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Final

**Supplemental Site Investigation Report
for Site 19**

**St. Juliens Creek Annex
Chesapeake, Virginia**

Prepared for

**Department of the Navy
Naval Facilities Engineering Command
Mid-Atlantic**

Under the

**CLEAN III Program
Contract N62470-02-D-3052
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Prepared by



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Acronyms and Abbreviations

bgs	below ground surface
CLEAN	Comprehensive Long-Term Environmental Action – Navy
COPCs	constituents of potential concern
CTO	Contract Task Order
DPT	direct-push technology
DRMO	Defense Reutilization and Marketing Office
EE/CA	Engineering Evaluation/Cost Analysis
EPA	United States Environmental Protection Agency
ft	foot, feet
HHRS	human health risk screening
HRS	Hazard Ranking System
IAS	Initial Assessment Study
IR	Installation Restoration
MARMC	Mid-Atlantic Regional Maintenance Center
MEC	Munitions and Explosives of Concern
mg/kg	milligrams per kilogram
MS/MSD	matrix spike/matrix spike duplicate
NAPEC	Naval Ammunition Production Engineering Center
NAVFAC	Naval Facilities Engineering Command
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
QA/QC	quality assurance/quality control
RBC	risk-based concentration
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RI	Remedial Investigation
RRR	Relative Risk Ranking
SI	Site Investigation
SJCA	St. Juliens Creek Annex
SPAWAR	Space and Naval Warfare Systems Command
SSA	Site Screening Assessment
SSI	Supplemental Site Investigation
SVOC	semivolatile organic compound
TAL	Target Analyte List
TCL	Target Compound List

µg/kg	micrograms per kilogram
USDA	United States Department of Agriculture
UTL	upper tolerance limit
UXO	unexploded ordnance
VDEQ	Virginia Department of Environmental Quality
VOC	volatile organic compound

SECTION 1

Introduction

This Supplemental Site Investigation (SSI) report presents data, results, and conclusions of the investigations conducted at Site 19, St. Juliens Creek Annex (SJCA), Chesapeake, Virginia. A regional location map of SJCA and its surrounding area is provided as Figure 1-1; the location of Site 19 is shown on Figure 1-2.

This SSI was prepared under the United States Navy, Naval Facilities Engineering Command (NAVFAC) Mid-Atlantic, Comprehensive Long-Term Environmental Action Navy (CLEAN) III, Contract N62470-02-D-3052, Contract Task Order (CTO) 0014 for submittal to the SJCA Installation Restoration (IR) Partnering Team, which consists of representatives from NAVFAC, United States Environmental Protection Agency (EPA) Region III, and Virginia Department of Environmental Quality (VDEQ). The technical approach for the SSI was jointly scoped by the Partnering Team.

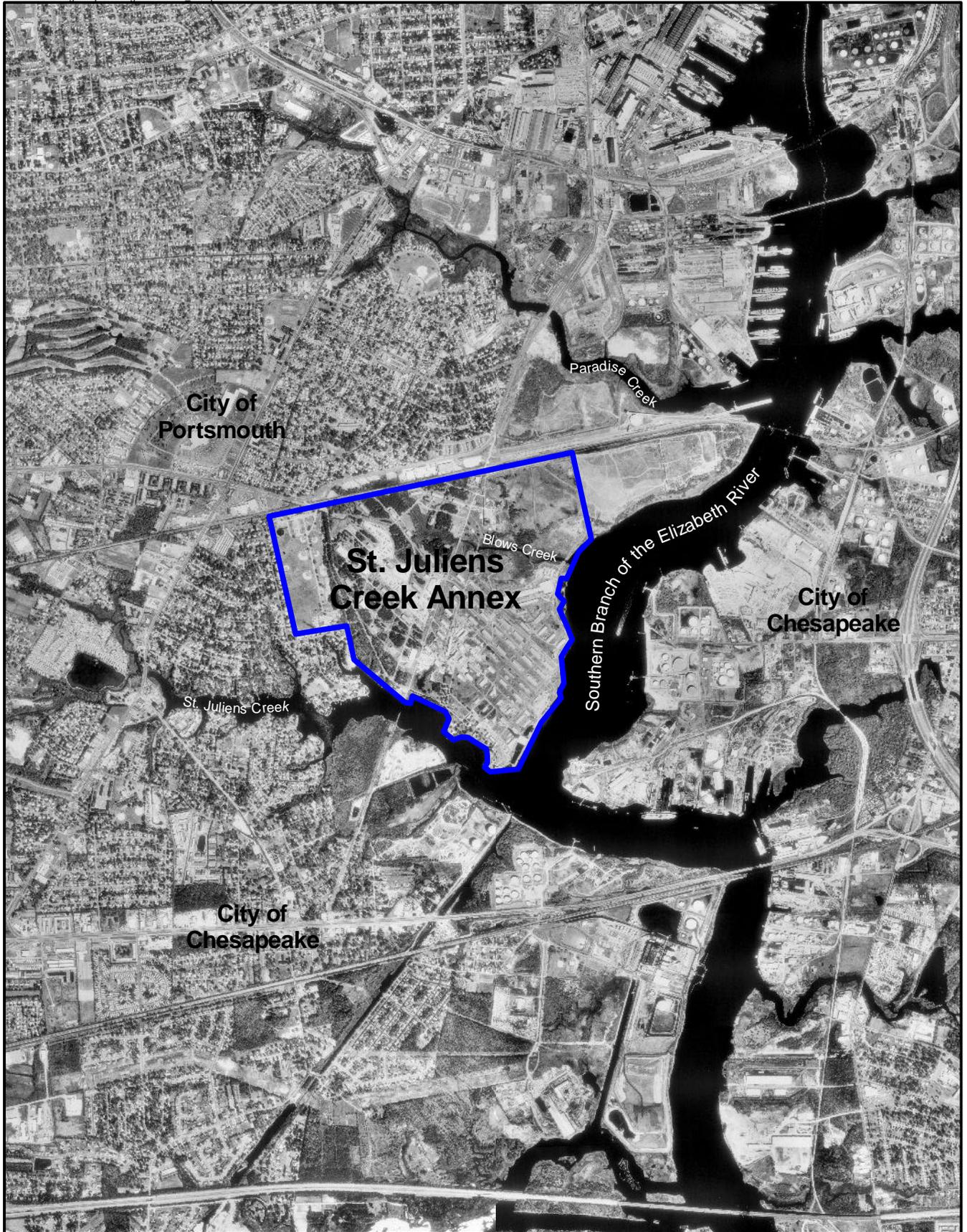
1.1 Objectives and Approach

Site 19 was initially investigated in 2004 and data presented in the *Final Site Investigation at Sites 8, 19, 21, and AOC 1* (CH2M HILL, June 2004). The Site Investigation (SI) recommended further investigation at Site 19 to determine if exposure to the surface and subsurface soil could result in unacceptable risks to human health. Specifically, the objectives of this SSI were to:

- Determine if polycyclic aromatic hydrocarbons (PAHs) detected in a surface soil sample collected from the gravel parking lot area are related to the site processes that occurred at Building 190
- Delineate the horizontal and vertical extent of PAHs detected in subsurface soil for potential removal and assess the potential impact to shallow (Columbia Aquifer) groundwater
- Delineate the horizontal and vertical extent of a metallic slag area for potential removal

1.2 Report Organization

The description and history of SJCA and Site 19 are presented in Section 2. Section 3 describes field sampling techniques and data management. Results of the SSI investigation are presented in Section 4. Conclusions and recommendations are provided in Section 5. References are listed in Section 6. Figures and tables are located at the end of each respective section; Appendix A is located at the end of the report.



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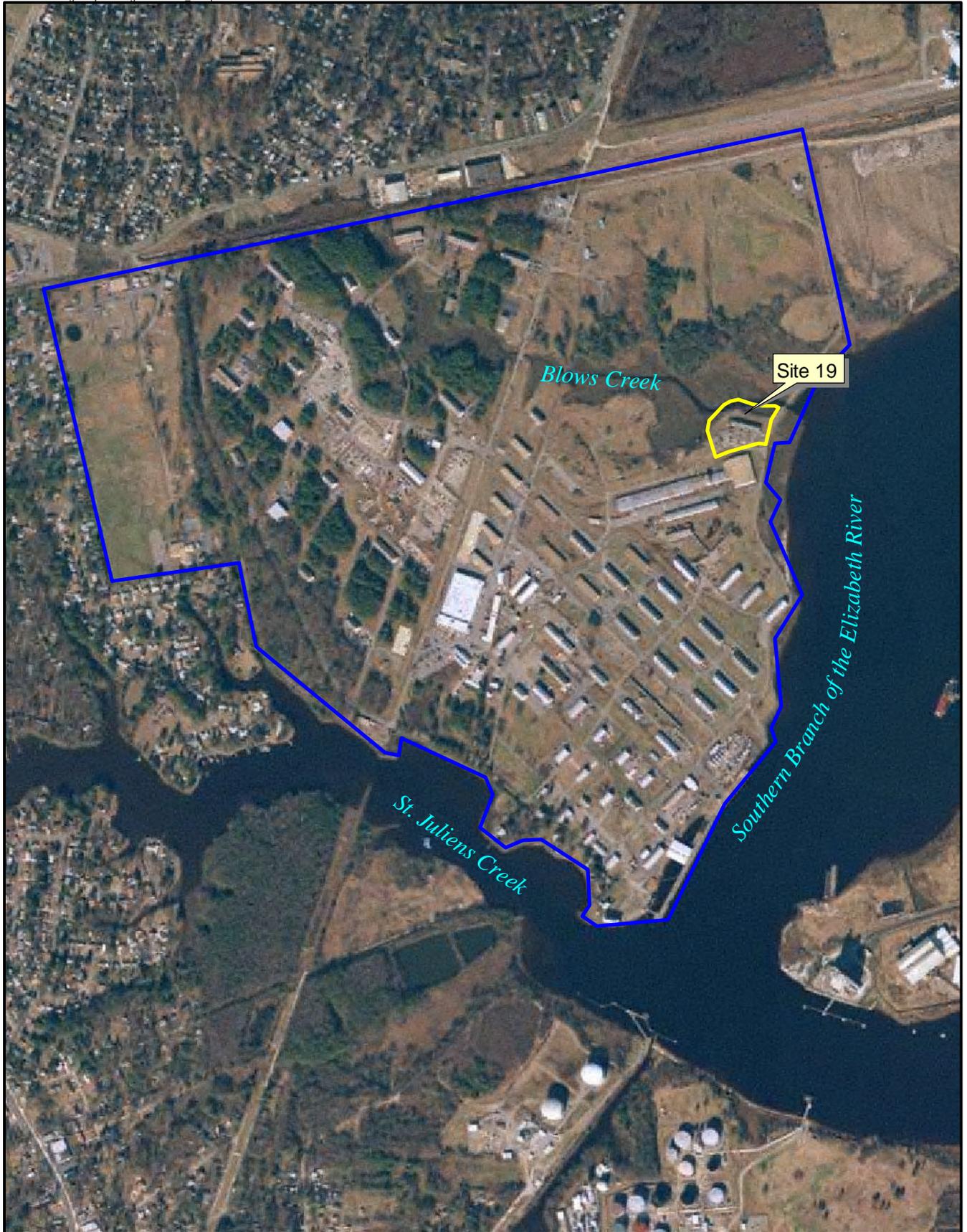
 St. Juliens Creek Annex



0 2500 5000 Feet



Figure 1-1
Location of St. Juliens Creek Annex
St. Juliens Creek Annex
Chesapeake, Virginia



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-  Site Location
-  Facility Boundary

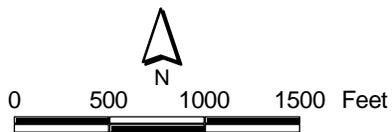


Figure 1-2
Location of Site 19
St. Juliens Creek Annex
Chesapeake, Virginia

SJCA and Site 19 Description and History

2.1 SJCA Description and History

St. Juliens Creek Annex is a 490-acre facility situated at the confluence of St. Juliens Creek and the Southern Branch of the Elizabeth River in the City of Chesapeake, in southeastern Virginia (Figure 1-1). The facility is bordered to the north by the Norfolk and Western Railroad, the City of Portsmouth, and residential areas; to the west by residential areas; to the south by St. Juliens Creek; and to the east by the Southern Branch of the Elizabeth River. Most surrounding areas are developed and include residences, schools, recreational areas, and shipping facilities for several large industries.

