



Draft (Prepared at Request of Counsel – Confidential and Privileged)

Extent of Contamination Study Report

**Pursuant to January 2007 Administrative Order for Removal Response
Action, Docket No. CERC-03-2007-0075DC**

PECK IRON AND METAL SITE

3850 ELM AVENUE, PORTSMOUTH VA, 23704

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ES.1 Introduction

This Extent of Contamination Study Report is being submitted, on behalf of The Peck Company, Inc., JSP Land Company, Inc., Peck-Portsmouth Recycling Company, Inc., and ELM Leasing Company, Inc. (collectively known hereafter as "Peck"), in accordance with the United States Environmental Protection Agency (EPA) Region III Administrative Order for Removal Response Action (EPA Docket No. CERC-03-2007-0075DC) dated January 11, 2007 (the "Order"). This report pertains to the former Peck Iron and Metal Site located at 3850 Elm Avenue, Portsmouth, Virginia (the "Site"). The Peck Site is the location of a former scrap metal facility which started operations in the 1940s and ceased operations in the 1990s. The Site is situated in a heavy industrial area within the City of Portsmouth, Virginia and is partially bordered by Paradise Creek (a tributary to the Southern Branch of the Elizabeth River).

The purpose of this report is to provide EPA with an Extent of Contamination Study Report as set forth in the Order. The work was consistent with the National Oil and Hazardous Substances Pollution Contingency Plan, as amended NCP, per 40 C.F.R. Part 300, and the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), 42 U.S.C. §§ 9601, *et seq.* The activities in this study were geared toward collecting the information necessary to evaluate the type and extent of contamination as well as any transport mechanisms and/or impacts of discovered contamination on various media such as sediment, soil, and/or groundwater.

As previously concluded by other investigations, this further study demonstrates that the "risk" created by this Site is caused by the concentration of metals and PCBs in soils typically present at a metal recycling facility in operation for several decades in the 20th century. The Study also confirms that any risks to human health and the environment can be greatly reduced if not entirely eliminated by capping of soils with concentrations exceeding 25 ppm and less than or equal to 100 ppm of PCBs and lead with concentrations greater than 1000 ppm. The Study confirms that there are insignificant groundwater and sediment impacts, and that the capping of the contaminated soils will further reduce those impacts over time. Accordingly, our conclusion is that capping of the contaminated soils at the concentrations noted above, maintenance of site security and institutional controls with appropriate signage restricting public access is the most appropriate and cost effective remedy for the Site.

A summary of the regulatory issues associated with the project, the nature and extent of contamination, site remedy assessment, and conclusions and recommendations is presented in the following sections.

ES.2 Regulatory Issues

A primary point of contention during previous investigations at the Site was EPA's reluctance to accept a remediation plan previously-submitted to the Voluntary Remediation Program of the Virginia Department of Environmental Quality which proposed risk reduction to human health

and the environment through widespread capping of Site contaminants (primarily PCBs and lead). At that time, EPA indicated that any remedy that did not include the removal and off-site disposal of soils with PCB concentrations greater than 25 parts per million (ppm) was unacceptable and would be rejected due to TSCA requirements. Although remediation was not a component of the Order under which this Study has been performed, the original draft of this Order included the following language:

8.3(g) Excavate and remove for disposal off-site, all contaminated soils and debris with concentrations of PCBs exceeding 25 ppm, or concentrations of lead exceeding 1,000 ppm.

After reviewing the TSCA regulations (40 CFR § 761.61 regarding PCB remediation waste), Malcolm Pirnie has identified several areas of disagreement with EPA as to the regulatory mandate for removal of all soils with concentrations of PCBs > 25 ppm or concentrations of lead > 1,000 ppm – a standard which has dominated many discussions to date. In accordance with the above section of TSCA, Malcolm Pirnie notes that, PCB concentrations up to 100 ppm can remain on-site safely as long as these soils are capped in accordance with TSCA regulations. This assumes that the site is considered a Low Occupancy property, which of course it is. The TSCA regulations governing PCB clean-up standards are presented as follows:

(B) Low occupancy areas. (3) Bulk PCB remediation wastes may remain at a cleanup site at concentrations >25 ppm and ≤100 ppm if the site is covered with a cap meeting the requirements of paragraphs (a) (7) and (a) (8) of this section.

In summary, as a matter of regulatory interpretation we respectfully suggest that EPA may authorize under the TSCA regulations (to the extent that they “mandate” as opposed to “guide” activities at this Site) capping of all soils with PCB concentrations greater than 25 ppm and less than or equal to 100 ppm at the Site. We believe the regulations adopt a pragmatic approach, consistent with protection of the public health and the environment, that authorize consideration and approval of considerably less expensive yet just as effective remediation methodologies.

ES.3 Nature and Extent of Contamination Summary

Soils

PCB Aroclors

PCBs were detected across much of the Site in the surface soil samples. The highest concentrations were in the central area of the Site extending into the eastern arm. Samples collected in the western arm and the southeastern portion of the Site were almost all below 10 mg/kg PCBs in surface soil. PCB concentrations greater than 1 mg/kg in surface soils extend over much of the Site with the highest concentrations (greater than 10 mg/kg) primarily located in the central portion extending into the eastern arm of the Site. The highest PCB concentrations (those greater than 10 mg/kg) in subsurface soils are almost entirely confined to

the central portion of the Site and extending toward the southern border. All PCB Aroclor detections in subsurface soils were less than 1 mg/kg in the eastern arm, and almost all detections were below 1 mg/kg in the western arm of the Site. The majority of the eastern part of the Site was below 10 mg/kg for subsurface soils

Metals

Arsenic, cadmium, chromium, lead, mercury, nickel, and silver were detected throughout the Site at varying concentrations. A brief summary of the extent of contamination associated with these metals is presented as follows:

- Arsenic. Arsenic was detected in concentrations from non-detect to 380 mg/kg. Most arsenic concentrations exceeded the 1.6 mg/kg RSL for industrial soils. The highest concentrations of arsenic were scattered throughout the site with no discernible location where the bulk of the highest arsenic concentrations were located. This area of Virginia is known for background levels of arsenic above the RSL level for industrial soils.
- Cadmium. Cadmium concentrations ranged from non-detect to 370 mg/kg. Cadmium concentrations exceeded the 81 mg/kg RSL for industrial soils in 39 soil samples. The highest concentrations of cadmium were located primarily in the eastern arm, eastern, and central portions of the Site.
- Chromium. Chromium concentrations ranged from non-detect to 31,000 mg/kg. Chromium concentrations exceeded the total chromium 1,400 mg/kg RSL for industrial soils in 39 soil samples collected. The bulk of the RSL exceedences were observed in two locations at the Site; the central and western portions of the Site.
- Lead. A large portion of the Site contained lead at concentrations greater than 1,200 mg/kg which is typically used as the industrial soil criteria. Almost all samples collected in the central area and extending into the eastern arm contained lead concentrations greater than 1,200 mg/kg. The concentrations of lead in subsurface soil greater than 1,200 mg/kg were largely confined to the south-central area, with scattered samples reaching these concentrations in the western area. The eastern side of the Site mostly contained lead concentrations less than 100 mg/kg in the deep soils.
- Mercury. Mercury concentrations ranged from non-detect to 110 mg/kg. Mercury concentrations exceeded the 31 mg/kg RSL for industrial soils in only five soil samples collected at the Site. The highest concentrations of mercury were primarily located in the eastern and central portions of the Site.
- Nickel. Nickel concentrations ranged from non-detect to 28,000 mg/kg. Nickel concentrations exceeded the 2,000 mg/kg RSL for industrial soils in 30 soil samples collected at the Site. The bulk of the RSL exceedences were observed in two locations at the Site; the central and western portions of the Site.

- Silver. Silver concentrations ranged from non-detect to 960 mg/kg. Silver concentrations exceeded the 510 mg/kg RSL for industrial soils in only one soil sample collected at the Site. The highest concentrations of silver were primarily located in the eastern arm, western portion, and central portions of the Site.

Sediment

PCB Homologue Results

PCBs were only detected in 3 of 36 sediment samples collected within Paradise Creek. These three samples contained PCBs exceeding the FSSB of 59.8 µg/kg. These samples included SD-4, SD-5, and SD-32 with concentrations of 75 µg/kg, 75 µg/kg, and 140 g/kg, respectively.

Metals Results

Metals were detected in all 36 sediment samples collected within Paradise Creek. Metals exceedances were found throughout the area sampled with no discernable pattern of distribution. Because there has not been a background study conducted for sediments within Paradise Creek and the tidal influences of the Creek, it is uncertain if the presence of the metals is related to runoff from the Site, from another source located within the Paradise Creek watershed, or represents background soil concentrations for this area.

Groundwater

No PCBs, dissolved chromium, lead, and mercury were detected above EPA drinking water standards while dissolved nickel was only found in one well on-site above its RSL (no MCL has been developed) and dissolved arsenic was detected in 4 of 8 site wells above its MCL. Based on the Site groundwater data, the following conclusions are presented:

- Because there have been minimal exceedences of drinking water standards and all adjacent properties are on public water supply (source of the public water are lakes and groundwater in a neighboring municipality which are not impacted by Site groundwater), there does not appear to be any potential human receptors that would be impacted by Site groundwater.
- Impacts to aquatic receptors in the Elizabeth River or Paradise Creek are not anticipated due to the low concentrations of metals detected in Site groundwater. The PCB concentrations being below its MCL reduce if not eliminate any threat of bioaccumulation in aquatic life. A comparison of the groundwater concentrations to the Virginia Surface Water Quality Standards for salt water yielded that only dissolved nickel in one well (MW-2) exceeded any of the standards. Due to continued attenuation in groundwater

prior to potential discharge into the adjacent surface water bodies and the mixing that takes place in these bodies, impacts to aquatic receptors are not anticipated.

Based on the above conclusions and how the data relates to potential site remedies, a potential cap at the site would be an acceptable remedy to further reduce metals leaching to Site groundwater and also reduce off-site migration potential.

ES.4 Site Remedy Summary

Site remedies are probably limited to capping of materials or removal and off-site disposal. Although these costs for the potential remedial alternatives are preliminary, the costs associated with the soil removal options are considerably more expensive (in the range of 3 to 10 times more based on the target PCB and lead remediation goals) than the capping scenarios. We believe that all of the scenarios will achieve virtually the same level of risk reduction and protection of public health and the environment at the Site. Accordingly, we recommend selection of the first option, which is the least expensive.

On March 29, 1999, U.S. EPA signed a Record of Decision Amendment for Neal's Landfill which addresses the source of the contamination. The remedy consists of the following:

- Excavation and removal to an offsite, permitted landfill of selected areas of contamination (referred to as hot spots) greater than 500 parts per million PCBs.
- The current 18 acre landfill will be reduced to 10 acres by consolidation of excavated soils and materials, contaminated with less than 500 parts per million (ppm) PCBs. It was anticipated that through this consolidation the possibility of PCB material becoming wet and migrating from the site would be reduced and perhaps eliminated.

This decision illustrates that EPA does have flexibility regarding the implementation of PCB cleanups at concentrations higher than those specified as TSCA remediation goals referenced in 40 CFR Part 761 previously discussed. For this Site, utilizing the same strategy used at Neal's Landfill, only a few (6-10) grids with concentrations greater than 500 mg/kg would have to be excavated and disposed off-site with the rest of the site capped. As noted in the decision above, soil consolidation of the PCB-contaminated soils remaining on-site would reduce the area of the Site to be capped. There have been several other similar sites where EPA and state regulators have allowed PCB concentrations up to 100 mg/kg to be left on-site with appropriate capping and land use controls. Accordingly we believe a similar remedy at this Site can be utilized effectively.

ES.5 Conclusions

PCBs and metals were detected throughout the Site in soils, sediments, and groundwater; however, unacceptable impacts appear to be limited to Site soils. PCB and metals exceeded

industrial RSLs throughout the site with the highest concentrations noted in the central portion of the Site.

PCBs were only detected in 2 of 36 sediment samples and although metals were detected in sediment above screening criteria; their presence may not be related to Site runoff. Since PCBs were located throughout the site in the same locations as the metals and have higher sorption characteristics, their absence in Paradise Creek sediments indicates that there does not appear to be significant transport of contaminants from site soils to sediments through stormwater runoff. Due to the presence of numerous industrial facilities along Paradise Creek and the Elizabeth River, there could be numerous other sources of metals within this watershed.

