.	No significant risk to community anticipated. Engineering controls would be used during implementation to mitigate risks.
Worker Protection	No risk to workers anticipated.	No significant risk to workers anticipated if proper PPE is used during well and fence installation and long-term monitoring.
Environmental Impacts	No adverse impacts to the environment anticipated.	No adverse impacts to the environment anticipated.
Time Until Action is Complete	Not applicable.	Approximately one-year to institute CEA.
IMPLEMENTABILITY		
Ability to Construct and Operate	No construction or operation involved.	No difficulties anticipated. Monitoring well and fencing installation are readily implementable technologies.
Ease of Doing More Action if Needed	Additional actions would be easily implemented if required.	Additional actions would be easily implemented if required.

TABLE 32

COMPARATIVE ANALYSIS OF SITE 17 REMEDIAL ACTION ALTERNATIVES
OU 9 RECORD OF DECISION
NWS EARLE, COLTS NECK, NEW JERSEY

CRITERION:	ALTERNATIVE 1: NO ACTION	ALTERNATIVE 2: INSTITUTIONAL CONTROLS AND LONG-TERM MONITOIRING
IMPLEMENTABILITY (Continued)		
Ability to Monitor Effectiveness	Not applicable.	Monitoring would provide assessment of potential exposures, contaminant presence, and migration, or changes in site conditions.
Ability to Obtain Approvals and Coordinate with Other Agencies.	Not applicable.	Coordination for five-year reviews may be required and would be obtainable. Coordination with the state would be required to establish a CEA and would be obtainable.
Availability of Treatment, Storage Capacities, and Disposal Services	None required.	None required.
Availability of Equipment, Specialists, and Materials	Not applicable.	Ample availability of equipment and personnel to install monitoring well/fencing and perform long-term maintenance, monitoring, and five-year reviews.
Availability of Technology	Not required.	Common construction techniques and materials required for construction.
COST		
Capital Cost	$0	$44,360
First-Year Annual O&M Cost	$0	$11,000
Five-Year Reviews	$0	$15,500
Present Worth Cost (30 years with 7% interest rate)	$0	$214,280

3. Long-Term Effectiveness and Permanence

Potential future users of site groundwater may be at risk under Alternative 1 because of the lack of land use controls that would prohibit use of untreated contaminated groundwater. Alternative 2 would mitigate risks due to ingestion of site groundwater by implementing land use controls to prohibit use of untreated contaminated groundwater. Therefore, Alternative 2 offers a more effective remedy for the long term.

For Alternative 2, no difficulties or uncertainties are anticipated in performing the long-term monitoring. Groundwater monitoring wells may require replacement if damage occurs, but wells would be readily replaceable.

4. Reduction of Toxicity, Mobility, or Volume through Treatment

Neither alternative contains any proposed action that would provide additional treatment. These alternatives would not reduce the toxicity, mobility or volume through treatment.

5. Short-Term Effectiveness

Since Alternative 1 contains no response actions, implementation of this alternative would not pose additional short-term risks to Station personnel or the local community. The implementation of Alternative 2 is not expected to pose significant risks to Station personnel or the local community. Workers who implement these alternatives would be adequately safeguarded by using appropriate PPE to prevent exposure to contaminated media. OSHA standards would be followed and proper PPE would be used during all monitoring activities under these alternatives.

No permanent adverse impacts to the environment are anticipated to result from implementing either of the alternatives.

6. Implementability

Since no response activities would occur under Alternative 1, the alternative is readily implementable and no permits are required. The technical feasibility criteria, including constructibility, operability, and reliability, are not relevant to this alternative.

Alternative 2 is implementable. Long-term monitoring (sampling and analyses) requires readily available resources. The alternative allows for assessing contaminant presence, migration, and changes in media

quality that may indicate potential impacts to downgradient receptors. Permits (with the exception of well installation permits) would not be required for this alternative; however approval for implementation of the CEA would be needed from NJDEP. There is ample availability of companies with trained personnel, equipment, and materials to implement this alternative. Additionally, regulatory personnel and environmental specialists are readily available to perform five-year reviews associated with this alternative.

Since no treatment or off site disposal is proposed under either alternative, the criterion of availability of treatment technologies, TSD facilities, and capacity is not applicable.

Lastly, under these alternatives, additional actions can be easily implemented in the future, if warranted.

X. THE SELECTED REMEDY

A. Site 6

The Navy, with EPA and NJDEP, has selected Alternative 2 - Land use Controls and Long Term Monitoring - as its preferred remedy for Site 6. Alternative 2 relies on land use controls, and long-term monitoring with five-year reviews to limit potential exposure to site risks. This alternative does not employ engineered treatment or containment to address groundwater contamination. Land use controls would be enacted to prohibit use of impacted groundwater. Long-term periodic monitoring would be conducted to assess the alternative's effectiveness and potential threats to human health and the environment. Site conditions and risks would be reviewed every five years because contaminants would be left in place. Alternative 2 provides assurance to the regulatory agencies and the community that groundwater use by potential human receptors will be prevented by implementation of land use controls until groundwater concentrations are below GWQS or MCLs.

The selected remedy for Site 6 is as follows:

- Land use Controls - LUCs will be established by the Navy to prevent human exposure to the contaminated groundwater. The Navy has prepared a RD for LUCs containing the LUCs implementation actions that has been submitted to the EPA for review and concurrence. The final RD for LUCs at OU 9 that includes incorporation of EPA comments has been submitted to EPA concurrently with the final ROD. The Navy is responsible for implementing, maintaining, reporting on, and enforcing the LUCs described in this ROD in accordance with the approved RD for LUCs. LUCs will be maintained until the concentration of hazardous substances in the groundwater are at such levels to allow for unrestricted use and exposure. The area proposed for the LUCs will include the entire site area, shown on Figure 4. The RD for LUCs will be amended to the NWS Earle Master Plan.