St. Juliens Creek Annex began operations as a Naval facility in 1849. The Annex was one of the largest ammunition depots in the United States involving wartime transfer of ammunitions to various other Naval facilities. Specific ordnance operations and processes conducted at SJCA included stockpiling Explosive D (ammonium picrate or picrate acid) for use in projectiles, manufacturing MARK VI mines, assembling small caliber guns and ammunition, storing torpedoes, filling shells, and testing ordnance. In 1975, all ordnance operations were transferred to the Yorktown Naval Weapons Station. As a result, decontamination was performed in, around, and under ordnance-handling facilities at SJCA in 1977.

St. Juliens Creek Annex has also been involved in nonordnance operations, including degreasing, paint shops, machine shops, vehicle and locomotive maintenance shops, pest control shops, battery shops, print shops, electrical shops, boiler plant operations, wash rack operations, potable water storage, saltwater fire-protection systems, fire-fighter training operations, and oil and chemical storage.

Activity at SJCA has decreased in recent years and many of the aging structures are being demolished. The current primary mission of SJCA is to provide a radar-testing range and warehousing facilities for nearby Norfolk Naval Shipyard and other local Naval activities. St. Juliens Creek Annex also provides administrative offices, light industrial shops, and storage facilities for local naval tenant commands; including Defense Reutilization and Marketing Office (DRMO), Space and Naval Warfare Systems (SPAWAR), Mid-Atlantic Regional Maintenance Center (MARMC), and a cryogenics school.

2.2 Site 19 Description and History

Site 19 consists of former Building 190 and the surrounding area. Building 190 was located just south of the mouth of Blows Creek at the confluence of the Southern Branch of the Elizabeth River (Figure 1-2). The building was heavily used for loading explosives into ammunition. From the 1940s to the 1970s, Explosive D and Composition A-3 were reportedly used.

In mid-1977, all ordnance-handling buildings were decontaminated by flushing with chemical solutions and water. Prior to decontamination, Naval Ammunition Production Engineering Center (NAPEC) visually inspected the facilities and collected samples for chemical analysis to develop appropriate decontamination procedures for each building. At the conclusion of the decontamination process, NAPEC visually reinspected each building, collected samples for chemical analysis, and certified that the facilities were decontaminated. However, the level of decontamination was not specified and residues of ordnance may remain.

The 1989 Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA) reported that various ordnance items had been disposed of in the area between Building M-5 and Building 190 during past ordnance management activities (Figure 2-1). The area was noted to contain a variety of construction rubble and facility personnel reported no knowledge of residual contamination from ordnance management operations.

Building 190 was demolished sometime after 2000 and the site is now a grass-covered field. Two concrete drainage culverts remain on-site, leading underground from former Building 190 to the Southern Branch of the Elizabeth River (Figure 2-1).

2.3 Previous Investigations

Previous facility-wide investigations conducted at SJCA related to Site 19 are listed below. A more detailed description of these activities is located in the SI Report (CH2M HILL, June 2004).

- Initial Assessment Study (IAS) - NEESA, August 1981
- Phase II RFA - A.T. Kearney, March 1989
- Aerial Photographic Site Analysis - EPA, February 1995
- Hazard Ranking System (HRS) Documentation Record - Tetra Tech, January 2000
- Background Investigation - CH2M HILL, October 2000 and August 2004

A description on the site-specific investigations conducted at Site 19 is provided in the following subsections.

2.3.1 Relative Risk Ranking - CH2M HILL, April 1996

During the Relative Risk Ranking (RRR) study, two surface soil samples and one groundwater sample were collected by direct-push technology (DPT) from the area between Building 190 and Building M-5. The surface soil samples were collected from 0 to 1 feet (ft) below ground surface (bgs). All samples were analyzed for Target Compound List (TCL) volatile organic compounds (VOCs), TCL semivolatile organic compounds (SVOCs), TCL pesticides/polychlorinated biphenyls (PCBs), Target Analyte List (TAL) inorganics, cyanide, and nitramines (a subset of explosives). As these data were used for screening purposes only, no background or quality assurance/quality control (QA/QC) samples were collected and these data were not validated.

Organic constituents detected in surface soil included several PAHs (a subset of SVOCs) and pesticides/PCBs. Organic constituents detected in the groundwater sample included acetone and methylene chloride. Several inorganics were detected in both the surface soil

and groundwater samples. No nitramines were detected in the surface soil or groundwater samples. The RRR sample locations are shown on Figure 2-2.

2.3.2 Site Screening Assessment – CH2M HILL, April 2002

During the SSA, the analytical data collected at Site 19 during the RRR study were evaluated with respect to human health and ecological risk screening. The SSA recommended that groundwater be further evaluated to confirm or deny the presence of arsenic and methylene chloride at concentrations that pose a potential human health risk. Surface soil was also identified as a potential concern to human health based on inorganic concentrations and was also recommended for further evaluation.

The SJCA IR Partnering Team decided to conduct soil sampling and based on the results; determine if further investigation of groundwater is warranted. Additionally, based on a site visit in July 2001, concerns were identified regarding the two concrete drainage culverts leading from former Building 190 and discharging to the Southern Branch of the Elizabeth River (Figure 2-1), and sediment sampling was proposed at the outfall locations.

2.3.3 Site Investigation – CH2M HILL, June 2004

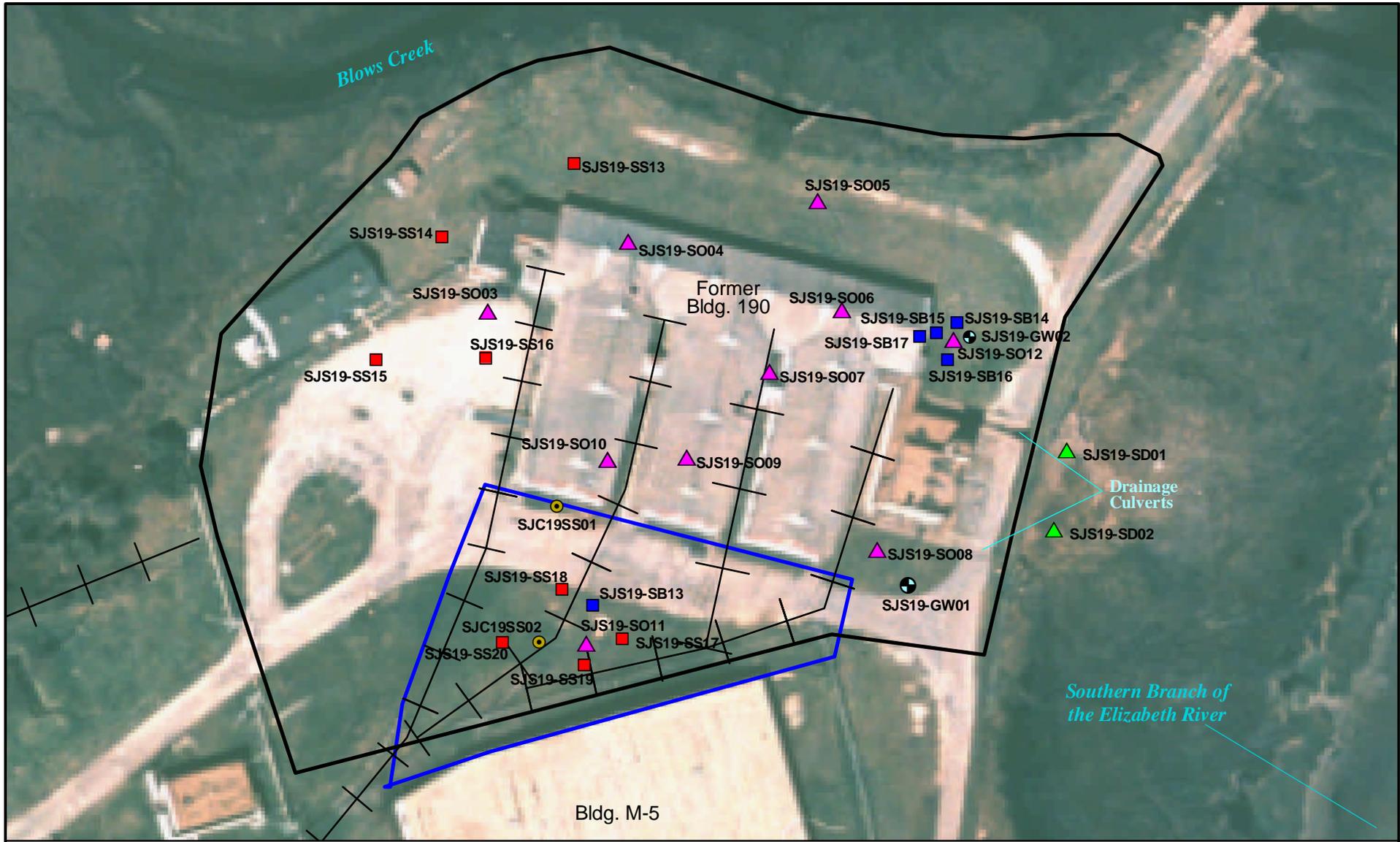
Based on the results of the SSA, an SI was completed at Site 19. Ten co-located surface and subsurface soil samples were collected by DPT and two sediment samples were collected by hand auger. Site Investigation sample locations were agreed upon by the SJCA IR Partnering Team to address data gaps from the previous investigations and collect data from within the new site boundary that encompasses the former Building 190 footprint. The two sediment samples were collected immediately downstream of the two stormwater drainage channels that discharge to the Southern Branch of the Elizabeth River. All samples were analyzed for TCL VOCs, TCL SVOCs, TCL pesticides/PCBs, TAL inorganics, cyanide, and explosives. The current site boundary and SI sample locations are shown on Figure 2-1.

Potential human health risks from PAHs and inorganics in soil were identified. The SI recommended further delineation of PAHs in surface soil in the former parking lot area (SJS19-SS03) and inorganics in surface soil adjacent to a metallic slag area (SJS19-SS11) to determine the potential impact to site soils. Groundwater sampling was also recommended to assess the potential impact of the elevated PAHs found in subsurface soil (SJS19-SB12).