Because there have been minimal exceedences of drinking water standards and all adjacent properties are on public water supply, there does not appear to be any potential human receptors that would be impacted by Site groundwater. Impacts to aquatic receptors in the Elizabeth River or Paradise Creek are not anticipated due to the low concentrations of metals and PCBs detected in Site groundwater.

The capping scenario appears to be the most cost effective means of reducing potential human health and ecological risk to Site soils. It is a proven technology and has been utilized by EPA at other sites with varying cleanup goals of 50 to 500 mg/kg.

1.1 Introduction

This Extent of Contamination Study Report is being submitted, on behalf of The Peck Company, Inc., JSP Land Company, Inc., Peck-Portsmouth Recycling Company, Inc., and ELM Leasing Company, Inc. (collectively known hereafter as "Peck"), in accordance with the United States Environmental Protection Agency (EPA) Region III Administrative Order for Removal Response Action (EPA Docket No. CERC-03-2007-0075DC) dated January 11, 2007 (the "Order"). A copy of the Order is provided in **Appendix A**.

This report pertains to the former Peck Iron and Metal Site located at 3850 Elm Avenue, Portsmouth, Virginia (the "Site"). **Figure 1-1** provides the location of the Site. The Peck Site is the location of a former scrap metal facility which started operations in the 1940s and ceased operations in the 1990s. The Site is situated in a heavy industrial area within the City of Portsmouth, Virginia and is partially bordered by Paradise Creek (a tributary to the Southern Branch of the Elizabeth River). As indicated on the parcel map provided in **Figure 1-2**, the Site is located on tax parcels 0386-0020, 0386-0025, 0386-0026, 0386-0027, 0386-0028, and 0386-0029 and consists of approximately 33 acres.

In accordance with paragraph 8.11 of the Order, Malcolm Pirnie, Inc. (Malcolm Pirnie) has prepared a final report in the form of this Extent of Contamination Study Report that presents the investigations conducted to characterize the Site for the following constituents:

- Arsenic, cadmium, chromium, lead, mercury, nickel, and silver
- Polychlorinated biphenyls (PCBs)

The above listed Constituents of Concern (COCs) were recommended by the EPA via the Order.

A Final Response Action Plan (RAP) was prepared in April 2007 and incorporated the plans, schedule, and methodologies for implementation of the Extent of Contamination Study as outlined in the Order, including the following:

- Field Sampling Plan (FSP);
- Quality Assurance Project Plan (QAPP);
- A Health and Safety Plan (HASP);
- Obtain a Hazardous Waste Generation Identification Number; and
- A preliminary project schedule on the execution of the major RAP tasks.

As per the Order and confirmatory email correspondence with Richard Rupert, On-Scene Coordinator, EPA Region III, an evaluation of fate and transport, ecological/human risk assessment, and potential remedial alternatives are not required as part of this Extent of

Contamination Study under the Order. Nevertheless, at the request of Peck and in an effort to provide the most accurate and useful information to EPA as possible within the limitations of this Study, we have provided commentary on some of these subjects though not required to do so under the terms of the Order

1.2 Conceptual Project Approach

A conceptual project approach was developed for the Site in the RAP and is presented as **Figure 1-3**. The major steps in this project approach included:

- Developing a Conceptual Site Model (CSM);
- Outlining the data gaps derived from the CSM;
- Conducting field activities to address the data gaps; and
- Submitting a final report to EPA that fully characterizes the Site.

As shown on **Figure 1-3**, the CSM was needed to determine pertinent data collection tasks to be executed via the Extent of Contamination Study. The overall scope of work is as follows:

- Reviewing past investigative activities and laboratory analyses for the Site. Data that conformed to a specified data quality level and analytical method was used as the foundation for developing the CSM and was expanded to include new data as it is collected.
- Developing a preliminary CSM. This was the basic building block for developing an understanding of the Site, which was used to direct Site investigations (i.e., Extent of Contamination Study). As data was collected during the Extent of Contamination Study, the CSM was adjusted accordingly.
- Conducting an Extent of Contamination Study as defined in paragraph 8.3 of the Order to fulfill the data requirements (and data gaps) defined in the CSM.

1.3 Site Description and Location

The 33 acre Site is currently owned by Peck, which acquired parcels comprising the current property in the late 1940s. The Site is a privately owned former scrap metal facility which recycled scrap metals from Federal and State governments; as well as commercial, industrial, and private sources.

The Site is depicted on a Digital Ortho Quarter-Quadrangle (DOQQ) aerial photograph from 2006 (**Figure 1-1**). The elevation of the Site ranges from approximately mean sea level to

approximately 10 feet above mean sea level (AMSL). There is a small mounded area (nearly 25 feet AMSL) present in the southeastern portion of the Site, but generally, the Site is flat. The Site is predominantly comprised of unpaved surfaces (hard-packed soils and gravel) and there are some partially vegetated areas.

The Site is situated in a heavy industrial area within the City of Portsmouth, Virginia. Elm Avenue borders the north and east sections of the Site; the Southeastern Public Service Authority's Refuse Derived Fuel ("SPSA RDF") facility borders the southeast; Sherwin-Williams Paint Facility partially borders the west side; and the Norfolk Naval Shipyard partially borders the west and southeast sections. Norfolk Naval Shipyard Facilities also occupy the areas across Elm Avenue from the Site. Paradise Creek, a tributary of the Southern Branch of the Elizabeth River, at one time bordered the Site, but a six-acre parcel of the Site along Paradise Creek was remediated, converted to a wetland buffer between the Site and Paradise Creek and donated to the Elizabeth River Project and the City of Portsmouth. Now only a small segment of the Site borders Paradise Creek to the southwest. A tidal marsh area is present along that border of the Site adjacent to Paradise Creek.

Tax parcel 0386-0027 is currently owned and occupied by Sherwin-Williams (**Figure 1-2**). The tax parcel was historically owned by Peck. Accordingly, EPA required that the parcel remain part of the Order, and so further information on the history and use of that parcel was included also in the investigation.

As an interim measure, a security fence was erected around the entire property to eliminate the potential for exposure to trespassers, incidental, or recreational use individuals. The chain link fence and a locked gate near the northwest corner of the Site near the Sherwin-Williams Paint Facility were installed in 2003. Access to the southeast corner of the property was restricted by way of a Jersey barrier. The Site is vacant with the exception of one tenant that leases a small portion of the property along the western border. Accumulations of scrap metal and miscellaneous debris are present across most of the Site and extend off-site in some areas. Much of the Site is unpaved and vacant, however, some of the property, particularly near Paradise Creek, is heavily overgrown with vegetation (primarily trees, scrubs, tall grasses, and reeds common to a flourishing wetland). As noted above, a portion of this area in the southwest section of the property was donated to the Elizabeth River Project (ERP) for permanent conservation in 2003. This area is 6 acres in size and underwent wetland restoration activities at that time.

The numerous Site investigations have identified varying concentrations of PCBs and metals, in particular lead, in surficial soils. The highest concentrations of COCs are in the southern portion of the Site. Analytical results indicate that the majority of the Site contains surficial soils (< 18 inches below ground surface) with lead concentrations less than 1,000 milligrams per kilogram (mg/kg) and a small area with lead exceeding 10,000 mg/kg in the southern portion [Draper

Aden Associates (DAA), 2005b]. Extensive PCB investigations by DAA in early 2005 sampled large portions of the Site using a 50 x 50 feet grid system. The investigation collected samples from nearly 20 acres of surficial soils [0 to 18 inches below ground surface (bgs)] and approximately 7 acres of soils from 18 to 36 inches bgs (2005a and 2005 b). Based on the intrusive investigations, PCB concentrations are estimated in surficial soils as follows: 11 acres – less than 10 mg/kg; 8 acres – between 10 to 100 mg/kg; and 2 acres – greater than 100 mg/kg. Similarly, PCB concentrations in subsurface soils are estimated as follows: 4 acres – less than 10 mg/kg; 2 acres – between 10 to 100 mg/kg; and 1 acre – greater than 100 mg/kg.

Prior to the investigations conducted under the Order, limited sediment samples were collected from Paradise Creek. Investigations conducted by Unger *et al.* (2005) in Paradise Creek found PCB sediment concentrations ranging from 0.001 to 1.5 mg/kg range and cited another study in which a PCB concentration of 17 mg/kg was detected in a sediment sample.

1.4 Purpose of the Report

The purpose of this report is to provide EPA with an Extent of Contamination Study Report as set forth in the Order. The work was consistent with the National Oil and Hazardous Substances Pollution Contingency Plan, as amended NCP, per 40 C.F.R. Part 300, and the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), 42 U.S.C. §§ 9601, *et seq.*

The activities in this study were geared toward collecting the information necessary to evaluate the type and extent of contamination as well as any transport mechanisms and/or impacts of discovered contamination on various media such as sediment, soil, and/or groundwater. The specific objectives of the investigation were to:

- Conduct a data review of previous Site investigations
- Complete validation of existing analytical data
- Prepare a preliminary CSM that accurately defines the Site setting
- Characterize the nature and extent of contamination in site soils, sediments, and groundwater.
- Assess transport mechanisms and migration pathways

1.5 Summary of Previous Investigations

Summaries of the previous environmental field investigations at the Site and from Paradise Creek (conducted by others) are provided below.

1.5.1 Environmental Site Assessment Report, November 1996

A Phase I Environmental Site Assessment Report was prepared by Hatcher-Sayre, Inc (Hatcher). Data collection and review was conducted with the following agencies: an independent records search company, City of Portsmouth Courthouse deeds records, and Virginia Department of Environmental Quality (DEQ). Hatcher concluded, "...there do not appear to be environmental concerns related to past or present uses of the Site, which may have or had a detrimental environmental impact on the Site with regard to current applicable Federal, State, and local ordinances or laws." The following areas of concern were noted for stained surface soils: adjacent to and northeast corner of the maintenance garage, adjacent to and on the concrete pad by the shearer building, beneath an above ground storage tank near the former Proctor and Gamble building, and south of the concrete building in the northwest corner of the Site. Hatcher also noted unlabeled drums with unknown contents at several locations on the Site.

1.5.2 Groundwater Sampling, November 1997

Hatcher drilled six Geoprobe borings at the Site and collected two composite groundwater samples from the six locations. Samples were analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and dissolved Resource Conservation and Recovery Act (RCRA) 8 metals. Analyses were performed using EPA SW-846 Method 8260, EPA SW-846 Method 8270, and EPA SW-846 Method 6010 (7470 for mercury), respectively. The only constituent which was detected was dissolved barium in concentrations of 0.054 to 0.093 milligrams per liter (mg/L).

1.5.3 Site Investigation, July 1999

Hatcher conducted a series of field investigations which included: field screening of 39 surface soil samples for metals using x-ray fluorescence (XRF), collection of 25 soil samples, installation of six monitoring wells, collection of ten groundwater samples, and three slug tests. Monitoring wells were installed to 15 feet bgs. The XRF field screening data was used to determine the locations of soil samples. Correlations between the x-ray method and lab analyses were reasonable for arsenic, lead, and copper analytes. Little or no correlation was observed for total chromium and mercury. Surface soil samples were collected and analyzed for RCRA 8 Metals and copper (15 samples), PCB Aroclors (eight samples), and total petroleum hydrocarbons-diesel range organics (TPH-DRO) for six samples. Ten soil samples were collected from the interval immediately above the soil/water interface. All ten samples were analyzed for RCRA 8 metals and copper, PCB Aroclors, TPH-DRO, and benzene, toluene, ethylbenzene, and total xylenes (BTEX). A total of ten groundwater samples were also collected from the Site. All samples were analyzed for both total and dissolved RCRA 8 metals and copper, PCB Aroclors, TPH-DRO, and VOCs. All samples (soil and groundwater) were analyzed using the following

methods: 8 RCRA metals and copper – EPA SW-846 Methods (ICP); PCB Aroclors – EPA SW-846 Method 8082; TPH-DRO – EPA SW-846 Method 8015 Modified; BTEX – EPA SW-846 Method 5035/8021B; and VOCs – EPA SW-846 Method 8260.

Results of the Site investigation found surface soil exceedences [compared to Tier III screening, Virginia DEQ Voluntary Remediation Program (VRP)] for copper, arsenic, chromium, lead, mercury, PCB Aroclor 1254, PCB Aroclor 1260; and subsurface soil exceedences for arsenic, lead, and PCB Aroclor 1260. Groundwater exceedences (compared to EPA MCL/RBC) were detected for (total) copper, arsenic, barium, chromium, lead, selenium, mercury, cadmium (total and dissolved), PCB Aroclor 1254, PCB Aroclor 1260, and seven VOCs. Most of the groundwater detections occurred in groundwater samples collected from the drilling auger stem (likely due to increased turbidity); PCBs and metals did not exceed screening criteria for any of the monitoring well samples.