The LUC objectives are:

a. Maintain the integrity of any current or future remedial or monitoring system such as monitoring wells, fencing and the landfill cover;

b. Except for environmental monitoring, prevent access or use of untreated groundwater until cleanup levels are met; and

c. Prohibit the development and use of property for residential housing, elementary and secondary schools, child care facilities and playgrounds.

- Current fencing at the site will be evaluated to see if it could be used in lieu of new fencing for this remedial alternative.

- Because site groundwater does not meet GWQS or MCLs, a CEA pursuant to N.J.A.C 7:9-6 will be established to provide the state with official notice that the constituent standards will not be met for a specified duration anticipated not to exceed 10 years and to ensure that use of groundwater in the affected area is prohibited. RD for LUC implementation action details may need to be adjusted periodically based on site conditions and other factors.

- Long-Term Monitoring - Groundwater monitoring will be conducted to assess migration of contaminants from the site and the potential impacts to downgradient areas. Background well data will be used for comparison to evaluate site contaminant status. The collected data will be evaluated during the five-year review period.

- Five-Year Reviews – Since wastes will be left in place, site conditions and risks will be reviewed every five years, as required by CERCLA. The reviews will consist of evaluation of analytical and hydrogeologic data to assess whether contaminant migration has increased and whether human or biological receptors or groundwater resources are at risk.

For the purpose of costing, it is assumed that groundwater samples will be collected from one new monitoring well, along with four existing monitoring wells, and the samples will be analyzed for metals. Only metals were selected for analysis because they contribute by far the greatest fraction of the estimated unacceptable risk. The sampling results will be evaluated to assess whether there have been changes in contaminant status and to determine whether additional response actions are warranted.

B. Site 12

The Navy, with EPA and NJDEP, has determined that NFA is applicable at Site 12. The previously

conducted excavation of contaminated soils at Site 12 achieves the remediation goal for protection of human health and the environment, including prevention of human exposure to contaminated surface and subsurface soil (removed) and migration of contaminants to the adjacent marsh. Based on EPA and NJDEP approval, Site 12 has met all the applicable requirements for closure.

C. Site 15

The Navy, with EPA and NJDEP, has selected Alternative 2 - Land use Controls and Long Term Monitoring - as its preferred alternative. The range of technologies in Alternative 2 is appropriate for the protection of human health and the environment at this former disposal area. Alternative 2 relies on access restrictions, land use controls, and long-term monitoring with five-year reviews to limit potential exposure to site risks. Long-term periodic monitoring would be conducted to assess the alternative's effectiveness and potential threats to human health and the environment. Site conditions and risks would be reviewed every five-years because contaminants would be left in place.

The selected remedy for Site 15 is as follows:

- Land use Controls - LUCs will be established by the Navy to prevent human exposure to contaminated soil. The Navy has prepared a RD for LUCs containing the LUC implementation actions that has been submitted to the EPA for review and concurrence. The final RD for LUCs at OU 9 that includes incorporation of EPA comments has been submitted to EPA concurrently with the final ROD. The Navy is responsible for implementing, maintaining, reporting on, and enforcing the LUCs described in this ROD in accordance with the approved RD for LUCs. LUCs will be maintained until the concentration of hazardous substances in the soil are at such levels to allow for unrestricted use and exposure. The area proposed for the LUCs will include the area within the fence. The RD for LUCs will be amended to the NWS Earle Master Plan. Under Alternative 2, LUCs will be incorporated into the Base Master Plan to restrict the future use of Site 15 to its present fenced security buffer use. Refer to the RD for LUCs implementation actions, since these details may need to be adjusted periodically based on site conditions and other factors.

The LUC objectives are:

a) Maintain the integrity of any current or future remedial or monitoring system such as soil sample locations, fencing and signage;

b) Except for environmental monitoring, prevent access to the site until cleanup levels are met and;

c) Prohibit the development and use of property for residential housing, elementary and secondary schools, child care facilities and playgrounds or any use other than its current use as a security buffer.

- Under Alternative 2, access restrictions will be enacted to limit future use of the property. Restrictions will be placed on future activities that could result in increased human exposure to contaminated site soils or increased erosion and contaminant migration. Restricted activities will include excavation, and excessive vehicular traffic (off-road vehicles and dirt bikes).

- Because contaminants will remain in Site 15 soil at levels above the RDCSCC, a review of site conditions and risks will be conducted every five years, as required by CERCLA. For the purpose of the five-year review, surface and subsurface soil samples will be collected every five years for metals concentration analysis. Analytical data from the soil sampling activity will be assessed to determine if human receptors or natural resources are at risk.

- Long-Term Monitoring - Surface and subsurface soil samples will be collected every five years for metals concentration analysis. Only metals were selected for analysis because they contribute by far the greatest fraction of the estimated unacceptable risk. The sampling results will be evaluated to assess whether there have been changes in contaminant status and to determine whether additional response actions are warranted.

- Five-Year Reviews – Since wastes will be left in place, site conditions and risks will be reviewed every five years, as required by CERCLA. The reviews will consist of evaluation of analytical data and assessing whether contaminant migration has increased and whether human or biological receptors are at risk.