Although the SSA concluded that groundwater should be further evaluated to confirm the presence of arsenic and methylene chloride, no further evaluation was deemed warranted based on the following:

- Detection of acetone and methylene chloride were from samples collected by DPT methods,
- Data were unvalidated,
- Methylene chloride is a common laboratory contaminant resulting in false positive detections, and
- There is no indication of elevated arsenic or methylene chloride in the site soils.

The compounds detected in Site 19 sediment were similar to those frequently detected in urban water bodies such as the Elizabeth River, and although these compounds may be in part related to historic site activities, the presence of these chemicals more likely reflects input from a variety of anthropogenic sources, therefore, no further evaluation of sediment was recommended.



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- ▲ SI Surface and Subsurface Soil Sample Locations
- ▲ SI Sediment Sample Locations
- SSI Surface Soil Sample Locations
- SSI Subsurface Soil Sample Locations
- SSI Groundwater Sample Location
- RRR Surface Soil Sample Locations

- ▭ Current Site Boundary
- ▭ Historical Site Boundary
- ++ Railroad

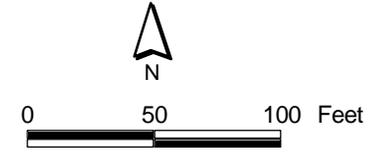


Figure 2-1
Site 19 Sample Locations
St. Juliens Creek Annex
Chesapeake, Virginia

Field Investigation Activities and Data Management

3.1 Field Investigation Activities

The SSI field activities were conducted in November 2004 and April 2005 and included the collection of surface soil and groundwater samples. All activities were conducted in accordance with the objectives defined in the *Final Work Plan, Supplemental Site Investigation of Sites 19 and 21* (CH2M HILL, August 2004). A summary of the samples collected to-date at Site 19, including the SSI samples is provided in Table 3-1 and the sample locations are shown on Figure 2-1.

Quality assurance/quality control sampling was performed in accordance with the EPA and VDEQ approved work plan (CH2M HILL, August 2004), and Navy CLEAN and CH2M HILL protocol, including field blanks, equipment blanks, duplicates, and matrix spike/matrix spike duplicates (MS/MSD).

3.1.1 Soil Sampling

In November 2004, four surface soil samples were collected in the vicinity of SI sample SJS19-SS03 to determine if PAHs near the parking lot are related to site activities or may be related to vehicular use. Two samples were collected from the parking lot area and two samples were collected from outside the parking lot area (Figure 3-1). These samples were collected from 0 to 0.5 ft bgs and analyzed for TCL PAHs.

Also in November 2004, four surface soil samples were collected from 0 to 0.5 ft bgs to delineate the horizontal extent of the metallic slag area for removal. To delineate the vertical extent of potential removal, one subsurface soil sample was collected from 14 to 16 inches bgs, which is below the extent of the metallic slag. The metallic slag is located near previous sample SJS19-SS11 where elevated inorganics were found to pose a potential risk to human health (Figure 3-1). The samples were analyzed for TAL inorganics.

In April 2005, four subsurface soil samples were collected in the vicinity of SI sample SJS19-SB12 to delineate the horizontal and vertical extent of elevated PAHs for potential removal (Figure 3-1). To delineate the horizontal extent, three subsurface soil samples were collected from 1 to 3 ft bgs. To delineate the vertical extent of potential removal, one subsurface soil sample was collected from 4 to 6 ft bgs, which is below SJS19-SB12 which was collected from 1 to 3 ft bgs. The samples were analyzed for TCL PAHs.

Prior to sampling, each location was cleared by unexploded ordnance (UXO) avoidance personnel. Although, abundant construction rubble was present, and some scrap metal was identified, no contacts related to Munitions and Explosives of Concern (MEC) were encountered. The soil samples were collected by DPT in disposable acetate sleeves. The soil samples were collected with a decontaminated stainless-steel trowel, placed in a

decontaminated stainless steel bowl, homogenized, and placed in pre-approved sample containers.

3.1.2 Groundwater Sampling

In November 2004, one groundwater sample was collected in the vicinity of the SI subsurface soil sample SJS19-SB12 to assess the potential impact of elevated PAHs to shallow (Columbia Aquifer) groundwater (Figure 3-1).

The sample was collected by DPT through a decontaminated stainless steel screen using a peristaltic pump and placed in a pre-approved sample container. The sample was collected from 10 to 14 ft bgs and was analyzed for TCL PAHs.

3.2 Data Management

Data management and tracking, from the time of field collection to receipt of validated electronic analytical results, is of primary importance and reflects the overall quality of the analytical results. Field samples and their corresponding analytical tests were recorded on executed chain-of-custody forms, which were submitted with the samples to the laboratory. Chain-of-custody entries were checked against the site-specific project instructions and SSI Work Plan (CH2M HILL, August 2004) to verify that all designated field samples were collected and submitted for the appropriate analysis. Upon receipt of the samples by the laboratories (CompuChem and GPL), a comparison to the field information was made to verify that each sample was analyzed for the correct parameters. In addition, a check was made to ensure that the proper number and types of QA/QC samples were collected.

Analytical data reports, in hardcopy and electronic format were submitted to Navy-approved third party data validators (E-Data, Inc. and DataQual Environmental Services, LLC). Procedures used for validation were *Region III Modifications to the National Functional Guidelines for Organic Data Review, Multi-media, Multi-concentration* (EPA, 1994), and *Region III Modifications to Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analysis* (EPA, 1993). The electronic data were downloaded into the CH2M HILL master Oracle database and are provided in Appendix A.

The data validation qualifiers, or flags, used for the SSI data include:

- Data qualified with a “B” flag by the data validator indicate that the analytes have also been detected in a field, equipment, or trip blank, or in a laboratory QA/QC sample. The concentration of a “B”-qualified result is less than 10 times the concentration of the constituent for an associated QA/QC result. If the sample concentration is less than ten times the associated blank concentration, the conclusion is that the parameter was not detected. Section 3.2.1 provides further discussion of potential sources of blank contamination.
- Data qualified with a “J” indicate that the analyte is present but the value is estimated.
- Data qualified with a “K” indicate that the analyte is present but the reported value may be biased high, the actual value is expected to be lower.

- Data qualified with an “L” indicate that the analyte is present but the reported value may be biased low, the actual value is expected to be higher.
- Data qualified with an “R” indicate an unusable result. The analyte may or may not be present and the result was rejected.
- Data qualified with a “U” indicate that the analyte was not detected and the associated value indicates the approximate sample concentration necessary to be detected.
- Data qualified with a “UJ” indicate that the analyte was not detected and the quantitation limit may be inaccurate or imprecise.
- Data qualified with a “UL” indicate that the analyte was not detected and the quantitation limit is probably higher.

3.2.1 Potential Non-Site Related Analytical Results

Some of the organic (e.g., PAHs) and inorganic constituents (e.g., metals) detected in soil and/or groundwater from Site 19 may be attributed to non-site-related conditions or sources such as laboratory contaminants, anthropogenic non-site release sources, and naturally occurring (background) concentrations of constituents.

Laboratory and Sample Blank Contamination. In some instances, chemical compounds detected in samples may have been introduced during field sampling, transportation to the analytical laboratory, or during laboratory procedures. A variety of blank samples were analyzed and used in the QA process to determine which of the constituents may or may not be attributed to the field sample.

A field blank is collected to account for ambient conditions during sample collection. An equipment or rinseate blank is collected to determine if the equipment used to collect the samples (e.g. augers, bailers, and sample containers) was adequately clean. Additionally, the laboratory analyzes a method blank in each batch of 20 samples to verify instrument cleanliness and function. Common phthalate compounds can be introduced during the analytical process and are often considered laboratory contaminants.

When blank samples are found to contain common laboratory contaminants, each of the aqueous field samples associated with that blank that contain up to 10 times the concentrations in the blanks are qualified during data validation with a “B” for that compound. A “B” qualifier means that the compound may not be attributed to the site at that sample location. When a sampling or laboratory blank contains contaminants other than the common laboratory contaminants, each of the aqueous field samples associated with that blank that contain up to 5 times the concentrations is qualified during data validation with a “B” for that compound.

To determine if a “B” qualifier should be assigned to a soil sample, a unit conversion is performed whereby soil sample concentrations relative to aqueous samples or laboratory blank concentrations are determined by dividing the soil concentration by the percentage of moisture, then dividing the result by five. A “B” qualifier designation, as described above for aqueous samples, can then be applied directly to the converted soil concentrations.

Background Data. To identify constituents present in site media reflective of a potential site-related release, naturally occurring and anthropogenic compounds (metals, pesticides, and PAHs) detected were compared to the soil background 95% upper tolerance levels (UTLs) established for SJCA.

The findings of the facility-wide background soil investigation were presented in the *Final Background Investigation Report* (CH2M HILL, October 2001). Based on mapping from the 1983 U.S. Department of Agriculture (USDA), the soil samples collected during this SSI were located in the Urban-Udorthents soil type. However, based on uncertainty in mapping, site topography, suspected dredge filling at the site, and comparable analytical data, the SJCA IR Partnering Team reached consensus to compare Site 19 soil data to UTLs for Dredge Fill soil.

Analytical Results

This section presents the analytical results of the soil and groundwater samples collected during the Site 19 SSI and a brief comparison to the analytical results from the SI. The complete analytical results for the SSI are provided in Appendix A. The results are organized by the specific area investigated; the parking lot, metallic slag, and elevated PAHs in subsurface soil (Figure 3-1).

4.1 Parking Lot Area

During the SI, several PAHs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene) detected in surface soil sample SJS19-SS03 were identified as constituents of potential concern (COPCs) based on the human health risk screening (HHRS). The concentrations of these PAHs were also in exceedance of the background UTLs.

In order to determine if the PAHs detected in SI Sample SJS19-SS03, collected from the gravel parking area, are related to site activities or vehicular use, two surface soil samples were collected from the parking lot area and two surface soil samples were collected from outside the parking lot area during the SSI. The constituents detected at concentrations exceeding background UTLs and EPA Region III risk-based criteria (RBCs) for residential use (adjusted by 0.1 for noncarcinogens) are summarized on Table 4-1 and Figure 4-1.

Sixteen PAHs were detected in the surface soil samples collected during the SSI. Two PAHs (acenaphthylene and anthracene) exceeded the background UTLs at SJS19-SS16, collected from within the parking lot area; the concentrations however were below the RBCs. Only two PAHs (benzo(a)pyrene and dibenz(a,h)anthracene) exceeded the RBCs at SJS19-SS13 and/or SJS19-SS16 but the concentrations were below the background UTLs and were significantly lower than the concentrations detected at SJS19-SS03 during the SI. None of the SSI samples had PAH concentrations that exceeded both the RBC and background UTL.

Based on these results, the SJCA IR Partnering Team agreed the PAHs detected in surface soil sample SJS19-SS03 are not related based on historical use of the area as a parking lot, no identified CERCLA source, and potential historical dredge fill of the site. The SJCA IR Partnering Team agreed PAHs in soil do not reflect a CERCLA release from Site 19 and warrants risk management.