1.5.4 Test Pit Investigation, May 2003

DAA performed a subsurface investigation in the southwestern corner of the Site. The purpose of the field study was to assess the area for a possible stormwater retention basin and to identify the types of soil or fill materials there for potential use as fill in other areas of the Site. Initial attempts to investigate the subsurface through soil borings failed: three borings were refused at depths above 3 feet. A track hoe was used to excavate ten test pits to depths ranging from 2 to 6.5 feet bgs. DAA observed sand/silt soils with brick fragments in the upper 2 feet, underlain by demolished building materials. The other materials consisted of scrap metal, wood timbers, electrical conduits, metal pipes, concrete rubble, and pieces of concrete floor slabs.

1.5.5 Site Characterization – Risk Assessment, May 2003

DAA prepared a Site Characterization which presented existing data, plans for developing the Site, and additional groundwater data from a May 2003 sampling event. Five of the Site monitoring wells were sampled for RCRA 8 metals and copper (both total and dissolved) and were analyzed using EPA SW-846 Methods. There were no inorganic constituents that exceeded the EPA MCL/RBC. In addition, DAA prepared a Risk Assessment for on-site soils using the available 1999 data. Using Virginia DEQ's Risk Exposure Analysis Modeling System (REAMS), DAA estimated that arsenic and lead were the primary COCs for on-site soils and would require consideration in future development of the Site. DAA concluded risk associated with groundwater as not a concern.

1.5.6 Site Characterization Addendum, November 2003

DAA prepared a Site Characterization Addendum which presented sampling activities from June to November 2003, laboratory analytical results, and the proposed approach to site remediation. During several sampling events, a total of 26 soil, six sediment, and five groundwater samples were collected. The five groundwater and all 26 soil samples were analyzed for PCB Aroclors using EPA SW-846 Method 8082; 24 soil samples were analyzed for lead using EPA SW-846 Method 6010B; and the six sediment samples were analyzed for dioxins using EPA SW-846 Method 1613B. Groundwater samples were analyzed for total PCB Aroclors. The soil and sediment samples were collected from depths between surface and 2 feet bgs. As a screening method, DAA tested 64 soil samples for PCBs using immunoassay technology; 13 confirmation samples were selected based on the assay results (included above) and submitted to an off-site laboratory.

DAA concluded the following: PCBs had not leached into Site groundwater; the majority of Site soils and the sediments contained less than 1,000 mg/kg of lead and less than 10 mg/kg of PCBs (Aroclors 1254 and 1260); the highest concentrations of lead and PCBs occurred in the southern portion of the Site (concentrations greater than 10,000 mg/kg and greater than 10 mg/kg, respectively); and soil dioxins were well below the EPA remediation level of 5 to 20 µg/kg. DAA proposed as part of the remediation of the Site removal of soils from the areas with the highest COC concentrations (and then backfilling) and installation of a 10-inch thick compacted soil cover for other areas.

1.5.7 Site Characterization & Self-Implementing PCB Cleanup Plan, October 2004

DAA's 2004 report characterizes the nature of the PCB contamination and provides a cleanup plan for the Site. The report cites that PCB contamination, namely, Aroclors 1254 and 1260, appears to exist intermittently across the Site (in soil) from ground surface to a maximum depth of approximately 2.5 feet bgs. Based on soil samples and immunoassay testing, the highest concentrations (10 mg/kg to 560 mg/kg) occur in the area where scrap metal was recycled during facility operations and occupy less than 1.5 acres of the Site. The remaining areas are reported to have less than 10 mg/kg of PCBs. Groundwater reportedly occurs at depths of 2 to 4 feet bgs. Cleanup options include excavation and backfilling of areas with higher concentrations of PCBs, off-site disposal, and covering the lower concentration areas with a 10-inch thick compacted soil cover.

1.5.8 PCB & PAH Sediment Sampling in Paradise Creek, January 2005

Unger et al. (2005) conducted sediment sampling in Paradise Creek adjacent to the former Peck Iron and Metal property. A total of 19 surface sediment samples and one core sample (divided into three depths) were collected from the creek. Eight samples were selected for PCB

and polycyclic aromatic hydrocarbons (PAHs) analyses to evaluate spatial distribution of these compounds. PCB concentrations ranged from 0.001 to 1.5 mg/kg and were determined to decrease with depth (up to 2 feet bgs) when compared to adjacent surface samples. Analysis of the PCB congeners also led investigators to conclude that a common PCB source contributed to the contamination at the various sampling sites. PAHs concentrations ranged from 11 to 52 mg/kg in creek sediments.

1.5.9 PCB Soil Sampling, February - May 2005

Extensive PCB investigations by DAA in early 2005 sampled large portions of the Site using a 50 x 50 feet grid system. The investigation collected a total of 524 samples from nearly 20 acres of surficial soils (0 to 18 inches bgs) and approximately 7 acres of soils from 18 to 36 inches bgs (2005a and 2005 b). Based on the intrusive investigations, PCB concentrations are estimated in surficial soils as follows: 11 acres – less than 10 mg/kg; 8 acres – between 10 to 100 mg/kg; and 2 acres – greater than 100 mg/kg. Similarly, PCB concentrations in subsurface soils are estimated as follows: 4 acres – less than 10 mg/kg; 2 acres – between 10 to 100 mg/kg; and 1 acre – greater than 100 mg/kg. Apparently no written report was prepared for this investigation; however two maps (Sheet A-1 and Sheet B in **Appendix B**) and the laboratory analytical reports were obtained.

1.6 Regulatory Issues

Numerous regulatory issues arose during the previous investigations at the Site. A chronology of Site activities which includes regulatory discussions and meetings is presented in **Appendix C**. A summary of the most critical item, which relates to applicability of the Toxic Substances Control Act (TSCA) is discussed below.

A primary point of contention during previous investigations at the Site was EPA's reluctance to accept a previously-submitted remediation plan which proposed widespread capping of Site contaminants (primarily PCBs and lead). EPA has stated that any remedy that did not include the removal and off-site disposal of soils with PCB concentrations greater than 25 parts per million (ppm) was unacceptable and would be rejected due to needed compliance with TSCA requirements. Although remediation was not a component of the Order under which this Study has been performed, the original draft of this Order included the following language:

8.3(g) Excavate and remove for disposal off-site, all contaminated soils and debris with concentrations of PCBs exceeding 25 ppm, or concentrations of lead exceeding 1,000 ppm.

After reviewing the TSCA regulations (40 CFR § 761.61 regarding PCB remediation waste), Malcolm Pirnie has identified several areas of disagreement with EPA as to the regulatory mandate for removal of all soils with concentrations of PCBs > 25 ppm or concentrations of lead

> 1,000 ppm – a standard which has dominated many discussions to date. In the view of Malcolm Pirnie and in accordance with the above section of TSCA, PCB concentrations up to 100 ppm can remain on-site safely as long as these soils are capped in accordance with TSCA regulations. This assumes that the site is considered a Low Occupancy property. The TSCA regulations governing PCB clean-up standards are presented as follows:

A) *High occupancy areas.* The cleanup level for bulk PCB remediation waste in high occupancy areas is ≤ 1 ppm without further conditions. High occupancy areas where bulk PCB remediation waste remains at concentrations >1 ppm and ≤ 10 ppm shall be covered with a cap meeting the requirements of paragraphs (a)(7) and (a)(8) of this section.

(B) *Low occupancy areas.* (1) The cleanup level for bulk PCB remediation waste in low occupancy areas is ≤ 25 ppm unless otherwise specified in this paragraph.

(2) Bulk PCB remediation wastes may remain at a cleanup site at concentrations >25 ppm and ≤ 50 ppm if the site is secured by a fence and marked with a sign including the M_L mark.

(3) Bulk PCB remediation wastes may remain at a cleanup site at concentrations >25 ppm and ≤ 100 ppm if the site is covered with a cap meeting the requirements of paragraphs (a)(7) and (a)(8) of this section.

Another citation in the referenced TSCA regulation is the following statement which indicates that the cleanup provisions referenced above are not binding on CERCLA investigations. Additional clarification of this provision is required to further assess its applicability.

(ii) The self-implementing cleanup provisions shall not be binding upon cleanups conducted under other authorities, including but not limited to, actions conducted under section 104 or section 106 of CERCLA, or section 3004(u) and (v) or section 3008(h) of RCRA.

Additionally, the following text from 40 CFR § 761.61 provides for a risk-based approach:

(c) *Risk-based disposal approval.* (1) Any person wishing to sample, cleanup, or dispose of PCB remediation waste in a manner other than prescribed in paragraphs (a) or (b) of this section, or store PCB remediation waste in a manner other than prescribed in §761.65, must apply in writing to the EPA Regional Administrator in the Region where the sampling, cleanup, disposal or storage site is located, for sampling, cleanup, disposal or storage occurring in a single EPA Region; or to the Director of the National Program Chemicals Division, for sampling, cleanup, disposal or storage occurring in more than one EPA Region. Each application must contain information described in the notification required by §761.61(a)(3). EPA may request other information that it believes necessary to evaluate the application. No person may conduct cleanup activities under this paragraph prior to obtaining written approval by EPA.

(2) EPA will issue a written decision on each application for a risk-based method for PCB remediation wastes. EPA will approve such an application if it finds that the method will not pose an unreasonable risk of injury to health or the environment.

In summary, we are in disagreement with EPA's position that removal and off-site disposal of all soils with PCB concentrations greater than 25 ppm is mandated by TSCA regulations which prevents any other approach to be implemented. We believe the regulations adopt a pragmatic approach, consistent with protection of the public health and the environment, that authorize consideration and approval of considerably less expensive yet just as effective remediation methodologies.

1.7 Report Organization

A summary of the organizational format of the report is provided as follows:

Section 1.0 addresses the **Introduction** to the report, provides background information including the facility and Site description and history and provides a discussion of previous investigations and provides the report organization.

Section 2.0 summarizes the **Field Investigation Procedures** at the Site including a discussion of the soil boring installations and sampling, monitoring well installations, sampling, and slug testing, sediment sampling, and site surveying.

Section 3.0 describes the **Physical Characteristics** of the Site including geology/hydrogeology, climatology, ecology, and topography.

Section 4.0 discusses the **Nature and Extent of Contamination** detected at the Site. A discussion of potential applicable or relevant and appropriate requirements (ARARs) is also provided.

Section 5.0 discusses the **Site Remedies** assessment conducted to evaluate the potential remedial alternatives available for the specific type of contaminants and media present at the Site.

Section 6.0 presents the **Conclusions and Recommendations** of the investigation including the nature and extent of contamination and Site remedy assessment and the recommendations.

This section documents specific field work for the extent of contamination study at the Peck Site in Portsmouth, Virginia. Field investigation procedures, sampling locations, analytical requirements, field documentation requirements, data quality objectives, and health and safety procedures were previously presented in the Final RAP for the Site and approved by EPA.

An overview of the field program including data gaps and needs is presented in Section 2.1, detailed field investigation procedures are described in Section 2.2, a summary of field work performed at the site is provided in Section 2.3, and a summary of changes to the field investigation program and rationale for such changes is provided in Section 2.4.

2.1 Field Investigation Overview

Additional soil, sediment, and groundwater were sampled to address the data gaps defined in the RAP (Section 3.3). To address the data gaps, the following activities have been completed:

- An initial field reconnaissance of the Site was conducted to identify potential physical hazards and any other significant conditions for the safe and efficient conduct of Site work;
- Validated existing data and identified analytical results that meet the data quality requirements;
- Based on results of the data validation, identified additional samples required to complete the grid system of 50 x 50 feet cells;
- Completed the PCB Aroclors and metals sampling to fill data gap areas for the existing grid system of 50 x 50 feet cells for surface and subsurface soils;
- Completed the total PCB homologue and metals sampling of sediments to fill data gap areas for the grid system of 50 x 50 feet cells for Paradise Creek adjacent to the Site;
- Installed five groundwater monitoring wells on Site;
- Conducted an additional round of groundwater sampling (four existing and five new wells) to confirm results of total PCB homologues and metals are still below screening criteria; and
- Conducted slug tests in eight monitoring wells to determine hydraulic parameters of the aquifer.

2.2 Field Investigation Procedures

The following sub-sections provide a description of the field activities conducted to fill the identified data gaps. All field activities conform to the protocols outlined in the FSP, QAPP, HASP, and investigation derived waste (IDW) management.