D. Site 17

The Navy, with EPA and NJDEP, has selected Alternative 2 - Land use Controls and Long Term Monitoring - as its preferred remedy for Site 17. Alternative 2 relies on land use controls, and long-term monitoring with five-year reviews to limit potential exposure to site risks. This alternative does not employ engineered treatment or containment to address groundwater contamination. Land use controls would be enacted to prohibit use of impacted groundwater. Long-term periodic monitoring would be conducted to assess the alternative's effectiveness and potential threats to human health and the environment. Site conditions and risks would be reviewed every five years because contaminants would be left in place. Alternative 2 provides assurance to the regulatory agencies and the community that groundwater use by potential human receptors will be prevented by implementation of land use controls until groundwater concentrations are below GWQS or MCLs.

The selected remedy for Site 17 is as follows:

- Land use Controls - LUCs will be established by the Navy to prevent human exposure to the contaminated groundwater. The Navy has prepared a RD for LUCs containing the LUC implementation actions that has been submitted to the EPA for review and concurrence. The final RD for LUCs at OU 9 that includes incorporation of EPA comments has been submitted to EPA concurrently with the final ROD. The Navy is responsible for implementing, maintaining, reporting on, and enforcing the LUCs described in this ROD in accordance with the approved RD for LUCs. LUCs will be maintained until the concentration of hazardous substances in the groundwater are at such levels to allow for unrestricted use and exposure. The area proposed for the LUCs will include the entire site area, shown on Figure 7. The RD for LUCs will be amended to the NWS Earle Master Plan.

The LUC objectives are:

d. Maintain the integrity of any current or future remedial or monitoring system such as monitoring wells, fencing and landfill cover;

e. Except for environmental monitoring, prevent access or use of untreated groundwater until cleanup levels are met; an

f. Prohibit the development and use of property for residential housing, elementary and secondary schools, child care facilities and playgrounds.

- Current fencing at the site will be evaluated to see if it could be used in lieu of new fencing for this remedial alternative.

- Because site groundwater does not meet GWQS or MCLs, a CEA pursuant to N.J.A.C 7:9-6 will be established to provide the state with official notice that the constituent standards will not be met for a specified duration anticipated not to exceed 10 years and to ensure that use of groundwater in the affected area is prohibited. RD for LUC implementation actions may need to be adjusted periodically based on site conditions and other factors.

- Long-Term Monitoring - Groundwater monitoring will be conducted to assess migration of contaminants from the site and the potential impacts to downgradient areas. Background well data will be used for comparison to evaluate site contaminant status. The collected data will be evaluated during the five-year review period.

- Five-Year Reviews – Since wastes will be left in place, site conditions and risks will be reviewed every five years, as required by CERCLA. The reviews will consist of evaluation of analytical and hydrogeologic data to assess whether contaminant migration has increased and whether human or biological receptors or groundwater resources are at risk.

For the purpose of costing, it is assumed that groundwater samples will be collected from the one new downgradient monitoring well, along with three existing monitoring wells, and the samples will be analyzed for metals. Only metals were selected for analysis because they contribute by far the greatest fraction of the estimated unacceptable risk. The sampling results will be evaluated to assess whether there have been changes in contaminant status and to determine whether additional response actions are warranted.

XI. STATUTORY DETERMINATIONS

The remedy selected for OU 9 satisfies the remedy selection requirements of CERCLA and the NCP. The remedy is expected to be protective of human health and the environment, comply with ARARs, and is cost effective. The following sections discuss how the selected remedial action addresses these statutory requirements.

The Navy is responsible for implementing, inspecting, reporting, and enforcing the remedy described in this ROD. For instance, at sites 6 and 17, the Navy is responsible for providing the state with the information required to activate, maintain, and remove a groundwater CEA, while the groundwater CEA itself will be maintained by the state of New Jersey.

A. Protection of Human Health and the Environment

1. Site 6

Alternative 2 will provide overall protection of human health and the environment by preventing direct exposure to contaminated groundwater, and instituting restrictions on use of site groundwater.

Groundwater contaminant concentrations should eventually decrease to acceptable levels (GWQS or MCLs), reducing the long-term risk posed by future use of site groundwater. Implementing access restrictions and establishing a groundwater CEA at the site will provide interim protection by prohibiting use of the aquifer until GWQS or MCLs are achieved.

The long-term periodic monitoring program will allow the Navy to monitor the quality of groundwater leaving the site, assess potential impacts to downgradient receptor, and determine whether additional remedial actions are necessary.

Use of engineering controls to minimize generation of fugitive dusts and vapors and proper use of PPE by site workers during groundwater sampling will effectively minimize short-term risks to the local community and workers posed by implementation of this alternative.

The Navy has prepared a RD for LUCs containing the LUC implementation actions that has been submitted to the EPA for review and concurrence. The Navy is responsible for implementing, maintaining, inspecting, reporting on, and enforcing the LUCs described in this ROD in accordance with the approved RD for LUCs. 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).

2. <u>Site 12</u>

Site cleanup to RDCSCC was confirmed by NJDEP and EPA after the Navy performed soil excavation, off site removal and disposal, and verification sampling in 1999. The remedial activities were followed by restoration of the site after excavation.

With the removal of contaminated material in 1999 and the verification of contamination removal through three rounds of verification sampling, protection of human health and the environment has been achieved.

3. <u>Site 15</u>

Alternative 2 will provide protection of human health and the environment by restricting access to contaminated site soil. Fencing/warning signs and access restrictions will provide additional long-term protection by limiting access to the area. Alternative 2 will also reduce the risks posed by future use of site soil. Soil contaminant concentrations should eventually decrease to acceptable levels (RDCSCC), reducing the long-term risk posed

by future use of site soil. Implementing access restrictions and establishing long-term monitoring and five-year reviews will provide interim protection by prohibiting use of the site until soil cleanup criteria are achieved.