4.2 Metallic Slag Area

During the SI, cadmium and chromium, detected in surface soil sample SJS19-SS11, were identified as COPCs based on the HHRS. The concentrations of these metals were also in exceedance of the background UTLs.

SJS19-SS11 was collected from an area where metallic slag was identified on the ground surface. In order to delineate the horizontal and vertical extent of the metallic slag area for potential removal, four surface soil samples and one subsurface soil sample were collected. The surface soil samples were collected around the perimeter of the metallic slag. The subsurface soil sample was collected from beneath the extent of metallic slag.

The constituents detected at concentrations exceeding background UTLs and EPA Region III RBCs for residential use (adjusted by 0.1 for noncarcinogens) are summarized on Table 4-2 and Figure 4-2.

Twenty-four metals were detected in the surface and subsurface soil samples collected during the SSI. With the exception of SJS19-SS18, located adjacent to the roadway, the metals concentrations were lower than or similar to those detected in the initial sample SJS19-SS11. Several metals (antimony, barium, chromium, copper, iron, lead, manganese, nickel, silver, and zinc) exceeded the background UTLs at SJS19-SS18 and zinc exceeded the background UTL at SJS19-SS19. Antimony, arsenic, cadmium, chromium, copper, iron, lead, manganese, and vanadium also exceeded the RBCs at SJS19-SS18 and iron exceeded the RBC at all locations.

Cadmium was not detected during the background investigation; therefore, no UTL was established. Cadmium was detected in three of the four surface soil samples (0.36 J - 32.2 mg/kg) and the subsurface soil sample (0.11 J mg/kg) at concentrations lower than SJS19-SS11 (52.5 mg/kg). The highest concentration (32.2 mg/kg) detected during the SSI was from SJS19-SS18 and exceeded the RBC (7.8 mg/kg). Chromium was only detected above the background UTL (45 mg/kg) and RBC (23 mg/kg) at SJS19-SS18 (110 mg/kg) at a concentration lower than SJS19-SS11 (195 mg/kg).

Based on these results, it is recommended that the metallic slag area be removed to the horizontal extent of the surface soil sample locations, with the exception of SJS19-SS18 where the removal should extend to the adjacent roadway. The vertical extent of removal is recommended to 1.5 ft bgs, the depth of SJS19-SB13 or to the visual limits of the metallic slag.

4.3 Elevated Subsurface PAHs Area

During the SI, PAHs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene) detected in subsurface soil sample SJS19-SB12 were identified as COPCs based on the HHRS. The concentrations of these PAHs were also in exceedance of the background UTLs.

To delineate the horizontal and vertical extent of the PAHs for potential removal, four subsurface soil samples were collected. The subsurface soil samples were collected around the perimeter of and from a depth beneath SJS19-SB12. The constituents detected at concentrations exceeding background UTLs and EPA Region III RBCs for residential use (adjusted by 0.1 for noncarcinogens) are summarized on Table 4-3 and Figure 4-3.

Nineteen PAHs were detected in the subsurface soil samples collected during the SSI. The concentrations of all the PAHs detected during the SSI were significantly lower than the concentrations at SJS19-SB12. Six PAHs exceed the background UTLs at SJS19-SB16 and

SJS19-SB17, located south and west of SJS19-SB12, respectively. No PAHs were detected at SJS19-SB14, located north of SJS19-SB12, or SJS19-SB15, collected from 4 to 6 ft beneath SJS19-SB12. Although four PAHs exceed the RBCs, concentrations were below background UTLs, with the exception of benzo(a)anthracene (2,200 µg/kg) at SJS19-SB16 which was detected at a similar concentration as the UTL (2,027 µg/kg).

Additionally, one groundwater sample was collected to assess the potential impact of elevated PAHs to shallow (Columbia Aquifer) groundwater. No PAHs were detected (analytical data is included in Appendix A).

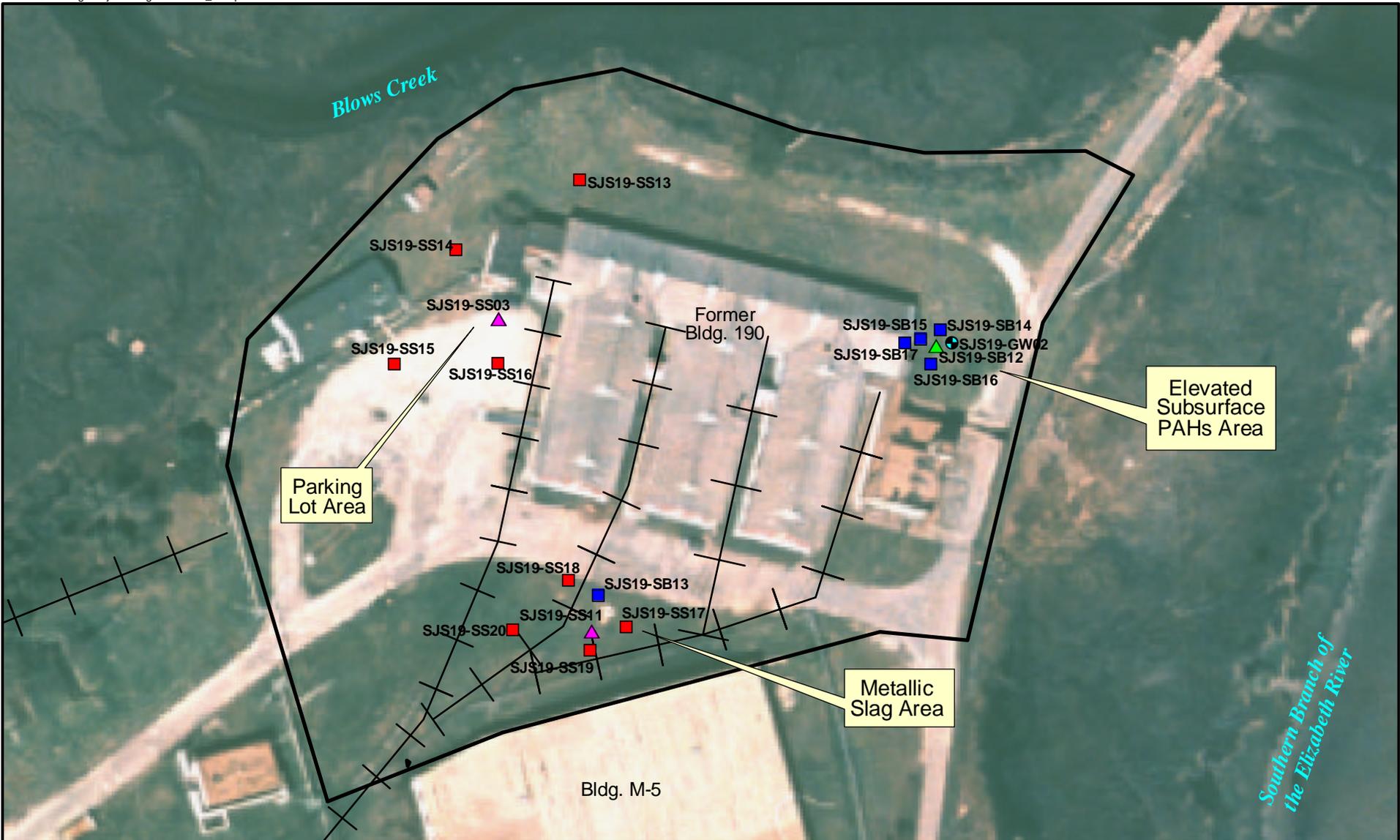
Based on these results, it is recommended that the elevated PAHs in subsurface soil be removed to the horizontal extent of the subsurface soil sample locations to the north, south, and west of SJS19-SB12 and to the east to the adjacent roadway. The vertical extent of removal is recommended to 4 ft bgs, the depth of SJS19-SB15.

**Table 3-1
Site 19 Sample Summary
Supplemental Site Investigation
St. Juliens Creek Annex Chesapeake, Virginia**

Number of Samples per Analysis							
Media	TCL VOCs	TCL SVOCs	TCL PAHs	TCL Pesticides/ PCBs	TAL Total Metals and Cyanide	TAL Dissolved Metals	Explosives
Relative Risk Ranking, April 1996							
Surface Soil (0-1' bgs)	2	2		2	2		2
Groundwater	1	1		1	1	1	1
Site Investigation, August 2003							
Sediment (0-0.5' bgs)	2	2		2	2		2
Surface Soil (0-0.5' bgs)	10	10		10	10		10
Subsurface Soil (1-3' bgs)	10	10		10	10		10
Supplemental Site Investigation, November 2004 and April 2005							
Surface Soil (0-0.5' bgs)			4		4		
Subsurface Soil (14-16" bgs)					1		
Subsurface Soil (1-3' bgs)			3				
Subsurface Soil (4-6' bgs)			1				
Groundwater			1				

Notes:

- bgs - below ground surface
- PAHs - polycyclic aromatic hydrocarbons
- PCBs - polychlorinated biphenyls
- SVOCs - semivolatile organic compounds
- TAL - Target Analyte List
- TCL - Target Compound List
- VOCs - volatile organic compounds



LEGEND

- ▲ SI Surface Soil Sample Location
- ▲ SI Subsurface Soil Sample Location
- SSI Surface Soil Sample Location
- SSI Subsurface Soil Sample Location
- SSI Groundwater Sample Location

- ++ Railroad
- Site Boundary

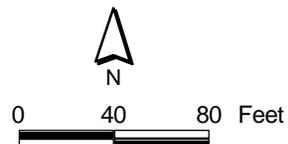


Figure 3-1
 Site 19 SSI Sample Locations
 and Areas of Investigation
 St. Juliens Creek Annex
 Chesapeake, Virginia

Table 4-1
Site 19 Parking Lot Area
Surface Soil Exceedances of Screening Criteria
Supplemental Site Investigation
St. Juliens Creek Annex
Chesapeake, Virginia

Station ID	Soil Residential Adjusted RBC	Surface Soil Dredge Fill Background UTL	SI Sample	SSI Samples				
			SJS19-SO03	SJS19-SS13	SJS19-SS14	SJS19-SS15	SJS19-SS16	
Sample ID			SJS19-SS03-00-03C	SJS19-SS13-00-04D ¹	SJS19-SS14-00-04D	SJS19-SS15-00-04D	SJS19-SS16-00-04D	
Sample Depth			0-0.5 ft bgs	0-0.5 ft bgs	0-0.5 ft bgs	0-0.5 ft bgs	0-0.5 ft bgs	
Sample Date			08/11/03	11/09/04	11/09/04	11/09/04	11/09/04	
Chemical Name								
Semivolatile Organic Compounds (UG/KG)								
2,4-Dinitrotoluene	16,000	--	210 J	NA	NA	NA	NA	
2-Methylnaphthalene	31,000	--	290 J	NA	NA	NA	NA	
Acenaphthene	470,000	592	390 J	10	7.4 U	7.1 U	52	
Acenaphthylene	160,000	246	4,600	18	15	54	800	
Acetophenone	780,000	--	220 J	NA	NA	NA	NA	
Anthracene	2,300,000	462	2,800	32	21	25	560	
Benzaldehyde	780,000	--	53 J	NA	NA	NA	NA	
Benzo(a)anthracene	870	2,027	4,000	100	51	38	660	
Benzo(a)pyrene	87	1,785	7,300	110	47	48	790	
Benzo(b)fluoranthene	870	3,197	5,500	140	72	67	860	
Benzo(g,h,i)perylene	230,000	1,655	2,500	48	34	39	350	
Benzo(k)fluoranthene	8,700	2,038	2,900	42	20	19	300	
Butylbenzylphthalate	340,000	--	160 J	NA	NA	NA	NA	
Carbazole	32,000	--	200 J	NA	NA	NA	NA	
Chrysene	87,000	3,487	4,000	110	52	40	620	
Di-n-octylphthalate	310,000	--	31 J	NA	NA	NA	NA	
Dibenz(a,h)anthracene	87	714	1,100	7.4 U	9.2	9.6	96	
Dibenzofuran	16,000	--	65 J	NA	NA	NA	NA	
Fluoranthene	310,000	2,766	7,700	180	93	56	840	
Fluorene	310,000	602	360 J	14	7.4 U	7.1 U	97	
Indeno(1,2,3-cd)pyrene	870	1,829	3,600	40	29	32	320	
Naphthalene	160,000	485	230 J	8.1	7.4 U	7.1 U	21	
Phenanthrene	230,000	913	710 J	140	40	14	360	
Pyrene	230,000	2,590	15,000	240	74	64	1,100	

Notes:

COPCs identified in HHRS conducted during the SI (CH2M HILL, June 2004)

Exceeds Background UTL

Exceeds RBC

¹ A duplicate was collected for this sample and the results provided are the maximum concentration between the sample and the duplicate.