2.2.1 Soil Sampling

Additional sampling of soil was required to fill the data gaps identified in the CSM for the grid system of 50 x 50 feet cells (a total of 569 cells) that EPA required in the RAP. The grid is presented on **Figure 2-1**. Soil sampling was the first medium to be sampled as part of the Extent of Contamination Study. As per the Order, all soil samples were analyzed for metals (arsenic, cadmium, chromium, lead, mercury, nickel, and silver) and PCB Aroclors. Metals were analyzed using EPA SW-846 Methods 6010/7471 and PCB Aroclors were analyzed using EPA SW-846 Method 8082. Laboratory analyses were conducted at a Level IV CLP-equivalent data quality which includes quality assurance/quality control (QA/QC) samples, such as laboratory control standards, matrix spike/matrix spike duplicate (MS/MSD), and surrogates (at a minimum). All laboratory analyses were conducted by Test America Laboratories of Savannah, Georgia.

Soil sampling was conducted from April 26 to October 17, 2007. During this interval, sampling was delayed numerous times due to equipment and operator scheduling conflicts, equipment failure, detection of potential unexploded ordinance (UXO), and UXO surveyor scheduling conflicts. Malcolm Pirnie collected soil samples from each cell location and for two to three sample depths: surface and up to two subsurface. Surface depth is defined as 0 to 18 inches bgs. Subsurface depth is defined as the interval from 18 inches bgs to the top of the saturated zone when there is native material. If native material was present, then only one subsurface soil sample was collected as a composite sample of that zone. If this interval consisted of fill, then two subsurface soil samples were collected: (1) one composite sample of the fill in the vadose zone and (2) one composite sample of the fill from the top to the bottom of the fill in the saturated zone.

Soil borings were initially collected using a Geoprobe Direct Push Technology (DPT) operated by Fishburne Drilling of Chesapeake VA. Samples collected via DPT were located mainly in the eastern arm portion and along most of the western edge of the Site. These areas of the Site had less debris and were more accessible for DPT drilling. When refusal was encountered more than four times during the DPT drilling, the 50 x 50 feet cell was sampled later on using an excavator. In most of the southern half, the excavator was used to excavate test pits due to the large amounts of debris on the surface and in the subsurface. Excavator services were provided by OSAGE of Virginia, located in Norfolk VA. A limited number of samples were collected using a hand auger near the water. **Table 2-1** provides a summary of the samples, sample depths, and analytical methods. Details on soil sampling procedures

and data QA/QC were provided in the FSP and QAPP as Appendices D and E, respectively of the previously approved RAP.

Any cells that were sampled previously according to the above stated data quality objectives were not re-sampled. Some cells had qualifying analyses for one interval only and, as such, only the remaining sample interval was collected. Previous data were validated by an outside consultant (URS Corporation).

The actual horizontal location of each soil sample was noted with a labeled marking flag and by global positioning system (GPS). All survey data was downloaded into an ArcGis map and plotted.

2.2.2 Sediment Sampling

Additional sampling of sediment was required to fill the data gaps identified in the CSM for the grid system of 50 x 50 feet cells (a total of 37 cells) that is described in the Order, paragraph 8.3 e. As per the Order, all sediment samples were analyzed for metals (arsenic, cadmium, chromium, lead, mercury, nickel, and silver) and PCB Homologue groups. Metals were analyzed using EPA SW-846 Methods 6010/7471 and PCBs were analyzed using EPA Method 680. Laboratory analyses were conducted at a Level IV CLP-equivalent data quality which includes QA/QC samples, such as, laboratory control standards, MS/MSD, and surrogates (at a minimum). All laboratory analyses were conducted by Test America Laboratories of Savannah, Georgia.

Malcolm Pirnie collected surficial sediment samples from each cell location on May 22, 2007. Surface depth is defined as 0 to 6 inches bgs. A Ponar Grab Sampler was used for obtaining the sediment samples. **Figure 2-2** provides the locations for the samples. **Table 2-1** provides a summary of the samples, sample depths, and analytical methods. Details on soil sampling procedures and data QA/QC were provided in the FSP and QAPP as Appendices D and E, respectively of the previously submitted RAP.

The actual horizontal location of each sediment sample was surveyed by GPS. All survey data were downloaded into an ArcGis map and plotted.

2.2.3 Monitoring Well Installation and Development

Following the soil and sediment sampling, five additional monitoring wells (MW-1R, MW-7, MW-8, MW-9, and MW-10) were installed on Site to fill the data gaps identified in the CSM. After the soil samples were analyzed, the results were submitted to EPA along with the recommended well locations (based on the soil sample results) for approval as part of a RAP Addendum dated November 9, 2007. The monitoring wells were installed on May 28 and 29, 2008; the locations are presented on **Figure 2-3**. The monitoring wells were constructed from 2-inch diameter PVC screen (10 feet) and PVC casing. The wells were installed to a depth

ranging from 14 to 16 feet bgs. Well installation and development were performed in accordance with EPA protocols. Construction details for the newly installed wells are provided in **Appendix D**.

2.2.4 Water Level Gauging

Water levels were gauged from all Site monitoring wells on July 1 and 24, 2008. For each event, the water levels were collected by two Malcolm Pirnie personnel simultaneously to capture a 'snapshot' of the water table and avoid possible bias from potential tidal influence. A temporary stake was installed in the creek to gage surface water levels for the July 1 event. The stake was surveyed for vertical control (see Section 2.2.9).

2.2.5 Groundwater Sampling

Additional sampling of groundwater was required to fill the data gaps identified in the CSM for the four existing monitoring wells (MW-2, MW-4, MW-5, and MW-6) and the five newly installed wells (MW-1R, MW-7, MW-8, MW-9, and MW-10). Groundwater sampling was conducted on July 1 and 2, 2008. As per the Order, all groundwater samples were analyzed for both total and dissolved metals (arsenic, cadmium, chromium, lead, mercury, nickel, and silver) and PCB homologue groups. Metals were analyzed using EPA SW-846 Methods 6010/7470 and PCB Homologues were analyzed using EPA Method 680. Laboratory analyses were conducted at a Level IV CLP-equivalent data quality which includes QA/QC samples, such as, laboratory control standards, MS/MSD, and surrogates (at a minimum).

Malcolm Pirnie conducted a reconnaissance survey of Site monitoring wells on November 5, 2007. The four existing wells were inspected to determine their integrity and functionality: the wells were determined fit for sampling and did not require repair, replacement, or permanent abandonment. This recommendation was presented to EPA in the RAP Addendum. It should be noted that two of the six monitoring wells installed by DAA could not be located. MW-3 could not be located sometime after 1999 and MW-1 could not be located during the reconnaissance survey.

Malcolm Pirnie collected groundwater samples from eight of the nine monitoring wells in accordance with EPA sampling protocols for low-flow sampling. Samples were collected using a peristaltic pump and new tubing for each well. Samples were collected after the water quality parameters (dissolved oxygen, temperature, conductivity, turbidity, and pH) had stabilized. It should be noted that problems were encountered with wells located in the eastern arm, MW-6 and MW-8. MW-6 initially had 4.4 feet of standing water which then dropped 3.5 feet over 38 minutes during purging. Due to the very slow recharge, the metals containers were filled on a separate day from the PCB containers (to allow for recharge overnight). MW-8, which is located near MW-6, was dry and could not be sampled. **Table 2-1** provides a summary of the samples, sample depths, and analytical methods. Details on

groundwater sampling procedures and data QA/QC were provided in the FSP and QAPP as Appendices D and E, respectively of the previously submitted RAP.

2.2.6 Slug/Bail Tests

In situ estimations of hydraulic conductivity were obtained through slug/bail tests conducted on July 23 and 24, 2008. A solid PVC pipe slug was added to the monitoring well to displace water in the well. After water returned to static levels, the pipe was quickly removed resulting in rising head levels. The rising head was measured using a down-hole pressure transducer connected to a data logger (Hermit 3000). The data logger recorded data on a semi-logarithmic time schedule to minimize measurement intervals at the beginning of the test (when change in drawdown is greatest), and lengthen measurement intervals at later time during the test (when change in drawdown decreases). The maximum time interval between data points was 1 minute. Tests were conducted on eight of the nine wells and ranged from approximately 10 to 60 minutes in duration. Results from the slug tests were analyzed using Bouwer and Rice Method (*Applied Hydrogeology*, C.W. Fetter 1994) and are included in **Appendix E**.

2.2.7 Equipment Decontamination

Sample collection equipment including stainless steel mixing bowls, stainless steel spoons, and hand augers were decontaminated prior to use to avoid potential cross contamination. Decontamination consisted of a phosphate free soap washing (Alconox), two separate rinses with distilled water, and a three part rinse of nitric acid, methanol, and de-ionized water. Decontaminated equipment was allowed to air dry on a clean plastic sheet.

2.2.8 Investigation Derived Waste

Investigation derived waste (IDW) includes soil, liquid wastes, and supply/equipment items. Soil cuttings were returned to the borehole/test pit for the soil investigation activities. Groundwater from redevelopment and sampling of wells, and water from decontamination of sampling equipment were containerized in 55-gallon drums, labeled, dated, and temporarily stored in an approved area of the Site. The analytical results from the groundwater sampling indicated that metals and PCB concentrations in the groundwater samples were much lower than concentrations in the vadose zone soils associated with each well location; thus the containerized groundwater were disposed of on-site at the well location. Used gloves, core liners, and any other disposable sampling equipment or personal protective equipment were double bagged and disposed of off-site as non-hazardous waste.

Additional details on IDW management procedures were provided in the FSP as Appendix D of the previously approved RAP.

2.2.9 Site Surveying

A Site survey was conducted of the nine monitoring wells and the temporary stake installed in the creek by a surveyor who is licensed and registered in the Commonwealth of Virginia (Hurt and Proffitt, Inc of Norfolk VA). Horizontal and vertical measurements were collected for each monitoring well: the elevation of the top of well casing, the top of the protective well casing or rim for flush mounted wells, and ground surface elevation at each monitoring well location. The elevation of the temporary stake was surveyed, however due to a miscommunication with the surveyor, information for the stake is deemed unreliable by Malcolm Pirnie and not included.

The latitude and longitude of each surveyed location are tied to the Universal Transverse Mercator North American Datum of 1983 (NAD 83). Elevations for the natural ground surface (and the surface water measuring rod) at each surveyed location are determined using the North American Vertical Datum of 1988 (NAVD 88). Measurements are third order accuracy. Temporary monuments were tied into the City of Portsmouth control network. Details on surveying requirements were presented in FSP which was previously submitted in the RAP (Appendix D).

2.2.10 MEC Identification and Clearance

After the discovery of potential munitions and explosives of concern (MEC) at the Site, a Malcolm Pirnie UXO specialist was called to the Site to provide UXO surveying and clearance. The UXO specialist performed daily MEC avoidance/discovery procedure briefings and visual inspections of all remaining investigation areas for MEC and munitions debris (MD). The UXO specialist was present on-site October 1 to 17, 2007 and May 28, 2008.

Daily records of all MEC/MD activities were prepared and discovered items were logged and photographed. When suspected MEC was encountered, local Navy Explosive Ordinance Disposal (EOD) was contacted and the suspected MEC was removed from the Site for proper disposal. Items that were determined to be inert were inspected, certified, and transported to a recycling facility in Hampton VA.

2.2.11 Off-site Laboratory Analysis

All samples (soil, sediment, and groundwater) were analyzed by Test America Laboratories of Savannah GA. Samples were analyzed as follows:

- | | | |
|------------|--------------------------|---|
| • Soil | PCB Aroclors
Metals | EPA SW-846 Method 8082
EPA SW-846 Method 6010/7471 |
| • Sediment | PCB Homologues
Metals | EPA Method 680
EPA SW-846 Method 6010/7471 |

- Groundwater PCB Homologues EPA Method 680
Metals (total and dissolved) EPA SW-846 Method 6010/7471

2.3 Site-Specific Field Investigations

In summary, samples were collected from soil, sediment, and groundwater at the Site. Selection of soil sample locations and depths was based on identified data gaps following the data validation of previously collected samples by DAA. A total of 542 soil cell locations were sampled from which 479 samples were collected from 0 to 18 inches bgs, 426 samples from 18 inches bgs to top of saturated zone, and 10 samples from saturated fill zone. A total of 37 sediment cell locations were sampled from which each sample was collected from 0 to 6 inches bgs. A total of eight groundwater samples were collected from existing and newly installed monitoring wells. QA samples were collected as described in the RAP and have not been included here in the totals above.