Use of engineering controls to minimize generation of fugitive dusts and vapors and proper use of PPE by site workers will effectively minimize short-term risks to the local community and workers posed by implementation of this alternative.

The Navy has prepared a RD for LUCs containing the LUC implementation actions that has been submitted to the EPA for review and concurrence. The Navy is responsible for implementing, maintaining, inspecting, reporting on, and enforcing the LUCs described in this ROD in accordance with the approved RD for LUCs. 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).

4. <u>Site 17</u>

Alternative 2 will provide overall protection of human health and the environment by preventing direct exposure to contaminated groundwater, and instituting restrictions on use of site groundwater.

Groundwater contaminant concentrations should eventually decrease to acceptable levels (GWQS or MCLs), reducing the long-term risk posed by future use of site groundwater. Implementing access restrictions and establishing a groundwater CEA at the site will provide interim protection by prohibiting use of the aquifer until GWQS or MCLs are achieved.

The long-term periodic monitoring program will allow the Navy to monitor the quality of groundwater leaving the site, assess potential impacts to downgradient receptors and determine whether additional remedial actions are necessary.

Use of engineering controls to minimize generation of fugitive dusts and vapors and proper use of PPE by site workers sampling groundwater will effectively minimize short-term risks to the local community and workers posed by implementation of this alternative.

The Navy has prepared a RD for LUCs containing the LUC implementation actions that has been submitted to the EPA for review and concurrence. The Navy is responsible for implementing, maintaining, inspecting, reporting on, and enforcing the LUCs described in this ROD in accordance with the approved RD for LUCs. 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).

B. Compliance With and Attainment of ARARs

The selected remedy for OU 9 will comply with all ARARs; chemical-specific, location-specific, and action specific identified in Tables 33 through 38. The potential effects of the proposed actions on wetlands, floodplains, water bodies, and other sensitive receptors will be identified, and all necessary measures will be taken to comply with the Federal and State chemical, action, and location specific ARARs identified in Tables 33 through 38. The remedial action alternatives described in Section VIII were evaluated in Section IX using the nine evaluation criteria established by the NCP.

The following discussion provides a synopsis of the ARARs and issues To Be Considered (TBCs) for OU 9 remedies.

1. Chemical-Specific ARARs

The Federal and state chemical-specific ARARs are MCLs and GWQS; listed in Tables 33 and 34, respectively.

a. Site 6

Alternative 2 would eventually comply with MCLs and GWQS and would be in compliance with ARARs because temporary exemption (CEA) from these requirements will be obtained until the GWQS or MCLs are achieved.

b. Site 12

With the removal of contaminated material in 1999 and the verification of contamination removal through three rounds of verification sampling, compliance with Federal and state chemical-specific ARARs and TBCs has been achieved.

c. Site 15

Because Alternative 2 does not include active treatment of soils, the soil at Site 15 will initially not meet the RDCSCC. However, contaminants in the soils should gradually reduce naturally to cleanup criteria.

TABLE 33
FEDERAL CHEMICAL-SPECIFIC ARARs AND TBCs
OU 9 RECORD OF DECISION
NAVAL WEAPON STATION EARLE, COLTS NECK, NEW JERSEY

REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION IN THE ROD
Safe Drinking Water Act (SDWA) - Maximum Contaminant Levels (MCLs) (40 CFR 141.11-141.16)	Applicable	MCLs have been promulgated for a number of common organic and inorganic contaminants to regulate the concentration of contaminants in public drinking water supply systems. MCLs may be relevant and appropriate for groundwater because the aquifer beneath the site is a potential drinking water supply.	MCLs may be used to establish clean-up levels for the portion of the aquifer underlying the OU 9 sites. MCLs can be used to derive potential soil clean-up levels.

TABLE 34
STATE CHEMICAL-SPECIFIC ARARs AND TBCs
OU 9 RECORD OF DECISION
NAVAL WEAPON STATION EARLE, COLTS NECK, NEW JERSEY

REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION IN THE ROD
New Jersey Ground Water Quality Standards (GWQS) (N.J.A.C. 7:9-6)	Applicable	This regulation establishes the rules to protect ambient groundwater quality through establishing groundwater protection and clean-up standards and setting numerical criteria limits for discharges to groundwater. The GWQS are the maximum allowable pollutant concentrations in groundwater that are protective of human health. This regulation also prohibits the discharges to groundwater that subsequently discharges to surface water that do not comply with the Surface Water Quality Standards (SWQS).	Because contaminated groundwater is present underneath OU 9 sites in excess of GWQS, these regulations were considered in determining groundwater action levels. Application for a CEA will be required during the term of proposed remediation. The CEA procedure ensures that designated groundwater uses at remediation sites are suspended for the term of the CEA.
New Jersey Safe Drinking Water Act (N.J.A.C. 7:10)	Applicable	These regulations were promulgated to assure the provision of safe drinking water to consumers in public community water systems. MCLs have been established to regulate the concentration of organic and metal contaminants in water supplies. MCLs may be relevant and appropriate for groundwater because the aquifer beneath the site is a potential drinking water supply.	MCLs were used to establish clean-up levels for groundwater underlying the OU 9 sites. MCLs can be used to derive potential soil clean-up levels.
New Jersey Soil Cleanup Criteria	TBC	These are non-promulgated soil clean-up criteria for residential direct contact, non-residential direct contact, and impact to groundwater (through leaching).	These criteria were considered in the development of soil clean-up goals.