-- No criteria available

NA - Not analyzed

J - Reported value is estimated

U - Not detected

**Table 4-2
Site 19 Metallic Slag Area
Surface and Subsurface Soil Exceedances of Screening Criteria
Supplemental Site Investigation
St. Juliens Creek Annex
Chesapeake, Virginia**

Station ID Sample ID Sample Depth Sample Date	Soil Residential Adjusted RBC	Surface Soil Dredge Fill Background UTL (0-0.5 ft bgs)	Subsurface Soil Dredge Fill Background UTL (1-3 ft bgs)	SI Samples		SSI Samples				
				SJS19-SO11		SJS19-SO13	SJS19-SS17	SJS19-SS18	SJS19-SS19	SJS19-SS20
				SJS19-SS11-00-03C	SJS19-SB11-03-03C	SJS19-SB13-04D	SJS19-SS17-00-04D	SJS19-SS18-00-04D ¹	SJS19-SS19-00-04D	SJS19-SS20-00-04D
				0-0.5 ft bgs	1-3 ft bgs	14-16 inches bgs	0-0.5 ft bgs	0-0.5 ft bgs	0-0.5 ft bgs	0-0.5 ft bgs
				08/13/03	08/13/03	11/12/04	11/09/04	11/09/04	11/09/04	11/09/04
Chemical Name										
Total Metals (MG/KG)										
Aluminum	7,800	22,786	18,839	2,860	6,310	5,310	6,520	4,240	3,900	4,830
Antimony	3.1	1.47	1.47	5.3 J	0.63 U	0.67 UL	1 L	7.1 L	0.72 UL	0.87 UL
Arsenic	0.43	24	14	5.5	2.1 J	0.54 U	3.6 B	15.6	1.8 B	2.1 B
Barium	550	98	50	241	30.5 J	12.5 J	24.1 J	264	26.7 J	19.7 J
Beryllium	16	1	0.81	0.1 B	0.13 B	0.15 J	0.22 B	0.5 J	0.19 B	0.17 B
Boron	1,600	--	--	NA	NA	0.77 B	1.8 B	4.6	1.1 B	1 B
Cadmium	7.8	ND	ND	52.5	1.7	0.11 J	0.36 J	32.2	2.7	0.11 B
Calcium	--	3,251	3,251	1,610	503 J	320 J	225 J	1,120	302 J	155 J
Chromium	23	45	39	195	14.6	5.9	12.3	110	6.6	6.9
Cobalt	160	13	13	4.3 J	1.2 J	0.59 J	1.3 L	6.4 J	0.83 L	0.75 L
Copper	310	58	40	1,780	98	8.8	27.2	1,570	17	8.6
Cyanide	160	ND	ND	8.1	0.59 B	0.16 U	0.22 U	0.18 U	0.19 U	0.18 U
Iron	2,300	45,805	36,585	34,200	7,220	2,970	5,870	55,100	3,330	3,030
Lead	400	147	86	885	28.8	4.9 K	34.7	497	36.1	14.4
Magnesium	--	4,507	3,847	422 J	705 J	430 J	669 J	1,180	396 J	456 J
Manganese	160	198	151	419	41.4	13 L	27	596	37.3	15
Mercury	2.3	1.3	0.62	0.18	0.044 U	0.016 U	0.034 J	0.27	0.035	0.021 J
Molybdenum	39	--	--	NA	NA	0.4 B	0.86 B	9.6	0.37 B	0.35 U
Nickel	160	19	15	25.1	5.6 J	2.6 J	4 J	51	2.9 B	2.7 B
Potassium	--	4,577	3,465	306 J	577 J	204 J	452 J	877	197 J	291 J
Selenium	39	2.2	1.5	0.71 U	0.72 U	0.53 U	0.58 U	1	0.56 U	0.68 U
Silver	39	0.67	0.67	1.3 J	0.29 U	0.19 U	0.2 UL	0.72 L	0.2 UL	0.24 UL
Sodium	--	620	203	184 J	289 J	68 J	219 L	195 L	214 L	150 L
Vanadium	7.8	70	42	8.4 J	15.8	7.3	14.3	17.1	6.8 J	8.9 J
Zinc	2,300	137	87	1,100	62.3	21.6	52.8	672	195	22.3

Notes:

COPCs identified in HHRS conducted during the SI (CH2M HILL, June 2004)

Exceeds Background UTL

Exceeds RBC

¹ A duplicate was collected for this sample and the results provided are the maximum concentration between the sample and the duplicate.

-- No criteria available

NA - Not analyzed

ND - Not detected

B - Blank contamination

J - Reported value is estimated

L - Reported value is biased low

U - Not detected

Table 4-3
Site 19 Elevated Subsurface PAHs Area
Subsurface Soil Exceedances of Screening Criteria
Supplemental Site Investigation
St. Juliens Creek Annex
Chesapeake, Virginia

Station ID	Soil Residential Adjusted RBC	Subsurface Soil Dredge Fill Background UTL (1-3 ft bgs)	SI Sample	SSI Samples				
			SJS19-SO12	SJS19-SO14	SJS19-SO15	SJS19-SO16	SJS19-SO17	
Sample ID			SJS19-SB12-03-03C ¹	SJS19-SB14-03-05B	SJS19-SB15-06-05B	SJS19-SB16-03-05B	SJS19-SB17-03-05B	
Sample Depth			1-3 ft bgs	1-3 ft bgs	4-6 ft bgs	1-3 ft bgs	1-3 ft bgs	
Sample Date			08/13/03	04/20/05	04/20/05	04/20/05	04/20/05	
Chemical Name								
Semivolatile Organic Compounds (UG/KG)								
1,1-Biphenyl	390,000	--	72 J	370 U	380 U	81 J	42 J	
2-Methylnaphthalene	31,000	--	320 J	370 U	380 U	190 J	150 J	
Acenaphthene	470,000	592	860	370 U	380 U	320 J	230 J	
Acenaphthylene	160,000	131	610 J	370 U	380 U	190 J	390 U	
Acetophenone	780,000	--	760 U	370 U	380 U	400 U	390 U	
Anthracene	2,300,000	462	2,000	370 U	380 U	720	390 J	
Benzaldehyde	780,000	--	79 J	370 UJ	380 UJ	400 UJ	390 UJ	
Benzo(a)anthracene	870	2,027	9,400	370 U	380 U	2,200	1,200 J	
Benzo(a)pyrene	87	1,785	9,400	370 U	380 U	1,700	890 J	
Benzo(b)fluoranthene	870	2,335	7,100	370 U	380 U	1,900	920 J	
Benzo(g,h,i)perylene	230,000	2,099	3,700	370 U	380 U	1,100	540 J	
Benzo(k)fluoranthene	8,700	2,038	2,100	370 U	380 U	880	310 J	
Carbazole	32,000	--	660 J	370 U	380 U	320 J	120 J	
Chrysene	87,000	3,487	12,000	370 U	380 U	2,200	1,100 J	
Di-n-octylphthalate	310,000	--	760 U	370 U	380 U	400 U	390 U	
Dibenz(a,h)anthracene	87	708	1,800	370 U	380 U	400 U	390 U	
Dibenzofuran	16,000	--	420 J	370 U	380 U	450	170 J	
Fluoranthene	310,000	2,766	19,000	370 U	380 U	4,300	1,800 J	
Fluorene	310,000	602	1,000	370 U	380 U	600	360 J	
Indeno(1,2,3-cd)pyrene	870	1,769	4,300	370 U	380 U	910	380 J	
Naphthalene	160,000	485	580 J	370 U	380 U	320 J	410 J	
Phenanthrene	230,000	913	15,000	370 U	380 U	4,700	2,500 J	
Pyrene	230,000	2,590	22,000	370 U	380 U	3,900	2,200 J	
n-Nitrosodiphenylamine	130,000	--	130 J	370 U	380 U	400 U	390 U	

Notes:

COPCs identified in HHRS conducted during the SI (CH2M HILL, June 2004)