In addition to the soil, sediment, and groundwater sampling, numerous other field activities occurred at the Site. Additional field work included: initial site reconnaissance, monitoring well reconnaissance survey, installation of five monitoring wells, slug/bail tests conducted in eight monitoring wells, survey of the nine monitoring wells for horizontal and vertical control, UXO surveying and clearance, and removal of UXO items from the Site.

2.4 Field Investigation Changes

A total of 569 soil cell locations and up to 1,707 soil samples were identified in the RAP for possible sampling, but actual sampling included 542 soil cells and 915 samples. The difference in the anticipated sample numbers versus the actual is due to the number of previously sampled cells by DAA that passed the data validation and the fill was almost exclusively within the vadose zone. Some cell locations and depths were not sampled for the following reasons: outside of property, refusal-concrete, refusal-subsurface debris, utility lines, marsh, water table encountered, dense vegetation, or inaccessible.

Five monitoring wells were installed at the Site instead of the proposed four. The additional well (MW-1R) was installed to replace an existing well (MW-1) which could not be located during the reconnaissance survey. Eight of the nine monitoring wells were sampled for constituents instead of the proposed nine wells. The ninth well (MW-8) was dry and could not be sampled. Slug/bail tests were conducted in eight of the nine monitoring wells; the ninth well (MW-8) was dry and could not be tested.

A Malcolm Pirnie UXO specialist was required at the Site following the discovery of UXO. Intrusive field investigations could not be conducted without the area being surveyed and cleared by the UXO specialist. The specialist was present on-site each day of soil sampling following the discovery of the UXO items and during the installation of the monitoring wells.

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All MEC/MD items were logged and photographed. Types of items that were discovered include: 3-inch naval round fuze, but not fired, heat round, inert/training .50 caliber BMG rounds, machine gun, and casings. MEC/MD items were removed by local Navy EOD for any suspected items and inert items were inspected, certified, and transported to a recycling facility in Hampton VA. Photographs of some of the MEC/MD items are presented in **Appendix F**.

3.1 Land Use

The Site is an inactive, privately owned, former scrap metal facility which recycled scrap metals from federal and state governments, as well as commercial, industrial, and private sources. Miscellaneous debris and scrap metal are present throughout the majority of the Site and extend off-site in some areas. Surface cover includes concrete fragments, scrap metal, broken brick, gravel, tires, and other miscellaneous debris. A concrete pad is located near the west central border. Currently, one small portion of the property along the western border is leased; the Site is otherwise vacant. This leased portion includes a maintenance garage in which hauling trucks are entering and leaving the property daily.

A security chain linked fence and locked gate were installed around the entire property in 2003 to minimize the potential for trespassers and incidental use. A Jersey barrier further restricts access on the southeast corner of the property.

3.2 Topography

The Site topography is relatively flat with elevations ranging from approximately mean sea level to 10 feet above mean sea level (AMSL). The southeastern portion of the Site contains one small mounded area with a relief of about 25 feet AMSL. Paradise Creek is located immediately outside of the site boundary on the southwestern corner. The land on this corner gently slopes toward the creek as it transitions to a tidal marsh along the creek.

3.3 Surface Water Hydrology

Surface runoff flows from higher Site areas through the tidal marsh into Paradise Creek on the southwestern boundary of the Site. Paradise Creek is approximately 100 feet wide and has a mean tidal range of approximately 3 feet.

3.4 Geology and Hydrogeology

Following is a characterization of the geology and hydrogeology across the Site based on the descriptions from soil and groundwater investigations that occurred at the Site during the 2007 and 2008 sampling events. Generally, within the Site, the upper 5 feet of material is typically a silty clay fill mixed with varying amounts of debris. Below the fill in the western to central portion of the property is a medium to fine sand. This sand layer is discontinuous and absent in the eastern portion of the property, where a clayey sand is present below the fill. Additional information, specifically soil borings for wells, was gathered from previous investigations conducted by others. A cross section from the southwest area of the site (MW-10) to the northeast area (MW-6) is provided on **Figure 3-1**; the location of the cross section is provided on **Figure 3-2**.

Borings on the eastern arm of the site indicate fill material to an average depth of two feet bgs; however, fill material was encountered as deep as 8.5 feet bgs. The fill is underlain by a clayey sand layer that is several feet thick. A grey clay layer was encountered below the clayey sand. The deepest borings in this portion of the site went to 16 feet bgs, and groundwater was encountered at approximately 6 to 7 feet bgs.

South of the eastern arm, the eastern side of the Site contained fill material to a depth of approximately 4 feet bgs. Clay was present from 4 to 8 feet bgs, and 8 to 12 feet bgs was occupied by a soft clay layer mixed with sand. Groundwater was encountered at a depth of 10 to 12 feet bgs. Borings did not extend beyond 12 feet bgs.

In the center of the Site, fill material was typically present to a depth of 8 feet but extended as deep as 12 feet at some points. This was underlain by sand mixed with a little clay from 8 to 12 feet bgs, and groundwater was encountered between 8 to 11 feet bgs. Refusal was encountered in isolated points. A sheet of concrete was encountered at approximately 6 feet bgs in the south-central area, and equipment could not go beyond this point.

The western arm of the Site contained fill material in the interval from 1.5 to 2 feet bgs. Fine sand or sandy silt was present beneath the fill from 1.5 to 4 feet, underlain by a stiff clay layer from 3 to 8 feet that transitioned to sandy clay. A sand layer was present at a depth of 8 feet bgs and it extended to a depth of approximately 15 feet bgs. Groundwater was typically encountered at 7 feet bgs in this area of the Site.

South of the western arm, the western side of the Site surrounding the concrete pad was largely fill material to an average depth of 4 feet bgs. Clay or sandy clay occupied approximately 4 to 8 feet bgs, and in places contained poorly graded gravel lenses. Coarse sand was found from 8 to 12 feet bgs, with groundwater encountered at 11 to 12 feet bgs. In a small pocket immediately east of the concrete pad, the 4 to 8 feet bgs interval contained sand, and the 8 to 12 feet bgs interval contained sandy clay.

Borings in the southwestern portion of the Site encountered groundwater at a depth of 8 to 9 feet which decreased to less than 0.5 feet bgs near the creek. There was substantial refusal in this corner of the Site due to large amounts of brick and rock. Fill material typically occupied the top 1 to 3 feet and was underlain by soft clay or soft sandy clay. In the southernmost area of the Site, fill material was encountered as deep as 12 feet bgs and groundwater was reached at a depth of 11 feet bgs or deeper. A fine sand layer was also present at this depth. The deep borings were terminated at 12 feet bgs due to equipment limitations. The borings closest to Paradise Creek contained mostly silty clay and were terminated at 0.5 to 1 feet bgs.

Monitoring wells indicate that groundwater flows radially outward from the area of MW-4 (7.46 feet AMSL), which is located near the mound in the southeastern portion of the site (**Figure 3-2**). In the southwestern area, groundwater appears to mimic surface topography, flowing outward from the well and migrating toward Paradise Creek as indicated from MW-7 (0.14 feet

AMSL). Groundwater elevation in the northwest portion (or western arm) was measured at 4.39 feet AMSL (MW-1R). The water table aquifer is absent in the northeast area (or eastern arm), as evidenced by the dry well MW-8 and residual water measured in MW-6 at -5.37 feet AMSL. The water table generally ranged from 0.14 feet MSL to 7.46 feet AMSL across the remaining areas of the Site. All measurements were made on July 24, 2008 and within 30 minutes to capture a snapshot of the water table. Data from a round of water levels collected on July 1, 2008 showed a similar pattern to July 24 data and, as such, has not been presented. Estimates of hydraulic conductivity range from 0.03 to 2.9 feet/day with an average of 0.9 feet/day based on slug test (bail down); this is comparable to estimates by DAA which ranged from 0.1 to 0.7 feet/day. Plots of the slug test data are provided in **Appendix E**.

3.5 Ecology

Scattered debris and scrap metal is scattered throughout the Site, which is otherwise covered with dirt paths, gravel, weeds, and marsh. There is a line of trees and shrubs just to the west of the eastern arm of the Site and along the southwestern border, including a mix of red maple, black oak, and sweet gum. The marsh area is influenced by the tidal effects of the creek and is dominated by common reed (*Phragmites australis*). Other plants found across the site include fescue grass, Queen Anne's lace, white clover, goldenrod, and common dandelion. Although the Site is highly disturbed, the surrounding habitat and the trees on-site support wildlife including mice, rabbits, red fox, herring gulls, grackle, and the American robin. Egrets and dense populations of fiddler crabs were observed in the marsh area.

In addition to data collected from soil and groundwater sampling conducted in previous years (1999, 2003, 2004, and 2005), soil sampling was conducted during the spring, summer, and fall of 2007, sediment sampling during the spring 2007, and groundwater sampling was conducted in the summer of 2008. This additional data were collected to fill in data gaps and better define the nature and extent of contamination. Surface and subsurface soil samples were collected using DPT and an excavator; sediment sampling was conducted using a Ponar Grab Sampler; and groundwater samples were collected from monitoring wells using a peristaltic pump. A copy of all of the analytical data as well as the data validation reports is presented on CDs in **Appendix G**.

Analytical data were evaluated based on EPA screening criteria. Groundwater data were compared to EPA Maximum Contaminant Levels (MCLs) and Oak Ridge National Laboratory (ORNL) Regional Screening Levels (RSLs) for residential tap water, July 2008; sediment data were compared to Freshwater Sediment Screening Benchmarks (FSSBs), August 2008; and soil data were compared to ORNL RSLs, July 2008.

4.1. Surface and Subsurface Soils

Soil sampling was conducted from April 26 to October 17, 2007. Samples were collected from a depth of 0 to 18 inches (surface soils), and from 18 inches to bottom of fill material (subsurface soils). If fill extended beyond the water table, the second sample was from 18 to inches to water table, with a third sample collected from top of water table to bottom of fill. Samples were analyzed for PCB Aroclors and metals (arsenic, cadmium, chromium, lead, mercury, nickel, and silver) with lead being the primary metal of concern. Due to the volume of data generated in this effort, the graphical presentation of results on figures is the most practical method of identifying the nature and extent of contamination for the primary constituents of concern, lead and PCB Aroclors. The analytical results are summarized in **Figures 4-1 through 4-4**.

4.1.1 PCB Aroclor Results

As seen in **Figure 4-1**, PCBs were detected across the Site in the surface soil samples. The highest concentrations were in the central area of the Site extending into the eastern arm. The maximum concentration detected was 5,170 mg/kg with PCB results in seven samples at concentrations greater than 1,000 mg/kg. Samples collected in the western arm and the southeastern portion of the Site were almost all below 10 mg/kg PCBs in surface soil. The PCB Aroclor concentrations in approximately 365 of the 479 (76 percent) surface soil samples exceeded the industrial RSL of 0.74 mg/kg for Aroclors 1254 and 1260 which were the primary Aroclors detected at the Site.

Analytical results for PCBs in the deep soils (18 inches to water table) are shown in **Figure 4-2**. The highest PCB concentrations (those greater than 10 mg/kg) are almost entirely confined to the central portion of the Site and extending toward the southern border. All detections were less than 1 mg/kg in the eastern arm, and almost all detections were below 1 mg/kg in the western arm of the Site. The majority of the eastern part of the Site was below 10 mg/kg, and the southeastern

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area could not be sampled due to surface cover and marsh lands. The PCB Aroclor concentrations in approximately 208 of the 426 (49 percent) subsurface soil samples exceeded the industrial RSL of 0.74 mg/kg for Aroclors 1254 and 1260 which were the primary Aroclors detected at the Site.

A summary of PCB Aroclor concentrations in relation to the acreage of impacted soils at these concentration ranges is presented in the following table:

PCB Concentrations (mg/kg)	Surface Area (acres)	Subsurface Area (acres)
Less than 1	8	13.3
1 to 10	10.8	6.3
10 to 25	4.4	1.7
25 to 50	3.7	1
Greater than 50	4	2.2

Note:

Acreage is different for the surface as compared to the subsurface due to the presence of concrete and other debris in the subsurface that prevented the collection of samples from all grids.

4.1.2 Metal Results

As shown in **Table 4-1**, arsenic, cadmium, chromium, lead, mercury, nickel, and silver were detected throughout the Site. **Table 4-1** presents all of the metals data as compared to the RSLs for industrial soils. A brief summary of the extent of contamination associated with these metals is presented as follows:

Arsenic

Arsenic was detected in almost all soil samples collected at the Site. Concentrations ranged from non-detect to 380 mg/kg. Most arsenic concentrations exceeded the 1.6 mg/kg RSL for industrial soils. Although a soil background study has not been performed at the Site, soils in the Tidewater Region of southeastern Virginia typically have arsenic concentrations in the 5 to 20 mg/kg range.