TABLE 35
FEDERAL LOCATION-SPECIFIC ARARs AND TBCs
OU 9 RECORD OF DECISION
NAVAL WEAPON STATION EARLE, COLTS NECK, NEW JERSEY

REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION IN THE ROD
Endangered Species Act of 1973 (16 USC 1531 et seq.); (50 CFR Part 200)	Potentially Applicable, if present	Actions shall be taken to conserve endangered or threatened species or to protect critical habitats. Consultation with the Department of the Interior is required.	The RI determined that there were sensitive habitats at NWS Earle, including an endangered plant and animal habitat.

TABLE 36
STATE LOCATION-SPECIFIC ARARs AND TBCs
OU 9 RECORD OF DECISION
NAVAL WEAPON STATION EARLE, COLTS NECK, NEW JERSEY

REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION IN THE ROD
New Jersey Freshwater Wetlands Protection Act Rules (N.J.A.C. 7:7A)	Applicable	Regulate activities that result in the disturbance in and around freshwater wetland areas including removing or dredging wetland soils, disturbing the water level or water table, driving piles, placing obstructions, destroying plant life, and discharging dredged or fill materials into open water.	Remedial alternatives have been developed to avoid activities that would be detrimental to the wetlands located at and adjacent to OU 9 sites.

TABLE 37
FEDERAL ACTION-SPECIFIC ARARs AND TBCs
OU 9 RECORD OF DECISION
NAVAL WEAPON STATION EARLE, COLTS NECK, NEW JERSEY

REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION IN THE ROD
Resource Conservation and Recovery Act (RCRA) - Hazardous Waste Generator and Transporter Requirements (40 CFR parts 262 and 263)	Potentially Applicable	These regulations establish the responsibilities of generators and transporters of hazardous waste in the handling, transportation, and management of waste. The regulations specify the packaging, labeling, recordkeeping, and manifest requirements.	Activities performed in connection with off-site transport of hazardous wastes will comply with the requirements of these regulations.

TABLE 38
STATE ACTION-SPECIFIC ARARs AND TBCs
OU 9 RECORD OF DECISION
NAVAL WEAPON STATION EARLE, COLTS NECK, NEW JERSEY

REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION IN THE ROD
New Jersey Labeling, Records, and Transportation Requirements (N.J.A.C. 7:26-7)	Potentially Applicable	These regulations establish the responsibilities of generators and transporters of hazardous waste in the handling, transportation, and management of waste. The regulations specify the packaging, labeling, record keeping and manifest requirements.	Activities performed in connection with off-site transport of hazardous wastes will comply with the requirements of these regulations.

b. Site 17

Implementation of Alternative 2 does not include active treatment of groundwater. Initially the groundwater beneath Site 17 will not meet MCLs or GWQS. However, the long-term monitoring associated with Alternative 2 will provide information that can be used to determine that the groundwater contaminants are being reduced and migration of contaminants to downgradient receptors is not occurring. In addition, Alternative 2 includes a provision to seek a temporary exemption (CEA) from these requirements until the GWQS or MCLs are achieved through active treatment or natural attenuation. The CEA will be established to provide the state official notice that the constituent standards will not be met for a duration anticipated not to exceed 10 years and to ensure that consumption of untreated groundwater is prohibited.

2. Location-Specific ARARs

Federal and state location-specific ARARs are listed in Tables 35 and 36, respectively.

a. Site 6

Currently the groundwater contamination associated with Site 6 is not affecting the wetlands, floodplains, water bodies, and other sensitive receptors. Implementation of Alternative 2 is not expected to disturb wetlands, floodplains, water bodies, or other sensitive receptors. Implementation of this alternative will ensure that potential receptors are protected from the groundwater contamination associated with Site 6.

During the preparation of the implementation plan for Alternative 2, all necessary measures will be taken to comply with the location-specific Federal and state ARARs. It is expected that Alternative 2 will easily comply with these ARARs.

b. Site 12

With the removal of contaminated material in 1999 and the verification of contamination removal through three rounds of verification sampling, compliance with Federal and state location-specific ARARs and TBCs has been achieved.

c. Site 15

Currently the soil contamination associated with Site 15 is not affecting the wetlands, floodplains, water bodies, and other sensitive receptors. The implementation of Alternative 2 is not expected to disturb wetlands, floodplains, water bodies or other sensitive receptors. Implementation of this alternative will ensure

that potential receptors are protected from the contamination associated with Site 15. During the preparation of the implementation plan for Alternative 2, all necessary measures will be taken to comply with the location-specific Federal and state ARARs identified. It is expected that Alternative 2 will easily comply with these ARARs.

d. Site 17

Currently the groundwater contamination associated with Site 17 is not affecting the wetlands, floodplains, water bodies and other sensitive receptors. Implementation of Alternative 2 is not expected to disturb wetlands, floodplains, water bodies, or other sensitive receptors. Implementation of this alternative will ensure that potential receptors are protected from the groundwater contamination associated with Site 17. During the preparation of the implementation plan for Alternative 2, all necessary measures will be taken to comply with the location-specific Federal and state ARARs. It is expected that Alternative 2 will easily comply with these ARARs.

3. <u>Action-Specific ARARs</u>

Federal and state action-specific ARARs are listed in Tables 37 and 38, respectively.

a. Site 6

The long-term monitoring plan proposed under Alternative 2 will comply with Federal, state, and municipal regulations regarding the transportation, storage, and disposal/treatment of generated waste (liquid and solid). Because this alternative does not include active treatments of the contaminated groundwater, it is anticipated that generated waste will include purge water and PPE from groundwater sampling.

b. Site 12

With the removal of contaminated material in 1999 and the verification of contamination removal through three rounds of verification sampling, compliance with Federal and state action-specific ARARs and TBCs has been achieved.

c. Site 15

The long-term monitoring plan proposed under Alternative 2 will comply with Federal, state, and municipal regulations regarding the transportation, storage, and disposal/treat of generated waste (liquid and solid).