Exceeds Background UTL

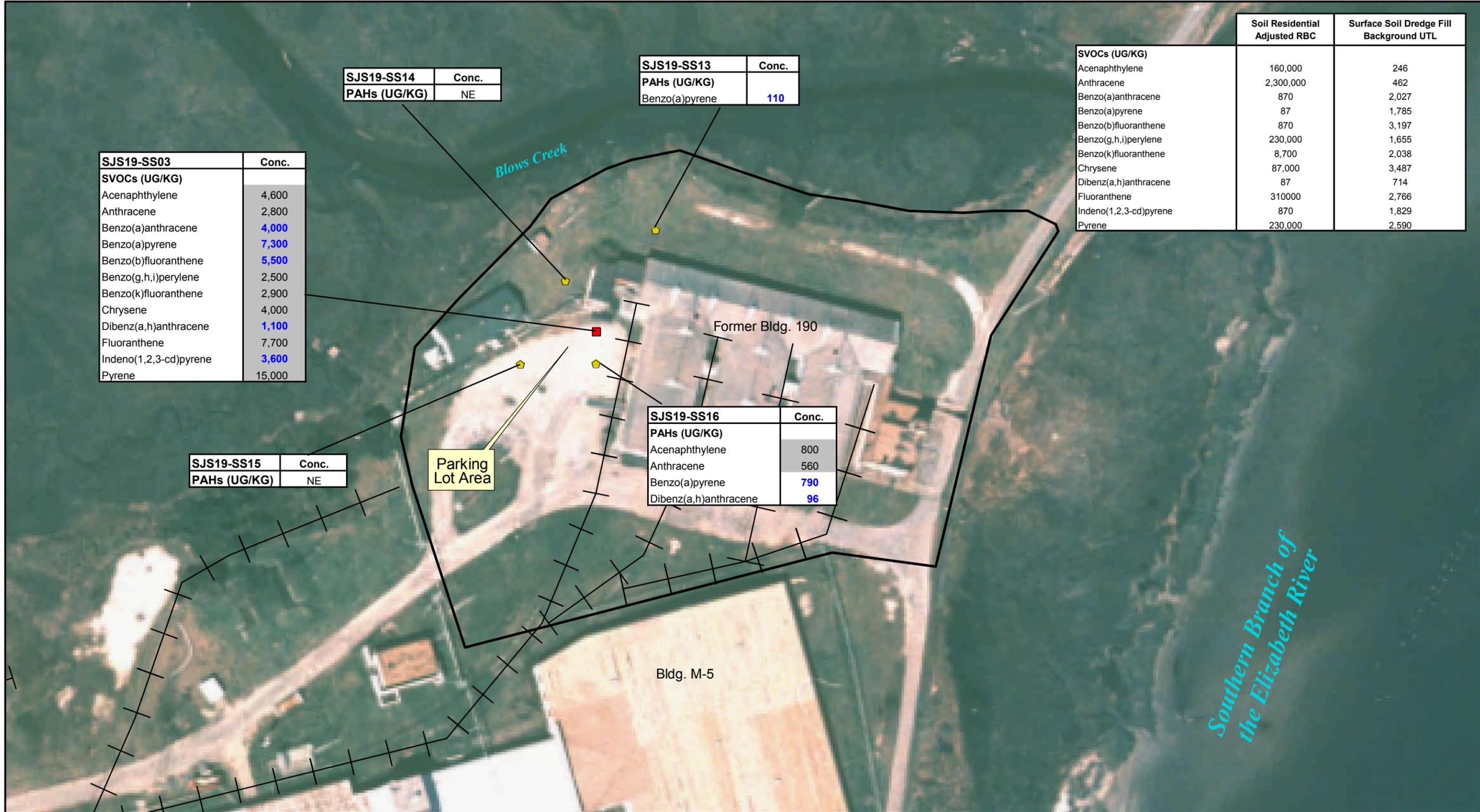
Exceeds RBC

¹ A duplicate was collected for this sample and the results provided are the maximum concentration between the sample and the duplicate.

-- No criteria available

J - Reported value is estimated

U - Not detected



LEGEND

- SI Surface Soil Sample Location
- ◆ SSI Surface Soil Sample Locations
- ++ Railroad
- ▭ Site Boundary

NE - compound not detected above screening criteria

Exceeds Background UTL
Exceeds RBC

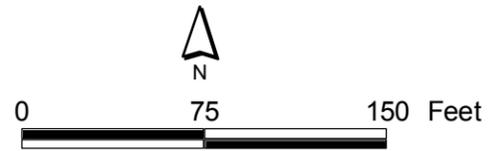


Figure 4-1
Site 19 Parking Lot Area
Surface Soil Exceedances of Screening Criteria
St. Juliens Creek Annex
Chesapeake, Virginia

	Soil Residential Adjusted RBC	Surface Soil Dredge Fill Background UTL	Subsurface Soil Dredge Fill Background UTL
Total Metals (MG/KG)			
Antimony	3.1	1.47	1.47
Arsenic	0.43	24	14
Barium	550	98	50
Cadmium	7.8	ND	ND
Chromium	23	45	39
Copper	310	58	40
Cyanide	160	ND	ND
Iron	2,300	45,805	36,585
Lead	400	147	86
Manganese	160	198	151
Nickel	160	19	15
Silver	39	0.67	0.67
Sodium	-	620	203
Vanadium	7.8	70	42
Zinc	2,300	137	87

SJS19-SS18	Conc.
Total Metals (MG/KG)	
Antimony	7.1 L
Arsenic	15.6
Barium	264
Cadmium	32.2
Chromium	110
Copper	1,570
Iron	55,100
Lead	497
Manganese	596
Nickel	51
Silver	0.72 L
Vanadium	17.1
Zinc	672

SJS19-SS20	Conc.
Total Metals (MG/KG)	
Iron	3,030
Vanadium	8.9 J

SJS19-SS11	Conc.
Total Metals (MG/KG)	
Antimony	5.3 J
Arsenic	5.5
Barium	241
Cadmium	52.5
Chromium	195
Copper	1,780
Cyanide	8.1
Iron	34,200
Lead	885
Manganese	419
Nickel	25.1
Silver	1.3 J
Vanadium	8.4 J
Zinc	1,100

SJS19-SB11	Conc.
Total Metals (MG/KG)	
Arsenic	2.1 J
Cadmium	1.7
Copper	98
Iron	7,220
Sodium	289 J
Vanadium	15.8

SJS19-SB13	Conc.
Total Metals (MG/KG)	
Cadmium	0.11 J
Iron	2,970

SJS19-SS17	Conc.
Total Metals (MG/KG)	
Cadmium	0.36 J
Iron	5,870
Vanadium	14.3

SJS19-SS19	Conc.
Total Metals (MG/KG)	
Cadmium	2.7
Iron	3,330
Zinc	195

LEGEND

- SI Surface and Subsurface Soil Sample Location
- SSI Surface Soil Sample Location
- ▲ SSI Subsurface Soil Sample Location
- ++ Railroad
- Site Boundary

L - reported value is biased low
 J - estimated value
 ND - not detected

Exceeds Background UTL
 Exceeds RBC

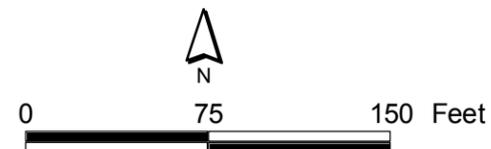


Figure 4-2
 Site 19 Metallic Slag Area
 Surface and Subsurface Soil Exceedances of Screening Criteria
 St. Juliens Creek Annex
 Chesapeake, Virginia

SVOCs (UG/KG)	Soil Residential Adjusted RBC	Subsurface Soil Dredge Fill Background UTL
Acenaphthene	470,000	592
Acenaphthylene	160,000	131
Anthracene	2,300,000	462
Benzo(a)anthracene	870	2,027
Benzo(a)pyrene	87	1,785
Benzo(b)fluoranthene	870	2,335
Benzo(g,h,i)perylene	230,000	2,099
Benzo(k)fluoranthene	8,700	2,038
Chrysene	87,000	3,487
Dibenz(a,h)anthracene	87	708
Fluoranthene	310,000	2,766
Fluorene	310,000	602
Indeno(1,2,3-cd)pyrene	870	1,769
Naphthalene	160,000	485
Phenanthrene	230,000	913
Pyrene	230,000	2,590

SJS19-SB17	
PAHs (UG/KG)	Conc.
Benzo(a)anthracene	1,200 J
Benzo(a)pyrene	890 J
Benzo(b)fluoranthene	920 J
Phenanthrene	2,500 J

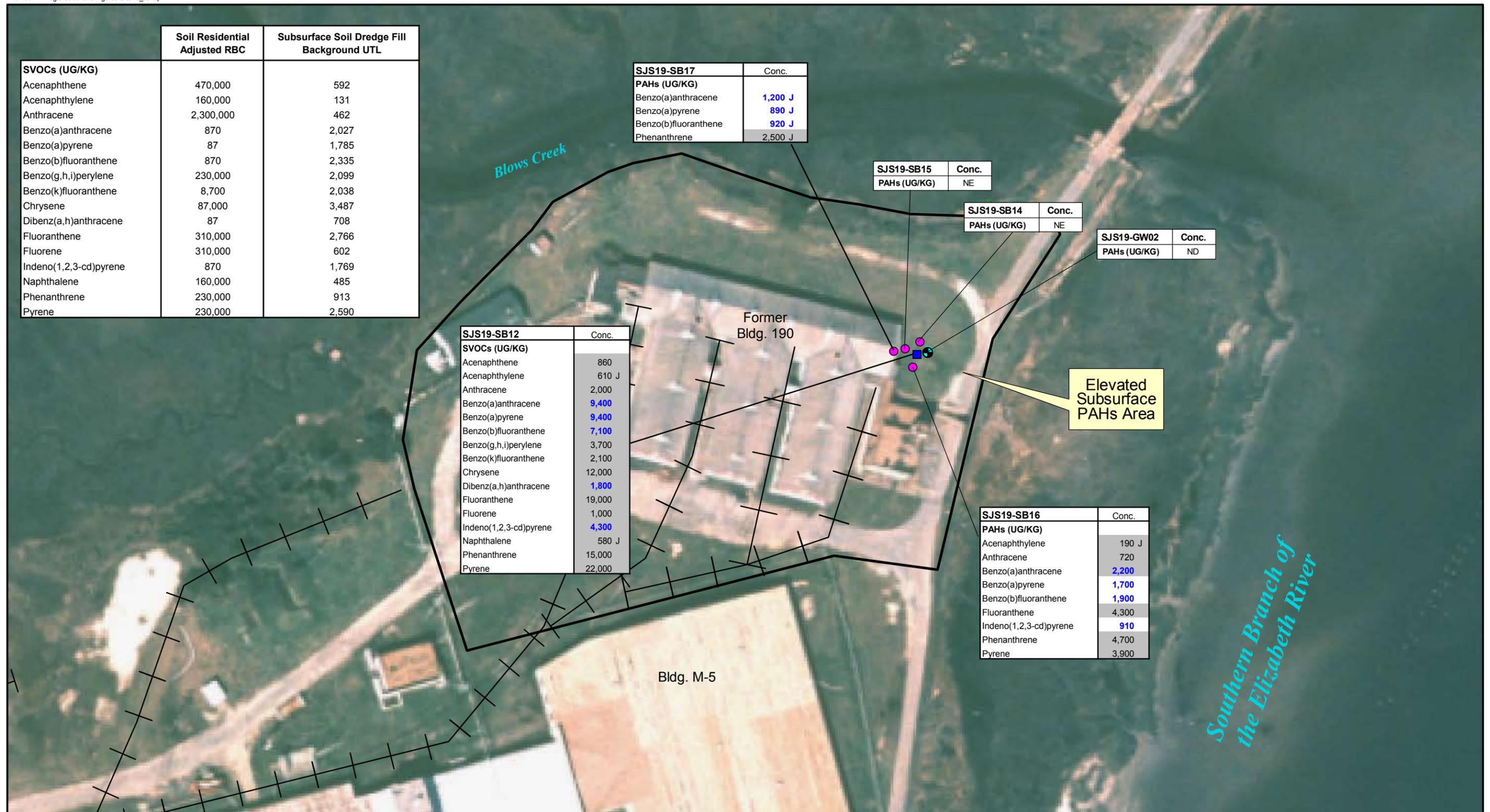
SJS19-SB15	
PAHs (UG/KG)	Conc.
PAHs (UG/KG)	NE

SJS19-SB14	
PAHs (UG/KG)	Conc.
PAHs (UG/KG)	NE

SJS19-GW02	
PAHs (UG/KG)	Conc.
PAHs (UG/KG)	ND

SJS19-SB12	
SVOCs (UG/KG)	Conc.
Acenaphthene	860
Acenaphthylene	610 J
Anthracene	2,000
Benzo(a)anthracene	9,400
Benzo(a)pyrene	9,400
Benzo(b)fluoranthene	7,100
Benzo(g,h,i)perylene	3,700
Benzo(k)fluoranthene	2,100
Chrysene	12,000
Dibenz(a,h)anthracene	1,800
Fluoranthene	19,000
Fluorene	1,000
Indeno(1,2,3-cd)pyrene	4,300
Naphthalene	580 J
Phenanthrene	15,000
Pyrene	22,000