There were 23 surface soil and 23 subsurface soil samples with arsenic concentrations greater than 100 mg/kg; none of which were located within the same sampling grid indicating that there is no vertical delineation pattern. This 100 mg/kg threshold was only established as a means to identify the areas of the Site with the highest arsenic concentrations. The highest concentrations of arsenic were scattered throughout the Site with no discernible location where the bulk of the highest arsenic concentrations were located. The locations of the 46 samples with arsenic concentrations greater than 100 mg/kg are presented as follows:

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- Eastern Arm: 7 surface and 3 subsurface
- Western Arm: 6 surface and 8 subsurface
- Central Area: 6 surface and 10 subsurface
- Western Area: 4 surface and 1 subsurface
- Eastern Area: 1 subsurface

The locations of the highest arsenic concentrations at the Site are not the same as the lead or PCB contamination indicating that the arsenic impacts are the result of a different type of activity at the Site than those COCs.

Cadmium

Cadmium was detected in most soil samples collected at the Site. Concentrations ranged from non-detect to 370 mg/kg. Cadmium concentrations exceeded the 81 mg/kg RSL for industrial soils in 39 soil samples collected at the Site which is approximately 4 percent (39 of 915 samples) of the total number of samples collected. Although a soil background study has not been performed at the Site, soils in the Tidewater Region of southeastern Virginia typically have cadmium concentrations in the 0.50 to 1.0 mg/kg range.

There were 27 surface soil and 12 subsurface soil samples with cadmium concentrations greater than the RSL of 81 mg/kg. The highest concentrations of cadmium were in several locations with approximately half of the RSL exceedences in the central portion of the Site. The locations of the 39 samples with cadmium concentrations greater than the RSL of 81 mg/kg are presented as follows:

- Eastern Arm: 5 surface and 2 subsurface
- Central Area: 11 surface and 9 subsurface
- Western Area: 2 surface and 1 subsurface
- Eastern Area: 9 surface

The locations of the highest cadmium concentrations (eastern arm, eastern, and central portions) at the Site are similar to the highest PCB concentrations.

Chromium

Chromium was detected in most soil samples collected at the Site. Concentrations ranged from non-detect to 31,000 mg/kg. Chromium concentrations exceeded the total chromium 1,400 mg/kg RSL for industrial soils in 39 soil samples collected at the Site which is approximately 4 percent (39 of 915 samples) of the total number of samples collected. Although a soil background study has not been performed at the Site, soils in the Tidewater Region of southeastern Virginia typically have chromium concentrations in the 10 to 30 mg/kg range.

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There were 27 surface soil and 12 subsurface soil samples with chromium concentrations greater than the RSL of 1,400 mg/kg. The bulk of the RSL exceedences were observed in two locations at the Site; the central and western portions of the Site. The locations of the 39 samples with chromium concentrations greater than the RSL of 81 mg/kg are presented as follows:

- Eastern Arm: 2 surface and 1 subsurface
- Western Arm: 1 surface
- Central Area: 10 surface and 8 subsurface
- Western Area: 14 surface and 2 subsurface
- Eastern Area: 1 subsurface

The locations of the highest chromium concentrations (western and central portions) at the Site are similar to the highest PCB concentrations except for the western portion near the property boundary.

Lead

Lead was detected across the entire Site in surface soils as seen in **Figure 4-3**. A large portion of the Site contained lead at concentrations greater than 1,200 mg/kg which is typically used as the industrial soil criteria. Although high concentrations were detected throughout the Site, the western arm and the southeastern portion of the Site had fewer sample results with high concentrations of lead than the rest of the Site. Almost all samples collected in the central area and extending into the eastern arm contained lead concentrations greater than 1,200 mg/kg. The maximum concentration detected was 76,000 mg/kg, but most of the high concentrations detected were in the range of 3,000 to 6,000 mg/kg. Overall, lead concentrations exceeded the criteria in 217 of 379 (45 percent) of surface soil samples collected at the Site.

Lead was also detected across the extent of the Site in the deep soils but overall at lower concentrations than those seen in surface soils (**Figure 4-4**). The concentrations greater than 1,200 mg/kg were largely confined to the central area, with scattered samples reaching these concentrations in the western area. The southeastern portion was not sampled at this depth due to the marsh and dense vegetation. The eastern side of the Site mostly contained lead concentrations less than 100 mg/kg in the deep soils. Overall, lead concentrations exceeded the criteria in 71 of 426 (17 percent) of subsurface soil samples collected at the Site.

Mercury

Mercury was detected in most soil samples collected at the Site. Concentrations ranged from non-detect to 110 mg/kg. Mercury concentrations exceeded the 31 mg/kg RSL for industrial soils in only five soil samples collected at the Site which is approximately 0.6 percent (5 of 915 samples) of the total number of samples collected. Although a soil background study has not been performed at the Site, soils in the Tidewater Region of southeastern Virginia typically have mercury concentrations in the 0.02 to 0.10 mg/kg range.

There were only four surface soil and one subsurface soil sample with mercury concentrations greater than the RSL of 31 mg/kg. The highest concentrations of mercury were primarily located in the eastern and central portions of the Site. The locations of the highest mercury concentrations (eastern and central portions) at the Site are similar to the highest PCB concentrations.

Nickel

Nickel was detected in most soil samples collected at the Site. Concentrations ranged from non-detect to 28,000 mg/kg. Nickel concentrations exceeded the 2,000 mg/kg RSL for industrial soils in 30 soil samples collected at the Site which is approximately 3 percent (30 of 915 samples) of the total number of samples collected. Although a soil background study has not been performed at the Site, soils in the Tidewater Region of southeastern Virginia typically have nickel concentrations in the 5 to 10 mg/kg range.

There were 19 surface soil and 11 subsurface soil samples with nickel concentrations greater than the RSL of 2,000 mg/kg. The bulk of the RSL exceedences were observed in two locations at the Site; the central and western portions of the Site. The locations of the 30 samples with nickel concentrations greater than the RSL of 2,000 mg/kg are presented as follows:

- Eastern Arm: 3 surface
- Central Area: 3 surface and 7 subsurface
- Western Area: 13 surface and 4 subsurface

The locations of the highest nickel concentrations (western and central portions) at the Site are similar to the highest PCB concentrations except for the western portion near the property boundary.

Silver

Silver concentrations ranged from non-detect to 960 mg/kg. Silver concentrations exceeded the 510 mg/kg RSL for industrial soils in only one soil sample collected at the Site which is approximately 0.1 percent (1 of 915 samples) of the total number of samples collected. Although a soil background study has not been performed at the Site, soils in the Tidewater Region of southeastern Virginia typically have silver concentrations at less than 1 mg/kg.

There was one subsurface soil sample with a silver concentration greater than the RSL of 510 mg/kg which was located in the southwest corner of the site near the wetland area. The highest concentrations of silver were primarily located in the eastern arm, western portion, and central portions of the Site.

4.1.3 Soil Analytical Results Summary

In summary, PCBs and lead soil impacts cover the extent of the Site, but appear to be most heavily concentrated in surface soils in the central area and extending into the eastern arm of the Site. While surface soils are impacted in a larger area and in greater concentrations, subsurface soil impacts follow a similar pattern. The eastern arm had only a scattering of subsurface soil samples with high constituent concentrations. A more detailed summary of the extent of PCB and metal contamination is presented below.

PCBsSurface Soils

- PCB concentrations greater than 1 mg/kg in surface soils extend over much of the Site with the highest concentrations (greater than 10 mg/kg) primarily located in the central portion extending into the eastern arm of the Site.
- PCB concentrations were typically less than 5 mg/kg in the western arm with only two detects above 10 mg/kg.
- The western portion of the Site had varying concentrations of PCBs with the bulk of the concentrations less than 10 mg/kg; however, sporadic PCB concentrations greater than 25 mg/kg are located in this area.
- The southwestern corner of the Site had varying concentrations of PCBs with the bulk of the concentrations less than 10 mg/kg; however, sporadic PCB concentrations greater than 20 mg/kg are located in this area.

Subsurface Soils

- The highest PCB concentrations in subsurface soils are located in the central portion of the Site with concentrations consistently greater than 25 mg/kg.
- A few isolated PCB concentrations greater than 10 mg/kg were noted in the western and eastern arm portions of the Site with most concentrations in the non-detect to 5 mg/kg range.
- The bulk of the subsurface soil samples in the western arm were either non-detect or less than 1 mg/kg for PCBs with a few locations up to 8 mg/kg.

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Metals

Arsenic, cadmium, chromium, lead, mercury, nickel, and silver were detected throughout the Site. A summary of the locations where the highest detect of each metal is presented as follows:

- Arsenic. The highest concentrations of arsenic were scattered throughout the Site with no discernible location where the bulk of the highest arsenic concentrations were located.
- Cadmium. The highest concentrations of cadmium were in several locations (eastern arm, eastern area, and central area) with approximately half of the RSL exceedences in the central portion of the Site.
- Chromium. The bulk of the RSL exceedences for chromium were observed in two locations at the Site; the central and western portions of the Site.
- Lead. The highest concentrations of lead were primarily located in the eastern arm, central, and western portions of the Site, although there were scattered high concentrations throughout the Site.
- Mercury. The highest concentrations of mercury were primarily located in the eastern and central portions of the Site.
- Nickel. The bulk of the RSL exceedences for nickel were observed in two locations at the Site; the central and western portions of the Site.
- Silver. The highest concentrations of silver were primarily located in the eastern arm, western portion, and central portions of the Site

A summary of the metal detections above their respective RSL is presented in the following table:

Metal	Exceedences of the RSL		
	Surface Soils	Subsurface Soils	Total
Arsenic	472 of 479 samples (99 percent)	421 of 426 samples (99 percent)	893 of 915 samples (99 percent)
Cadmium	27 of 479 samples (6 percent)	12 of 426 samples (3 percent)	39 of 915 samples (4 percent)
Chromium	27 of 479 samples (6 percent)	12 of 426 samples (3 percent)	39 of 915 samples (4 percent)
Lead	217 of 479 samples (45 percent)	71 of 426 samples (17 percent)	288 of 915 samples (31 percent)

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Metal	Exceedences of the RSL		
	Surface Soils	Subsurface Soils	Total
Mercury	4 of 479 samples (0.8 percent)	1 of 426 samples (0.2 percent)	5 of 915 samples (0.6 percent)
Nickel	19 of 479 samples (4 percent)	11 of 426 samples (3 percent)	30 of 915 samples (3 percent)
Silver	0 of 479 samples	1 of 426 samples (0.2 percent)	1 of 915 samples (0.10 percent)

4.2. Sediment

4.2.1 PCB Homologue Results

Sediment was collected from 37 locations on May 22, 2007 in the portion of Paradise Creek bordering Peck property (**Figure 2-2**). Samples were analyzed for PCBs and metals, and analytical results are provided in **Table 4-2**. PCBs were only detected in 3 of 36 sediment samples collected within Paradise Creek. These three samples contained PCBs exceeding the FSSB of 59.8 µg/kg. These samples included SD-4, SD-5, and SD-32 with concentrations of 75 J µg/kg, 75 J µg/kg, and 140 J g/kg, respectively. (J indicates an estimated value.)

4.2.2 Metals Results

Metals were detected in all 36 sediment samples collected within Paradise Creek. Seven metals were detected above screening criteria. The following table provides a summary of metals detections:

Metal	Samples exceeding screening criteria	Concentration Range (mg/kg)	Median Concentration	FSSB (mg/kg)
Arsenic	All samples except SD-2	11 to 21	14	9.8
Cadmium	All samples	1.0 to 2.7	2.2	0.99
Chromium	All samples	88 to 1,400	120	43.4
Nickel	All samples	45 to 540	63	22.7
Lead	All samples	110 to 450	180	35.8
Mercury	All samples except SD-1	0.083 to 1.8	0.78	0.2
Silver	SD-1	0.30 to 3.0	0.80	1.0

Metals exceedances were found throughout the area sampled with no discernable pattern of distribution. Because there has not been a background study conducted for sediments within Paradise Creek, it is uncertain if the presence of the metals is related to runoff from the Site or from another source located within the Paradise Creek watershed.