Because this alternative does not include active treatments of the contaminated soils, it is anticipated that generated waste will include soil cuttings, decontamination waters, and PPE.

d. Site 17

The long-term monitoring plan proposed under Alternative 2 will comply with Federal, state, and municipal regulations regarding the transportation, storage, and disposal/treatment of generated waste (liquid and solid). Because this alternative does not include active treatment of the contaminated groundwater, it is anticipated that generated waste will include purge water and PPE from groundwater sampling.

4. TBC Standards

State soil cleanup criteria were considered during the development of remedial Alternative 2 for Site 15.

C. Cost-Effectiveness

The Navy and EPA have determined that the selected remedy for OU 9 is cost effective. The estimated costs for the selected remedy for OU 9 are summarized below.

1. Site 6

Capital costs associated with Alternative 2 of $44,360 have been included in the first-year O&M cost to include installation of fencing and implementing land use controls. The average annual O&M cost for long-term monitoring is $11,000 and five-year reviews are $15,500 per event. Over a 30-year period, the net present-worth cost is $214,280 (at a seven percent discount rate).

2. Site 12

There are no expected costs associated with the NFA alternative.

3. Site 15

Capital costs associated with Alternative 2 of $19,490 have been included in the first-year O&M cost. The average annual O&M cost for long-term monitoring is $0, and five-year reviews (including sampling costs)

are $14,500 per event. Over a 30-year period, the net present-worth cost is $50,760 (at a seven percent discount rate).

4. Site 17

Capital costs associated with Alternative 2 of $44,360 have been included in the first-year O&M cost to include installation of fencing and implementing land use controls. The average annual O&M cost for long-term monitoring is $11,000 and five-year reviews are $15,500 per event. Over a 30-year period, the net present-worth cost is $214,280 (at a seven percent discount rate).

D. Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

The Navy and EPA have determined that the selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a cost-effective manner at Sites 6, 15, and 17.

As a result of the 1999 remedial action conducted at Site 12, permanent solutions and alternative treatment technologies are no longer needed. The Navy and EPA have determined that NFA represents the most appropriate and cost-effective action for Site 12.

E. Preference for Treatment as a Principal Element

The Navy and EPA have determined that the selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a cost-effective manner at Sites 6, 15, and 17.

As a result of the 1999 remedial action conducted at Site 12, treatment is no longer needed. The Navy and EPA have determined that NFA represents the most appropriate and cost effective action for Site 12.

XII. DOCUMENTATION OF SIGNIFICANT CHANGES

No significant changes from the PRAP for OU 9 appear in this ROD.

RECORD OF DECISION
NAVAL WEAPONS STATION EARLE
OPERABLE UNIT 7

PART III - RESPONSIVENESS SUMMARY

The purpose of this Responsiveness Summary is to review public response to the PRAP for OU 9. It also documents the consideration of comments during the decision-making process and provides answers to any comments raised during the public comment period.

The Responsiveness Summary for OU 9 is divided into the following sections:

- **Overview** - This section briefly describes the remedial alternative recommended in the PRAP and any impacts on the PRAP due to public comment.

- **Background on Community Involvement** - This section describes community relations activities conducted with respect to the area of concern.

- **Summary of Major Questions and Comments** - This section summarizes verbal and written comments received during the public meeting and the public comment period.

I. OVERVIEW

This Responsiveness Summary addresses public response to the PRAP for OU 9. The PRAP and other supporting information are maintained for public review in the Administrative Record file for NWS Earle, which is maintained at the Monmouth County Library-Eastern Branch, Route 35, Shrewsbury, New Jersey.

II. BACKGROUND ON COMMUNITY INVOLVEMENT

This section provides a brief history of community participation in the investigation and interim remedial planning activities conducted for OU 9. Throughout the investigation period, EPA and NJDEP reviewed work plans and reports and provided comments and recommendations that were incorporated into appropriate documents. A Technical Review Committee (TRC), consisting of representatives from the Navy, EPA, the NJDEP, the Monmouth County Health Department, and other agencies and local groups surrounding NWS Earle, was formed. The TRC later was transformed into the RAB to include community members, as well as the original officials from the TRC. The RAB has been holding periodic meetings to maintain open lines of communication with the community and to inform all parties of current activities.

On September 29 and 30, 2004 and on October 1, 2004, a newspaper notification inviting public comment on the PRAP appeared in the Asbury Park Press. The public notice summarized the PRAP and the preferred alternative. The announcement also identified the time and location of the public meeting and specified a public comment period as well as the address to which written comments could be sent. Public comments were accepted from October 1, 2004 to October 30, 2004. The newspaper notification identified the Monmouth County Library - Eastern Branch, Route 35, Shrewsbury, New Jersey as the location of the Administrative Record.

The public meeting was held on October 5, 2004 at 7:00 PM at the Colts Neck Library Meeting Room, One Winthrop Drive, Colts Neck, New Jersey. At this meeting, representatives from the Navy, U.S. EPA and NJDEP were available to answer questions concerning OU 9 and the preferred alternative. The attendance list from the October 5, 2004 public meeting is included in Appendix B.