SJS19-SB16	
PAHs (UG/KG)	Conc.
Acenaphthylene	190 J
Anthracene	720
Benzo(a)anthracene	2,200
Benzo(a)pyrene	1,700
Benzo(b)fluoranthene	1,900
Fluoranthene	4,300
Indeno(1,2,3-cd)pyrene	910
Phenanthrene	4,700
Pyrene	3,900



LEGEND

- SI Subsurface Soil Sample Location
- SSI Subsurface Soil Sample Locations
- ++ Railroad
- Site Boundary

- J - estimated value
- NE - compound detected but not above screening criteria
- ND - not detected

Exceeds Background UTL
Exceeds RBC

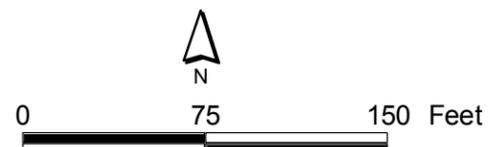


Figure 4-3
Site 19 Elevated Subsurface PAHs Area
Subsurface Soil Exceedances of Screening Criteria
St. Juliens Creek Annex
Chesapeake, Virginia

Conclusions and Recommendations

5.1 Parking Lot Area

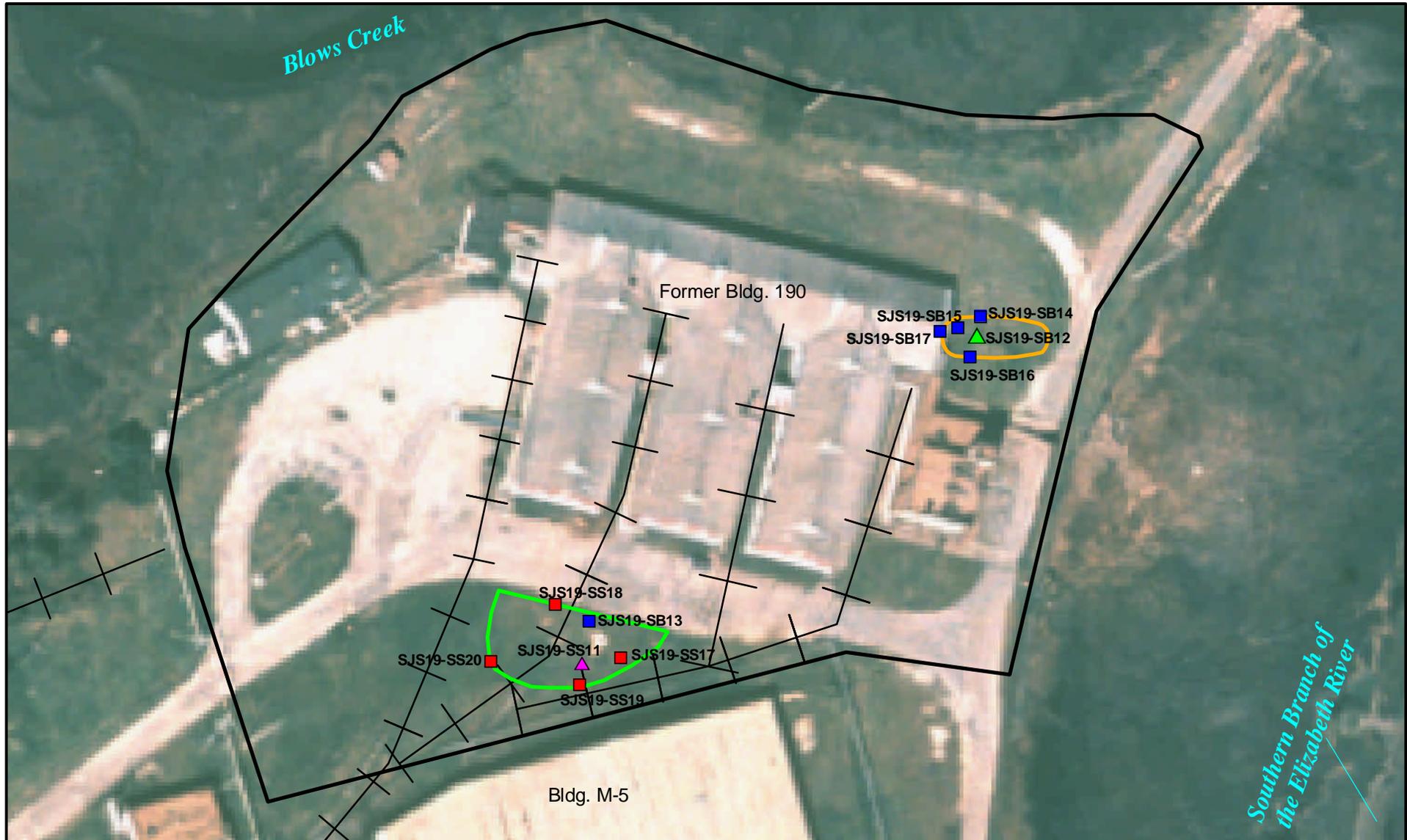
Surface soils were collected during the SSI to determine if the PAHs detected in surface soil during the SI sampling are related to site activities or vehicular use. Based on the SSI results, presented in Section 4.1, the SJCA IR Partnering Team agreed PAHs in soil do not reflect a CERCLA release from Site 19 and potential soil risk is acceptable.

5.2 Metallic Slag Area

Surface and subsurface soil samples were collected during the SSI to delineate the horizontal and vertical extent of the metallic slag area for potential removal. Based on the SSI results, presented in Section 4.2, it is recommended that these samples serve as pre-confirmation samples to define the extent of removal. An Engineering Estimate/Cost Analysis (EE/CA) is recommended for removal of the metallic slag and the surrounding soil, encompassing approximately 2,866 ft². Figure 5-1 presents the proposed removal area.

5.3 Elevated Subsurface PAHs Area

Subsurface soil samples were collected during the SSI to delineate the horizontal and vertical extent of the elevated PAHs detected during the SI for potential removal. Based on the SSI results, presented in Section 4.3, it is recommended that these samples serve as pre-confirmation samples to define the extent of removal. An EE/CA is recommended for removal of the elevated PAHs in subsurface soil, an area encompassing approximately 1,084 ft². Figure 5-1 presents the proposed removal area.



LEGEND

-  SI Surface Soil Sample Location
-  SI Subsurface Soil Sample Location
-  SSI Surface Soil Sample Location
-  SSI Subsurface Soil Sample Location
-  Extent of PAH Removal (Area = 1,084 sq.ft.)
-  Extent of Metallic Slag Removal (Area = 2,866 sq.ft.)
-  Site Boundary

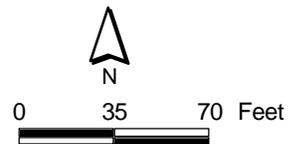


Figure 5-1
Site 19 Proposed Removal Areas
St. Juliens Creek Annex
Chesapeake, Virginia

SECTION 6

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Appendix A

Analytical Data

Table A-1
Site 19 Surface Soil Analytical Results
Supplemental Site Investigation
St. Juliens Creek Annex
Chesapeake, Virginia

Station ID	SJS19-SS13		SJS19-SS14	SJS19-SS15	SJS19-SS16	SJS19-SS17	SJS19-SS18		SJS19-SS19	SJS19-SS20
Sample ID	SJS19-SS13-00-04D	SJS19-SS13-00-04D-P	SJS19-SS14-00-04D	SJS19-SS15-00-04D	SJS19-SS16-00-04D	SJS19-SS17-00-04D	SJS19-SS18-00-04D	SJS19-SS18-00-04D-P	SJS19-SS19-00-04D	SJS19-SS20-00-04D
Sample Date	11/09/04	11/09/04	11/09/04	11/09/04	11/09/04	11/09/04	11/09/04	11/09/04	11/09/04	11/09/04
Chemical Name										
Semivolatile Organic Compounds (UG/KG)										
Acenaphthene	10	8.3 U	7.4 U	7.1 U	52	NA	NA	NA	NA	NA
Acenaphthylene	18	8.3 U	15	54	800	NA	NA	NA	NA	NA
Anthracene	32	11	21	25	560	NA	NA	NA	NA	NA
Benzo(a)anthracene	100	42	51	38	660	NA	NA	NA	NA	NA
Benzo(a)pyrene	110	42	47	48	790	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	140	58	72	67	860	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	48	18	34	39	350	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	42	17	20	19	300	NA	NA	NA	NA	NA
Chrysene	110	41	52	40	620	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	7.4 U	8.3 U	9.2	9.6	96	NA	NA	NA	NA	NA
Fluoranthene	180	66	93	56	840	NA	NA	NA	NA	NA
Fluorene	14	8.3 U	7.4 U	7.1 U	97	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	40	16	29	32	320	NA	NA	NA	NA	NA
Naphthalene	8.1	8.3 U	7.4 U	7.1 U	21	NA	NA	NA	NA	NA
Phenanthrene	140	33	40	14	360	NA	NA	NA	NA	NA
Pyrene	240	82	74	64	1,100	NA	NA	NA	NA	NA
Metals (MG/KG)										
Aluminum	NA	NA	NA	NA	NA	6,520	4,240	4,440	3,900	4,830
Antimony	NA	NA	NA	NA	NA	1 L	2.7 L	7.1 L	0.72 UL	0.87 UL
Arsenic	NA	NA	NA	NA	NA	3.6 B	11.2	15.6	1.8 B	2.1 B
Barium	NA	NA	NA	NA	NA	24.1 J	264	221	26.7 J	19.7 J
Beryllium	NA	NA	NA	NA	NA	0.22 B	0.44 J	0.5 J	0.19 B	0.17 B
Boron	NA	NA	NA	NA	NA	1.8 B	1.6 B	4.6	1.1 B	1 B
Cadmium	NA	NA	NA	NA	NA	0.36 J	28.8	32.2	2.7	0.11 B
Calcium	NA	NA	NA	NA	NA	225 J	1,090	1,120	302 J	155 J
Chromium (total)	NA	NA	NA	NA	NA	12.3	84.9	110	6.6	6.9
Cobalt	NA	NA	NA	NA	NA	1.3 L	5.3 J	6.4 J	0.83 L	0.75 L
Copper	NA	NA	NA	NA	NA	27.2	1,200	1,570	17	8.6
Cyanide	NA	NA	NA	NA	NA	0.22 U	0.15 U	0.18 U	0.19 U	0.18 U
Iron	NA	NA	NA	NA	NA	5,870	37,500	55,100	3,330	3,030
Lead	NA	NA	NA	NA	NA	34.7	384	497	36.1	14.4
Magnesium	NA	NA	NA	NA	NA	669 J	995	1,180	396 J	456 J
Manganese	NA	NA	NA	NA	NA	27	571	596	37.3	15
Mercury	NA	NA	NA	NA	NA	0.034 J	0.27	0.25	0.035	0.021 J
Molybdenum	NA	NA	NA	NA	NA	0.86 B	8.2	9.6	0.37 B	0.35 U
Nickel	NA	NA	NA	NA	NA	4 J	36	51	2.9 B	2.7 B
Potassium	NA	NA	NA	NA	NA	452 J	770 J	877	197 J	291 J
Selenium	NA	NA	NA	NA	NA	0.58 U	0.58 U	1	0.56 U	0.68 U
Silver	NA	NA	NA	NA	NA	0.2 UL	0.55 L	0.72 L	0.2 UL	0.24 UL
Sodium	NA	NA	NA	NA	NA	219 L	195 L	190 L	214 L	150 L
Thallium	NA	NA	NA	NA	NA	0.87 U	0.88 U	0.94 U	0.85 U	1 U
Vanadium	NA	NA	NA	NA	NA	14.3	15.2	17.1	6.8 J	8.9 J
Zinc	NA	NA	NA	NA	NA	52.8	584	672	195	22.3