4.3. Groundwater

Eight monitoring wells were sampled on July 1, 2008 and analyzed for PCB Homologues and total and dissolved metals. **Table 4-3** provides a summary of analytical results.

4.3.1 PCB Homologue Results

PCBs were detected in 3 of 8 groundwater samples: MW-7 (0.007 µg/L), MW-9 (0.1944 µg/L), and MW-10 (0.014 µg/L) (**Figure 2-3**). All of these wells with detected PCBs are in the southwestern corner of the Site and downgradient of the central portion of the Site where the highest concentrations of PCBs in soils are present. Detected levels of PCB Homologues were well below the MCL of 0.5 µg/L for all samples. Accordingly, we conclude that there is no groundwater impact resulting from the PCB-contaminated soils on Site, which suggests that controlling the PCB-contaminated soils on-site through a cap would be an effective remedy at the least cost.

4.3.2 Metal Results

Arsenic, chromium, nickel, lead, and mercury were the only metals detected in groundwater samples at the Site. Cadmium and silver were not detected in any groundwater samples collected at the Site. Chromium was not detected above its RSL or MCL while only one sample exceeded the RSL for nickel. No dissolved lead samples exceeded its EPA action limit while dissolved mercury did not exceed its MCL. A summary of the metal detections and RSL/MCL exceedences is presented as follows:

- **Arsenic.** Total and dissolved arsenic were detected in 6 of 8 samples at concentrations of 6.9 to 28 µg/L for total arsenic and 3 to 21 µg/L for dissolved arsenic. Total arsenic exceeded the RSL of 0.045 µg/L and the MCL of 10 µg/L in five wells (MW-1R, MW-4, MW-5, MW-6, and MW-7). Additionally, total arsenic exceeded just the RSL in MW-9. Dissolved arsenic concentrations exceeded its RSL and MCL in four wells (MW-1R, MW-4, MW-5, and MW-6) with concentrations ranging from 10 to 21 µg/L. Dissolved arsenic exceeded its RSL of 0.045 µg/L in two additional wells (MW-9 and MW-10).
- **Chromium.** Total chromium was detected at a concentration range of 1.4 to 93 µg/L in 3 of 8 samples while dissolved chromium was detected at a concentration range of 2.4 to 2.6 µg/L in 2 of 8 samples. Chromium (total and dissolved) concentrations did not exceed either its RSL or MCL in any groundwater samples collected at the Site.

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- Nickel. Total nickel was detected at a concentration range of 2 to 800 µg/L in 5 of 8 samples while dissolved nickel was detected at a concentration range of 2.2 to 730 µg/L in 6 of 8 samples. Only the total (800 µg/L) and dissolved nickel (730 µg/L) concentrations from one well (MW-2) exceeded the RSL of 73 µg/L. No MCL has been developed for nickel.
- Lead. Total lead was detected in 6 of 8 samples at a range of 2.7 to 50 µg/L while dissolved lead was only detected in 1 (MW-9) of 8 samples at a concentration of 2.6 µg/L. The total lead concentration (50 µg/L) in MW-7 was the only lead detection above the EPA action limit of 15 µg/L. No dissolved lead concentrations exceeded the EPA action limit.
- Mercury. Total mercury was detected in 2 of 8 samples at concentrations of 0.10 and 0.24 µg/L while no dissolved mercury was detected in any groundwater sample. The two total mercury detects are above the RSL of 0.063 µg/L but below the MCL of 2 µg/L.

4.3.3 Groundwater Analytical Results Summary

A summary of the groundwater analytical results is presented as follows:

- PCBs were detected in three wells at a concentration range of 0.007 to 0.19 µg/L in the southwestern corner of the Site but at concentrations less than their MCL of 0.50 µg/L.
- The total metals detected above EPA screening criteria (RSLs and/or MCLs) were total arsenic in MW-1R, MW-4, MW-5, MW-6, MW-7, and MW-9, total nickel in MW-2, total lead in MW-7, and total mercury in MW-7 and MW-10.
- The dissolved metals detected above EPA screening criteria (RSLs and MCLs) were dissolved arsenic in MW-1R, MW-4, MW-5, MW-6, MW-9, and MW-10 and dissolved nickel in MW-2. MCL exceedences were limited to dissolved arsenic in four wells (MW-1R, MW-4, MW-5, and MW-6) and dissolved nickel in one well, MW-2.

No PCBs, dissolved chromium, lead, and mercury were detected above EPA drinking water standards while dissolved nickel was only found in one well on-site above its RSL (no MCL has been developed) and dissolved arsenic was detected in 4 of 8 site wells above its MCL. Based on the Site groundwater data, the following conclusions are presented:

- Because there have been minimal exceedences of drinking water standards and all adjacent properties are on public water supply (source of the public water are lakes and groundwater in a neighboring municipality which are not impacted by Site groundwater), there does not appear to be any potential human receptors that would be impacted by Site groundwater.

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- Impacts to aquatic receptors in the Elizabeth River or Paradise Creek are not anticipated due to the low concentrations of metals detected in Site groundwater. A comparison of the groundwater concentrations to the Virginia Surface Water Quality Standards for salt water yielded that only dissolved nickel in one well (MW-2) exceeded any of the standards. Due to continued attenuation in groundwater prior to potential discharge into the adjacent surface water bodies and the mixing that takes place in these bodies, impacts to aquatic receptors are not anticipated.

Based on the above conclusions and how the data relates to potential site remedies, a potential cap at the site would be an acceptable remedy to further reduce metals leaching to Site groundwater and also reduce off-site migration potential.

Although not required by the U.A.O., an assessment of potential remedial alternatives for the Site has been made. Based on the contaminants present (PCBs and metals), their mobility, location, and concentrations, the primary identified potential remedial alternatives for the site soils are (i) installation of an “impermeable” soil cap to prevent storm water infiltration and reduction of potential future contaminant leaching into the groundwater. The client previously recommended and the VDEQ was poised to accept this remedy when the Site was enrolled in the voluntary remediation program (VRP), or (ii) removal of contaminated soils above action levels, which has been favored at times by the EPA OSC and various other EPA staff based upon an assumption (with which we respectfully disagree) that TSCA regulations mandate soil removal and off-site disposal of PCB contaminated soils above the EPA action level. A third option combines the capping remedy with “hot spot” soil removal.

5.1 Remedial Scenarios

These potential site remedies are widely utilized for contaminated soils and are also the only remedies specifically discussed in 40 CFR § 761.61, PCB Remediation Waste. A summary of these potential remedies is presented below.

5.1.1 Capping Scenario

This scenario would include the placement of a two-foot thick low permeability cap constructed of clay material that would reduce the potential for human or ecological exposure to contaminated soils, reduce the potential migration of contaminants via surface water, and reduce infiltration potential thereby reducing the potential for contaminant migration to groundwater. The specific coverage area for the cap is best established after a risk assessment for the Site is completed and specific risk-based cleanup goals for the PCBs and metals are established.

The cap discussed in 40 CFR Part 761 describes the use of asphalt or concrete as a capping material. This Site; however, is subject to a CERCLA Unilateral Administrative Order, which relegates the requirements of the TSCA regulations as regulatory guidance but not mandatory requirements with the force of law. The two-foot clay cap discussed in the previous section fulfills the performance criteria of a TSCA cap which is designed “to prevent or minimize human exposure, infiltration of water, and erosion.” See, 40 CFR § 761.61(a) (7). Institutional controls such as the existing fencing, land use controls (industrial usage only) and cap maintenance would be easily implemented and maintained.

The cost to implement this remedial option is estimated to range from approximately \$4,000,000 to \$7,400,000 based on the target PCB concentration required to be capped. A summary of the costs and assumptions are presented in **Appendix F** which presents the costs to cap soils with PCB concentrations greater than 1 mg/kg, 5 mg/kg and 10 mg/kg. The soils with lead

concentrations greater than 1,000 mg/kg are also to be capped under all three capping scenarios.¹

5.1.2 Excavation of PCB Concentration > 100 mg/kg, Off-site Disposal, and Capping

This scenario would include the excavation and off-site disposal of soils with lead concentrations greater than 1,000 mg/kg and PCB concentrations greater than 100 mg/kg consistent with the PCB cleanup levels in 40 CFR 761.61(a)(4)(A). This TSCA regulation provides that for low occupancy areas such as this Site, “Bulk PCB remediation wastes may remain at a cleanup site at concentrations >25 ppm and ≤100 ppm if the site is covered with a cap meeting the requirements of paragraphs (a) (7) and (a) (8) of this section”. Additional capping may also be placed in areas where metals concentrations justify such action based on the results of the subsequent risk assessment for the Site.

Off-site disposal of the PCB contaminated soils with PCB concentrations greater than 100 mg/kg requires disposal at a TSCA facility because these soils exceed the 50 mg/kg limit for disposal in a RCRA Subtitle D facility. We also anticipate that the lead in the soils selected for off-site disposal would exceed the 5 mg/L TCLP analysis limit thus classifying it as a RCRA Subtitle C hazardous waste and necessitating its disposal at a TSCA or RCRA hazardous waste treatment, storage or disposal permitted facility. Institutional controls, including the existing fencing, land use controls (industrial usage only), restrictions on ground water use, and cap maintenance are appropriate and would be implemented.

The cost to implement this second remedial option is estimated at approximately \$21,470,000 based on a target PCB removal concentration of 100 mg/kg and target lead removal concentration of 1,000 mg/kg. A summary of the costs and assumptions are presented in **Appendix F**. The remaining soils throughout other areas of the site with PCB concentrations greater than 10 mg/kg would be capped under this scenario.

5.1.3 Excavation to PCB Concentration of 25 mg/kg and Off-site Disposal and Capping

This scenario would include the excavation and off-site disposal of soils with lead concentrations greater than 1,000 mg/kg and PCB concentrations greater than 25 mg/kg applying the PCB cleanup levels in 40 CFR 761.61(a)(4)(A) for high occupancy areas.² Additional capping may also be placed in areas where the PCB concentrations are less than 25

¹ These figures are preliminary and hopefully conservative cost estimates generated merely to provide a good faith cost comparison between the various remediation options. Actual costs may be higher or lower depending upon the costs of materials and labor at the time the work is performed.

² We do not believe this Site qualifies as a “high occupancy” area under the regulation; however, we have included this scenario so the reader will have a picture of the costs and relative effectiveness of a various options to compare.

mg/kg and in locations where the metals concentrations justify the remedy based on the results of the risk assessment for the Site.

Off-site disposal would include a TSCA facility for soils with PCB concentrations greater than the 50 mg/kg, a RCRA Subtitle D facility for soils with PCB concentrations less than 50 mg/kg, and a RCRA Subtitle C facility based on the lead concentrations which would be expected to exceed the 5 mg/L RCRA hazardous waste limit for some soils. Institutional controls such as the existing fencing, land use controls (industrial usage only), restrictions on ground water use, and cap maintenance are appropriate and would be implemented.

The cost to implement this remedial option has been estimated at approximately \$25,530,000 based on a target PCB removal concentration of 25 mg/kg and target lead removal concentration of 1,000 mg/kg. A summary of the costs and assumptions are presented in **Appendix F**. The remaining soils throughout other areas of the site with PCB concentrations greater than 10 mg/kg would be capped under this scenario.

5.2 Potential Site Remedy Summary

As discussed above, site remedies are probably limited to capping of materials or removal and off-site disposal. Although these costs for the potential remedial alternatives are preliminary, the costs associated with the soil removal options are considerably more expensive (in the range of 3 to 10 times more based on the target PCB and lead remediation goals) than the capping scenarios. We believe that all of the scenarios will achieve virtually the same level of risk reduction and protection of public health and the environment at the Site. Accordingly, we recommend selection of the first option, which is the least expensive. An example of an EPA approved remedy involving the capping of PCB-contaminated soil follows:

NEAL'S LANDFILL (BLOOMINGTON) **EPA ID# IND980614556**

The Neal's Landfill site occupies nearly 18 acres of property, approximately three miles west of Bloomington, Indiana. The landfill accepted industrial and municipal wastes from 1949 until 1972. Between approximately 1962 until 1970, Westinghouse Electric Corporation, now doing business as Viacom, dumped waste electrical equipment and parts, including electrical capacitors containing polychlorinated biphenyls (PCBs), PCB-contaminated capacitor insulation material, rags, and filter clay at the site. Several springs located at the foot of the landfill feed the Conard's Branch stream which had become contaminated with PCBs. Conard's Branch is tributary to Richland Creek.