III. SUMMARY OF MAJOR QUESTIONS AND COMMENTS

A. Written Comments

During the public comment period from October 1, 2004 to October 30, 2004, no written comments were received from the public pertaining to OU 9. No new comments were received from NJDEP or EPA.

B. Public Meeting Comments

Questions or comments concerning OU 9 received from the public during the October 5, 2004 public meeting are presented with the government responsiveness summary in Appendix C.

APPENDIX A

NJDEP CONCURRENCE LETTER

State of New Jersey
Department of Environmental Protection

Richard J. Codey
Acting Governor

Bradley M. Campbell
Commissioner

October 13, 2005

Ms. Michele DiGeambeardino
Remedial Project Manager
Naval Facilities Engineering Command
10 Industrial Highway
Code 1821, Mail Stop 82
Lester, PA 19113-2090

Dear Ms. DiGeambeardino:

Re: Draft Record of Decision (ROD) for Operable Unit #9
Sites 6, 12, 15 and 17
Naval Weapons Station Earle
Colts Neck Twp., Monmouth Co.

The New Jersey Department of Environmental Protection (NJDEP) has reviewed the draft Record of Decision (ROD), prepared by Tetra Tech NUS, Inc. on behalf of Naval Weapons Earle for Operable Unit #9 (Sites 6, 12, 15 and 17) dated January 2005. The ROD has chosen the following remedial alternatives for each corresponding site.

Site 6 – Natural attenuation, in addition to a Classification Exception Area (CEA) for ground water exceedances, long-term periodic ground water monitoring will be implemented as well as a 5 year review of site risks and conditions. The majority of the landfill is covered with buildings and pavement. The Navy will be responsible for maintaining the cap and side slopes as part of the Base Master Plan. Current fencing at the site will be evaluated to see if it could be used in lieu of new fencing for this remedial alternative.

Site 12 – In December 1999, the Navy excavated approximately 260 tons of contaminated soil from this site. Post excavation samples demonstrated all contaminant levels are below regulatory concern. No ground water contamination was found at this site, therefore, "No Further Action" for this site is warranted.

Site 15 – The remedial alternative chosen is fencing, institutional controls and 5-year review. As part of the 5-year review, surface and subsurface soil samples will be collected. Analytical data from this sampling will be assessed to determine if human or ecological receptors are at risk. During several inspections and the remedial investigation, the area where the sludge was dumped

was not apparent; therefore, a cap was not placed on the site. All maintenance activities associated with this site must be included as part of the Base Master Plan.

Site 17 – The remedial alternative chosen for this site will be natural attenuation, in addition to a Classification Exception Area (CEA) for ground water exceedances. The landfill cap consists of seeding, soil cover, buildings and pavement. The Navy will maintain the cap and the vegetated side slopes as part of the Base Master Plan. Long-term periodic ground water monitoring will be implemented as well as a 5-year review of site risks and conditions. Current fencing at the site was installed in 1999 and appears to be sufficient. The fending will be evaluated as part of the 5-year review.

The NJDEP concurs with the chosen remedial alternatives for Sites 6, 12, 15 and 17. If you have any questions, please do not hesitate to call Mr. Robert Marcolina, of my staff at (609)-633-7237.

Sincerely,

Joseph J. Seebode, Assistant Commissioner
Site Remediation & Waste Management

c: [redacted]
Larry Burg, NWS Earle
Lester Jargowsky, Monmouth Co. Health Dept.
Bob Marcolina, BCM

APPENDIX B

TERMS USED IN THE RECORD OF DECISION

TERMS USED IN THE RECORD OF DECISION

Applicable or Relevant and Appropriate Requirements (ARARs): The federal and state requirements that a selected remedy must attain. These requirements may vary among sites and remedial activities.

Administrative Record: An official compilation of site-related documents, data, reports, and other information that are considered important to the status of and decisions made relative to a Superfund site. The public has access to this material.

Central Tendency Exposure (CTE): Human health risk assessment calculation approach using average, 50th percentile, receptor risk behavior patterns to estimate a realistic expectation of receptor risk.

Chemical of Potential Concern (COPC): A contaminant found in site-specific media, deemed by the human health assessment estimation calculation rules to be a compound potentially contributing to human health risk. Chemicals are selected to represent site contamination.

Carcinogenic: A type of risk resulting from exposure to chemicals that may cause cancer in one or more organs.

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 trust fund, known as Superfund, to investigate and clean up abandoned or uncontrolled hazardous substance facilities.

Ecological Toxicity Threshold (ET) – A set of ecological risk assessment values, such as primary federal ambient water quality criteria (AWQCs) or USEPA Tier II values, used to screen concentrations of compounds found in site-related media such as surface water, sediments and surface soil for potential for ecological impacts.

Explosive safety quantity distance (ESQD): A restrictive design and land use criterion in the Facility Master Plan for military explosives safe handling and operational controls. An ESQD arc is drawn around each facility storing or containing explosives to ensure personnel and facilities maintain sufficient separation from potential explosive hazards. Land use within the ESQD arc is typically limited to transient activities only (e.g., transit or entry for ordnance inspection and maintenance activities).

Feasibility Study (FS): Report identifying and evaluating alternatives for addressing the contamination present at a site or group of sites.

Groundwater Quality Standards (GWQS): New Jersey promulgated groundwater quality requirements, N.J.A.C. 7:9-6.

Hazard Index (HI): The sum of chemical-specific Hazard Quotients. A Hazard Index of greater than 1 is associated with an increased level of concern about adverse non-cancer health effects.

Hazard Quotient (HQ): A comparison of the level of exposure to a substance in contact with the body per unit time to a chemical-specific Reference Dose to evaluate potential non-cancer health effects. Exceedence of a Hazard Quotient of 1 is associated with an increased level of concern about adverse non-cancer health effects.