Notes:
NA - Not analyzed
B - Blank contamination
J - Reported value is estimated
L - Reported value is biased low
P - Duplicate Sample
U - Not detected

Table A-2
Site 19 Subsurface Soil Analytical Data
Supplemental Site Investigation
St. Juliens Creek Annex
Chesapeake, Virginia

Station ID	SJS19-SO13	SJS19-SO14	SJS19-SO15	SJS19-SO16	SJS19-SO17	
Sample ID	SJS19-SB13-04D	SJS19-SB14-03-05B	SJS19-SB15-06-05B	SJS19-SB16-03-05B	SJS19-SB17-03-05B-P	SJS19-SB17-03-05B
Sample Date	11/12/04	04/20/05	04/20/05	04/20/05	04/20/05	04/20/05
Chemical Name						
Semivolatile Organic Compounds (UG/KG)						
1,1-Biphenyl	NA	370 U	380 U	81 J	400 U	42 J
2,4,5-Trichlorophenol	NA	930 U	940 U	1,000 R	990 U	970 U
2,4,6-Trichlorophenol	NA	370 U	380 U	400 R	400 U	390 U
2,4-Dichlorophenol	NA	370 U	380 U	400 R	400 U	390 U
2,4-Dimethylphenol	NA	370 U	380 U	400 R	400 U	390 U
2,4-Dinitrophenol	NA	930 U	940 U	1,000 R	990 U	970 U
2,4-Dinitrotoluene	NA	370 U	380 U	400 U	400 U	390 U
2,6-Dinitrotoluene	NA	370 U	380 U	400 U	400 U	390 U
2-Chloronaphthalene	NA	370 U	380 U	400 U	400 U	390 U
2-Chlorophenol	NA	370 U	380 U	400 R	400 U	390 U
2-Methylnaphthalene	NA	370 U	380 U	190 J	400 U	150 J
2-Methylphenol	NA	370 U	380 U	400 R	400 U	390 U
2-Nitroaniline	NA	930 U	940 U	1,000 U	990 U	970 U
2-Nitrophenol	NA	370 U	380 U	400 R	400 U	390 U
3,3'-Dichlorobenzidine	NA	370 U	380 U	400 U	400 U	390 U
3-Nitroaniline	NA	930 U	940 U	1,000 U	990 U	970 U
4,6-Dinitro-2-methylphenol	NA	930 U	940 U	1,000 R	990 U	970 U
4-Bromophenyl-phenylether	NA	370 U	380 U	400 U	400 U	390 U
4-Chloro-3-methylphenol	NA	370 U	380 U	400 R	400 U	390 U
4-Chloroaniline	NA	370 U	380 U	400 U	400 U	390 U
4-Chlorophenyl-phenylether	NA	370 U	380 U	400 U	400 U	390 U
4-Methylphenol	NA	370 U	380 U	400 R	400 U	390 U
4-Nitroaniline	NA	930 U	940 U	1,000 U	990 U	970 U
4-Nitrophenol	NA	930 U	940 U	1,000 R	990 U	970 U
Acenaphthene	NA	370 U	380 U	320 J	400 U	230 J
Acenaphthylene	NA	370 U	380 U	190 J	400 U	390 U
Acetophenone	NA	370 U	380 U	400 U	400 U	390 U
Anthracene	NA	370 U	380 U	720	76 J	390 J
Atrazine	NA	370 U	380 U	400 U	400 U	390 U
Benzaldehyde	NA	370 UJ	380 UJ	400 UJ	400 UJ	390 UJ
Benzo(a)anthracene	NA	370 U	380 U	2,200	330 J	1,200 J
Benzo(a)pyrene	NA	370 U	380 U	1,700	310 J	890 J
Benzo(b)fluoranthene	NA	370 U	380 U	1,900	320 J	920 J
Benzo(g,h,i)perylene	NA	370 U	380 U	1,100	210 J	540 J
Benzo(k)fluoranthene	NA	370 U	380 U	880	130 J	310 J
Butylbenzylphthalate	NA	370 U	380 U	400 U	400 U	390 U
Caprolactam	NA	370 U	380 U	400 U	400 U	390 U
Carbazole	NA	370 U	380 U	320 J	400 U	120 J
Chrysene	NA	370 U	380 U	2,200	360 J	1,100 J
Di-n-butylphthalate	NA	370 U	380 U	400 U	400 U	390 U
Di-n-octylphthalate	NA	370 U	380 U	400 U	400 U	390 U
Dibenz(a,h)anthracene	NA	370 U	380 U	400 U	400 U	390 U
Dibenzofuran	NA	370 U	380 U	450	400 U	170 J
Diethylphthalate	NA	370 U	380 U	400 U	400 U	390 U
Dimethyl phthalate	NA	370 U	380 U	400 U	400 U	390 U
Fluoranthene	NA	370 U	380 U	4,300	580 J	1,800 J
Fluorene	NA	370 U	380 U	600	40 J	360 J
Hexachlorobenzene	NA	370 U	380 U	400 U	400 U	390 U
Hexachlorobutadiene	NA	370 U	380 U	400 U	400 U	390 U
Hexachlorocyclopentadiene	NA	370 U	380 U	400 U	400 U	390 U
Hexachloroethane	NA	370 U	380 U	400 U	400 U	390 U
Indeno(1,2,3-cd)pyrene	NA	370 U	380 U	910	150 J	380 J

Table A-2
Site 19 Subsurface Soil Analytical Data
Supplemental Site Investigation
St. Juliens Creek Annex
Chesapeake, Virginia

Station ID	SJS19-SO13	SJS19-SO14	SJS19-SO15	SJS19-SO16	SJS19-SO17	
Sample ID	SJS19-SB13-04D	SJS19-SB14-03-05B	SJS19-SB15-06-05B	SJS19-SB16-03-05B	SJS19-SB17-03-05B-P	SJS19-SB17-03-05B
Sample Date	11/12/04	04/20/05	04/20/05	04/20/05	04/20/05	04/20/05
Chemical Name						
Isophorone	NA	370 U	380 U	400 U	400 U	390 U
Naphthalene	NA	370 U	380 U	320 J	400 UJ	410 J
Nitrobenzene	NA	370 U	380 U	400 U	400 U	390 U
Pentachlorophenol	NA	930 U	940 U	1,000 R	990 U	970 U
Phenanthrene	NA	370 U	380 U	4,700	400 J	2,500 J
Phenol	NA	370 U	380 U	400 R	400 U	390 U
Pyrene	NA	370 U	380 U	3,900	640 J	2,200 J
bis(2-Chloro-1-methylethyl) ether	NA	370 U	380 U	400 U	400 U	390 U
bis(2-Chloroethoxy)methane	NA	370 U	380 U	400 U	400 U	390 U
bis(2-Chloroethyl)ether	NA	370 U	380 U	400 U	400 U	390 U
bis(2-Ethylhexyl)phthalate	NA	170 B	100 B	640 B	53 B	390 U
n-Nitroso-di-n-propylamine	NA	370 U	380 U	400 U	400 U	390 U
n-Nitrosodiphenylamine	NA	370 U	380 U	400 U	400 U	390 U
Metals (MG/KG)						
Aluminum	5,310	NA	NA	NA	NA	NA
Antimony	0.67 UL	NA	NA	NA	NA	NA
Arsenic	0.54 U	NA	NA	NA	NA	NA
Barium	12.5 J	NA	NA	NA	NA	NA
Beryllium	0.15 J	NA	NA	NA	NA	NA
Boron	0.77 B	NA	NA	NA	NA	NA
Cadmium	0.11 J	NA	NA	NA	NA	NA
Calcium	320 J	NA	NA	NA	NA	NA
Chromium	5.9	NA	NA	NA	NA	NA
Cobalt	0.59 J	NA	NA	NA	NA	NA
Copper	8.8	NA	NA	NA	NA	NA
Cyanide	0.16 U	NA	NA	NA	NA	NA
Iron	2,970	NA	NA	NA	NA	NA
Lead	4.9 K	NA	NA	NA	NA	NA
Magnesium	430 J	NA	NA	NA	NA	NA
Manganese	13 L	NA	NA	NA	NA	NA
Mercury	0.016 U	NA	NA	NA	NA	NA
Molybdenum	0.4 B	NA	NA	NA	NA	NA
Nickel	2.6 J	NA	NA	NA	NA	NA
Potassium	204 J	NA	NA	NA	NA	NA
Selenium	0.53 U	NA	NA	NA	NA	NA
Silver	0.19 U	NA	NA	NA	NA	NA
Sodium	68 J	NA	NA	NA	NA	NA
Thallium	0.8 U	NA	NA	NA	NA	NA
Vanadium	7.3	NA	NA	NA	NA	NA
Zinc	21.6	NA	NA	NA	NA	NA
Wet Chemistry (MG/KG)						
% Solids	89	89	89	83	84	86

Notes:

- NA - Not analyzed
- B - Blank contamination
- J - Reported value is estimated
- L - Reported value is biased low
- K - Reported value is biased high
- P - Duplicate Sample
- R - Unreliable result
- U - Not detected

Table A-3
Site 19 Groundwater Analytical Results
Supplemental Site Investigation
St. Juliens Creek Annex
Chesapeake, Virginia

Station ID	SJS19-GW02	
Sample ID	SJS19-GW02-04D	SJS19-GW02-04D-P
Sample Date	11/12/04	11/12/04
Chemical Name		
Semivolatile Organic Compounds (UG/L)		
Acenaphthene	0.23 U	0.23 U
Acenaphthylene	0.23 U	0.23 U
Anthracene	0.23 U	0.23 U
Benzo(a)anthracene	0.23 U	0.23 U
Benzo(a)pyrene	0.23 U	0.23 U
Benzo(b)fluoranthene	0.23 U	0.23 U
Benzo(g,h,i)perylene	0.23 U	0.23 U
Benzo(k)fluoranthene	0.23 U	0.23 U
Chrysene	0.23 U	0.23 U
Dibenz(a,h)anthracene	0.23 U	0.23 U
Fluoranthene	0.23 U	0.23 U
Fluorene	0.23 U	0.23 U
Indeno(1,2,3-cd)pyrene	0.23 U	0.23 U
Naphthalene	0.23 U	0.23 U
Phenanthrene	0.23 U	0.23 U
Pyrene	0.23 U	0.23 U

Notes:

P - Duplicate Sample

U - Not detected