On March 29, 1999, U.S. EPA signed a Record of Decision Amendment for Neal's Landfill which addresses the source of the contamination. The remedy consists of the following:

- Excavation and removal to an offsite, permitted landfill of selected areas of contamination (referred to as hot spots) greater than 500 parts per million PCBs.

- The current 18 acre landfill will be reduced to 10 acres by consolidation of excavated soils and materials, contaminated with less than 500 parts per million (ppm) PCBs. It was anticipated that through this consolidation the possibility of PCB material becoming wet and migrating from the site would be reduced and perhaps eliminated.

This decision illustrates that EPA does have flexibility regarding the implementation of PCB cleanups at concentrations higher than those specified as TSCA remediation goals referenced in 40 CFR Part 761 previously discussed. For this Site, utilizing the same strategy used at Neal's Landfill, only a few (6-10) grids with concentrations greater than 500 mg/kg would have to excavated and disposed off-site with the rest of the site capped. As noted in the decision above, soil consolidation of the PCB-contaminated soils remaining on-site would reduce the area of the Site to be capped. There have been several other similar sites where EPA and state regulators have allowed PCB concentrations up to 100 mg/kg to be left on-site with appropriate capping and land use controls. Accordingly we believe a similar remedy at this Site can be utilized effectively.

A summary of the nature and extent of contamination and site remedy assessment, conclusions, and recommendations is presented in the following sections.

6.1 Nature and Extent of Contamination Summary

6.1.1 Soils

PCB Aroclors

PCBs were detected over much of the Site in the surface soil samples; however, the highest concentrations were found in the central area of the Site extending to the eastern arm. The maximum concentration detected was 5,170 mg/kg. Samples collected in the western arm and the southeastern portion of the Site were almost all below 10 mg/kg PCBs in surface soil. A summary of PCB concentrations in surface soils is provided as follows:

- PCB concentrations greater than 1 mg/kg in surface soils extend over much of the Site with the highest concentrations (greater than 10 mg/kg) primarily located in the central portion extending to the eastern arm of the Site.
- PCB concentrations were typically less than 5 mg/kg in the western arm with only two out of x number of samples with detects above 10 mg/kg.
- The western portion of the Site had varying concentrations of PCBs with the bulk of the concentrations less than 10 mg/kg; however, sporadic PCB concentrations greater than 25 mg/kg are located in this area.
- The southwestern corner of the Site had varying concentrations of PCBs with the bulk of the concentrations less than 10 mg/kg; however, sporadic PCB concentrations greater than 20 mg/kg are located in this area.

A summary of PCB concentrations in subsurface soils is provided as follows:

- The highest PCB concentrations in subsurface soils are located in the central portion of the Site with concentrations consistently greater than 25 mg/kg.
- A few isolated PCB concentrations greater than 10 mg/kg were noted in the western and eastern arm portions of the Site with most concentrations in the non-detect to 5 mg/kg range.
- The bulk of the subsurface soil samples in the western arm were either non-detect or less than 1 mg/kg for PCBs with a few locations up to 8 mg/kg.

Metals

Arsenic, cadmium, chromium, lead, mercury, nickel, and silver were detected throughout the site. A brief summary of the extent of contamination associated with these metals is presented as follows:

Arsenic

Arsenic was detected in almost all soil samples collected at the Site. High concentrations of Arsenic are ubiquitous in the region where the Site is located. Concentrations at the Site ranged from non-detect to 380 mg/kg. Most arsenic concentrations exceeded the 1.6 mg/kg RSL for industrial soils.

Cadmium

Cadmium was detected in most soil samples collected at the Site. Concentrations ranged from non-detect to 370 mg/kg. Cadmium concentrations exceeded the 81 mg/kg RSL for industrial soils in 39 soil samples collected at the Site which is approximately 4 percent (39 of 915 samples) of the total number of samples collected. There were 27 surface soil and 12 subsurface soil samples with cadmium concentrations greater than the RSL of 81 mg/kg. The highest concentrations of cadmium were scattered throughout the site in several locations (eastern arm, eastern, and central portions) with approximately half of the RSL exceedences in the central portion of the Site.

Chromium

Chromium was detected in most soil samples collected at the Site. Concentrations ranged from non-detect to 31,000 mg/kg. Chromium concentrations exceeded the total chromium 1,400 mg/kg RSL for industrial soils in 39 soil samples collected at the Site which is approximately 4 percent (39 of 915 samples) of the total number of samples collected. There were 27 surface soil and 12 subsurface soil samples with chromium concentrations greater than the RSL of 1,400 mg/kg. The bulk of the RSL exceedences were observed in two locations at the Site; the central and western portions of the Site.

Lead

A large portion of the Site contained lead at concentrations greater than 1,200 mg/kg which is typically used as the industrial soil criteria. Almost all samples collected in the central area and extending into the eastern arm contained lead concentrations greater than 1,200 mg/kg. The maximum concentration detected was 76,000 mg/kg, but most of the high concentrations detected were in the range of 3,000 to 6,000 mg/kg.

The concentrations of lead in subsurface soil greater than 1,200 mg/kg were largely confined to the south-central area, with scattered samples reaching these concentrations in the western

area. The eastern side of the Site mostly contained lead concentrations less than 100 mg/kg in the deep soils.

Mercury

Mercury was detected in most soil samples collected at the Site. Concentrations ranged from non-detect to 110 mg/kg. Mercury concentrations exceeded the 31 mg/kg RSL for industrial soils in only five soil samples collected at the Site which is approximately 0.6 percent (5 of 915 samples) of the total number of samples collected. There were four surface soil and one subsurface soil sample with mercury concentrations greater than the RSL of 31 mg/kg. The highest concentrations of mercury were primarily located in the eastern and central portions of the Site.

Nickel

Nickel was detected in most soil samples collected at the Site. Concentrations ranged from non-detect to 28,000 mg/kg. Nickel concentrations exceeded the 2,000 mg/kg RSL for industrial soils in 30 soil samples collected at the Site which is approximately 3 percent (30 of 915 samples) of the total number of samples collected. There were 19 surface soil and 11 subsurface soil samples with nickel concentrations greater than the RSL of 2,000 mg/kg. The bulk of the RSL exceedences were observed in two locations at the Site; the central and western portions of the Site.

Silver

Silver was detected in over 50 percent of the soil samples collected at the Site. Concentrations ranged from non-detect to 960 mg/kg. Silver concentrations exceeded the 510 mg/kg RSL for industrial soils in only one soil sample collected at the Site which is approximately 0.1 percent (1 of 915 samples) of the total number of samples collected. There was no surface and only one subsurface soil sample with a silver concentration greater than the RSL of 510 mg/kg. The highest concentrations of silver were primarily located in the eastern arm, western portion, and central portions of the Site.

6.1.2 Sediment

PCB Homologue Results

PCBs were only detected in 3 of 36 sediment samples collected within Paradise Creek. These three samples contained PCBs exceeding the FSSB of 59.8 µg/kg. These samples included SD-4, SD-5, and SD-32 with concentrations of 75 µg/kg, 75 µg/kg, and 140 g/kg, respectively.

Metals Results

Metals were detected in all 36 sediment samples collected within Paradise Creek. Seven metals were detected above screening criteria. The following table provides a summary of metals detections:

Metal	Samples exceeding screening criteria	Concentration Range (mg/kg)	Median Concentration	FSSB (mg/kg)
Arsenic	All samples except SD-2	11 to 21	14	9.8
Cadmium	All samples	1.0 to 2.7	2.2	0.99
Chromium	All samples	88 to 1,400	120	43.4
Nickel	All samples	45 to 540	63	22.7
Lead	All samples	110 to 450	180	35.8
Mercury	All samples except SD-1	0.083 to 1.8	0.78	0.2
Silver	SD-1	0.30 to 3.0	0.80	1.0

Metals exceedances were found throughout the area sampled with no discernable pattern of distribution. Because there has not been a background study conducted for sediments within Paradise Creek, it is uncertain if the presence of the metals is related to runoff from the Site, from another source located within the Paradise Creek watershed, or represents background soil concentrations for this area.

6.1.3 Groundwater

A summary of the groundwater analytical results is presented as follows:

- PCBs were detected in three wells at a concentration range of 0.007 to 0.19 µg/L in the southwestern corner of the site but at concentrations far below their MCL of 0.50 µg/L established for drinking water.
- The total metals detected above EPA screening criteria (RSLs and MCLs) were total arsenic in MW-1R, MW-4, MW-5, MW-6, MW-7, and MW-9, total nickel in MW-2, total lead in MW-7, and total mercury in MW-7 and MW-10.
- The dissolved metals detected above EPA screening criteria (RSLs and MCLs) were dissolved arsenic in MW-1R, MW-4, MW-5, MW-6, MW-9, and MW-10 and dissolved nickel in MW-2. MCL exceedences were limited to dissolved arsenic in four wells (MW-1R, MW-4, MW-5, and MW-6) and dissolved nickel in one well, MW-2.

No PCBs, dissolved chromium, lead, and mercury were detected above EPA drinking water standards while dissolved nickel was only found in one well on-site above its RSL (no MCL has been developed) and dissolved arsenic was detected in 4 of 8 site wells above its MCL. Based on the Site groundwater data, the following conclusions are presented:

- Because there have been minimal exceedences of drinking water standards and all adjacent properties are on public water supply (source of the public water are lakes and groundwater in a neighboring municipality which are not impacted by Site groundwater), there does not appear to be any potential human receptors that would be impacted by Site groundwater. All PCB samples are well below drinking water standards, which reduces any concern for bioaccumulation of PCBs in aquatic life.
- Impacts to aquatic receptors in the Elizabeth River or Paradise Creek are not anticipated due to the low concentrations of metals detected in Site groundwater. A comparison of the groundwater concentrations to the Virginia Surface Water Quality Standards for salt water yielded that only dissolved nickel in one well (MW-2) exceeded any of the standards. Due to continued attenuation in groundwater prior to potential discharge into the adjacent surface water bodies and the mixing that takes place in these bodies, impacts to aquatic receptors are not anticipated.

Based on the above conclusions and how the data relates to potential site remedies, a potential cap at the site would be an acceptable remedy to further reduce metals leaching to Site groundwater and also reduce off-site migration potential.

6.2 Site Remedy Summary

As discussed in Section 5, Site remedies are expected to be limited to capping or removal and off-site disposal. Although the costing of the potential remedial alternatives is preliminary based on the data collected to date and certain assumptions made concerning site conditions, the costs associated with the soil removal options are considerably more expensive (in the range of 3 to 10 times more based on the target PCB and lead remediation goals) than the capping scenarios even though it is expected that all of the scenarios will achieve the approximately same level of risk reduction at the site.

As presented in Section 5.2, the Neal's Landfill decision illustrates that EPA does have flexibility regarding the implementation of PCB cleanups at concentrations higher than those specified as TSCA remediation goals referenced in 40 CFR Part 761 previously discussed. For this Site, utilizing the same strategy used at Neal's Landfill, only a few (6-10) grids with concentrations greater than 500 mg/kg would have to be excavated and disposed off-site with the rest of the site capped. As noted in the decision above, soil consolidation of the PCB-contaminated soils remaining on-site would reduce the area of the Site to be capped. There have been several other similar sites where EPA and state regulators have allowed PCB concentrations up to 100

mg/kg to be left on-site with appropriate capping and land use controls. Accordingly we believe a similar remedy at this Site can be utilized effectively.

6.3 Conclusions

PCBs and metals were detected throughout the Site in soils, sediments, and groundwater; however, unacceptable impacts appear to be limited to Site soils. PCB and metals exceeded industrial RSLs throughout the site with the highest concentrations noted in the central portion of the Site.

PCBs were only detected in 2 of 36 sediment samples and although metals were detected in sediment above screening criteria; their presence may not be related to Site runoff. Since PCBs were located throughout the site in the same locations as the metals and have higher sorption characteristics, their absence in Paradise Creek sediments indicates that there does not appear to be significant transport of contaminants from site soils to sediments through stormwater runoff. Due to the presence of numerous industrial facilities along Paradise Creek and the Elizabeth River, there could be numerous other sources of metals within this watershed.

Because there have been minimal exceedences of drinking water standards and all adjacent properties are on public water supply, there does not appear to be any potential human receptors that would be impacted by Site groundwater. Impacts to aquatic receptors in the Elizabeth River or Paradise Creek are not anticipated due to the low concentrations of metals detected in Site groundwater.

The capping scenario appears to be the most cost effective means of reducing potential human health and ecological risk to Site soils. It is a proven technology and has been utilized by EPA at other sites with varying cleanup goals of 50 to 500 mg/kg.