IEUBK Lead Model: This model is used for hypothetical children 0 to 7 years to predict potential blood lead levels.

Initial Assessment Study (IAS): Preliminary investigation usually consisting of review of available data and information of a site, interviews, and a non-sampling site visit to observe areas of potential waste disposal and migration pathways.

Maximum Contaminant Level (MCL): EPA-published (promulgated as law) maximum concentration level for compounds found in water in a public water supply system.

Noncarcinogenic: A type of risk resulting from the exposure to chemicals that may cause systemic human health effects.

National Contingency Plan (NCP): The National Contingency Plan is the basis for the nationwide environmental restoration program known as Superfund and is administered by EPA under the direction of the U.S. Congress.

National Priorities List (NPL): EPA's list of the nation's top priority hazardous substance disposal facilities that may be eligible to receive federal money for response under CERCLA.

Polynuclear aromatic hydrocarbons (PAHs): A class of semi volatile hydrocarbon compounds characterized by the presence of carbon ring structures in their construction.

Polychlorinated Biphenyls (PCBs): Class of chlorinated aromatic compounds (formerly used as cooling fluids in electrical devices) which are strongly adsorbed on solid particles.

Record of Decision (ROD): A legal document that describes the remedy selected for a Superfund facility, why the remedial actions were chosen and others not, how much they are expected to cost, and how the public responded.

Reference Dose (RfD): An estimate with an uncertainty spanning an order of magnitude or greater of a daily exposure level for the human population, including sensitive subpopulations, that is likely to be without an appreciable risk of deleterious effects during a portion of a lifetime.

Remedial Action Objective (RAO): An objective selected in the FS, against which all potential remedial actions are judged.

Remedial Investigation (RI): Study that determines the nature and extent of contamination at a site.

Reasonable Maximum Exposure (RME): The highest exposure that is reasonably expected to occur at a site. The RME estimates include both "high end" exposure factors (> 90th percentile) with average factors to develop an RME estimate of cancer risks and non-cancer HIs.

Site Inspection (SI): Sampling investigation with the goal of identifying potential sources of contamination, types of contaminants, and potential migration of contaminants. The SI is conducted prior to the RI.

Semivolatile Organic Compounds (SVOCs): Organic chemicals [e.g., phthalates or polynuclear aromatic hydrocarbons (PAHs)] that do not readily evaporate under atmospheric conditions.

Target Compound List/Target Analyte List (TCL/TAL): List of routine organic compounds (TCL) or metals (TAL) included in the EPA Contract Laboratory Program.

Total Petroleum Hydrocarbons (TPH): Analysis to measure petroleum-related compounds in total, rather than as individual chemicals

Volatile Organic Compounds (VOCs): Organic liquids [e.g., vinyl chloride or trichloroethylene (TCE)] that readily evaporate under atmospheric conditions.

APPENDIX C

ATTENDANCE LIST FOR OCTOBER 5, 2004 PUBLIC MEETING

NWS Earle Public Meeting
Colts Neck Public Library Meeting Room
Tuesday, October 5, 2004
7:00 PM

NAME	ADDRESS	PHONE/E-MAIL	ORGANIZATIONAL AFFILIATION
Russ Turner	TtNUS	610-491-9688	
Bob Marcolina	NJDEP	609-633-7237	
Alicia Hartmann	NWS Earle	732-866-2060	
Gus Hermanni	NWS Earle CNRME	732-866-2624	
John Mayerski	Colt Neck	732-462-9608	
Mary Lanko	Howell	732-462-2199	
Raymond Walton	Wall	732-932-5682	
Donald Olson	Colts Neck	732-431-0930	
Hinitner Kastkon	Colts Neck	hsKwave@aol.com	
Jessica Mollin	EPA		
Michele DiGeambeardino	EFANE		

APPENDIX D

RESPONSE TO QUESTIONS AND COMMENTS RECEIVED DURING THE PUBLIC MEETING HELD ON OCTOBER 5, 2004

RESPONSIVENESS SUMMARY
OU 9 ROD (Sites 6, 12, 15 and 17)
NAVAL WEAPONS STATION EARLE
COLTS NECK, NEW JERSEY
(October 5, 2004 Public Meeting)

Reply to Comments on the OU 9 PRAP

1. A RAB Member asked if Site 6 is in an active area. Is the building being used?

Mr. Turner replied that the Navy uses the building next to Site 6 for physical fitness training. The adjacent roads are used for transit to the active Navy piers, and there are maintenance activities. The whole Waterfront area is packed with maintenance work, administration work and all kinds of Navy needs.

2. A RAB Member asked about the process of comments and response on the PRAP.

Mr. Turner mentioned that future events would include preparation of a Record of Decision (ROD) for Operable Unit 9 (sites 6, 12, 15 and 17) with a Responsiveness Summary section that will be based on public comments from this meeting and any comments received during the remainder of the public comment period that ends October 30, 2004.

4. A member of the public asked about availability of documents pertaining to the geology at the subject Navy sites and how they can be viewed?

Ms. DiGeambeardino explained that the document is called the Remedial Investigation Report for Naval Weapons Station Earle (July 1996) (also see Remedial Investigation Addendum Report, January 1998). These documents are part of the Administrative Record maintained at the County Library in Shrewsbury. Mr. Turner suggested speaking with Mary Jane Kehoe at the library to ask for the "Administrative Record for Naval Weapons Station Earle."

5. Ms. DiGeambeardino asked if there were any more questions.

There were none.