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ST JULIENS CREEK  
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FINAL RECORD OF DECISION SITE 5 BURNING GROUNDS AND BLOWS CREEK USEPA  
DESIGNATION OPERABLE UNIT 5 (OU 5) ST JULIENS CREEK ANNEX VA  
05/20/2016  
CH2M HILL



# Record of Decision

## Site 5 (Burning Grounds) and Blows Creek USEPA Designation: OU-5

St. Juliens Creek Annex  
Chesapeake, Virginia  
EPA ID: VA5170000181

May 2016



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# 1. Declaration

## 1.1 Site Name and Location

This Record of Decision (ROD) presents the determination that no further action (NFA) is warranted to ensure protection of human health and the environment at Site 5 (Burning Grounds) and Blows Creek, at St. Juliens Creek Annex (SJCA), Chesapeake, Virginia. SJCA was placed on the United States Environmental Protection Agency (USEPA) National Priorities List (NPL) effective July 27, 2000 (USEPA ID: VA5170000181).

## 1.2 Statement of Basis and Purpose

The NFA determination was made in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986, and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on information contained in the Administrative Record<sup>a</sup> file for the site. Information not specifically summarized in this ROD but contained in the Administrative Record file has been considered and is relevant to the NFA determination for Site 5 and Blows Creek.

The Department of the Navy (Navy) is the lead agency and provides funding for site cleanups at SJCA. The Navy and USEPA Region 3 issue this ROD jointly. The Commonwealth of Virginia, Virginia Department of Environmental Quality (VDEQ) concurs with the decision.

Site 5 is one of several Environmental Restoration Program (ERP) sites at SJCA, and Blows Creek has been investigated in association with many ERP sites, that are subject to the requirements of CERCLA. The **status of all of the ERP sites<sup>1</sup>** at SJCA can be found in the current version of the Site Management Plan (SMP), which is located in the Administrative Record file.

## 1.3 Description of the Selected Remedy

The Selected Remedy for Site 5 and Blows Creek is NFA. During site investigation activities, potential unacceptable risks to human health and ecological receptors were identified for exposure to soil, upland drainage ditch sediment, and groundwater at Site 5; no unacceptable risk was identified for exposure to surface water. A non-time critical removal action (NTCRA) was conducted, which eliminated the unacceptable risk associated with exposure to soil and sediment. Further evaluation of groundwater determined the potential unacceptable risk was associated with metals that are naturally occurring and the result of natural processes; therefore, CERCLA does not provide authority to take action to reduce metals concentrations in the groundwater. Therefore, NFA under CERCLA is warranted for the site to ensure protectiveness for human health and the environment.

Several ERP sites at SJCA, in addition to Site 5, are located within the Blows Creek watershed, and were identified as potential historical sources of contaminants, including Sites 1, 3, 4, 6, 19 and Areas of Concern (AOCs) 1, 8, and 12. Therefore, Blows Creek was investigated, both independently and along with the ERP sites. Site 1 and AOCs 1, 8, and 12 were closed following site investigations, during which no unacceptable risks to human health or the environment were identified. During site investigation activities, potential unacceptable risks to human health and ecological receptors were identified for exposure to soil and upland drainage ditch sediment at Site 3, soil at Site 6, and soil at Site 19. NTCRAs were conducted at Sites 3, 6, and 19, which eliminated the potentially unacceptable risk associated with exposure to soil and/or sediment at the sites. During site investigation activities, potential unacceptable risks to human health and ecological receptors were identified for exposure to soil and/or upland drainage ditch sediment at Site 4. A remedial action was conducted at Site 4, which eliminated the potentially unacceptable risk associated with potential exposure to soil and sediment contamination at the site. Therefore, no unacceptable risk to human health or the environment remains at Blows Creek.

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<sup>a</sup> **Bold blue text** identifies detailed site information available in the Administrative Record and listed in numerical order in the References Table located at the back of this document. The References Table includes the specific location in the referenced document where the information can be found.

Because there are no unacceptable risks to human health and the environment in Site 5 soil, sediment, or surface water or at Blows Creek, and CERCLA does not provide authority to take action to reduce naturally occurring metals in Site 5 groundwater, NFA is required. No response action will be performed at Site 5 and Blows Creek and no restrictions on land use or exposure will be imposed.

### 1.4 Statutory Determinations

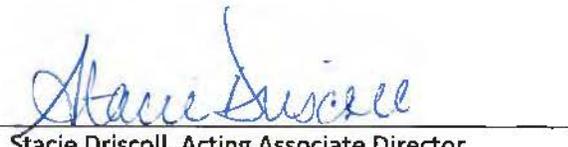
The removal actions conducted at Site 5 and the sites within the Blows Creek Watershed removed the potential threats to human health and the environment, thereby meeting the requirements of CERCLA Section 121 and the NCP eliminating the need for further remedial action. As there are no hazardous substances, pollutants, or contaminants remaining onsite above levels that allow for unlimited use and unrestricted exposure, five-year reviews are not required.

### 1.5 Authorizing Signatures



S. M. BROWN  
Captain, United States Navy  
Commanding Officer

5/9/16  
Date



Stacie Driscoll, Acting Associate Director  
Office of Federal Facilities Remediation and Site  
Assessment  
USEPA (Region 3)

5/30/16  
Date

## 2. Decision Summary

### 2.1 Site Name, Location, and Description

Site 5 – Burning Grounds (USEPA Designation: Operable Unit [OU]-5) and Blows Creek  
St. Juliens Creek Annex  
Chesapeake, Virginia  
USEPA ID: VA5170000181

SJCA covers approximately 490 acres and is situated at the confluence of St. Juliens Creek and the Southern Branch of the Elizabeth River in Chesapeake, Virginia (**Figure 1**). The current primary mission of SJCA is to provide a radar-testing range and various administrative and warehousing facilities for nearby Norfolk Naval Shipyard and other local naval activities. SJCA also provides light industrial shops and storage facilities for several tenant commands, including Defense Logistics Agency, Space and Naval Warfare Systems Command, Fleet Logistics Center Norfolk, Naval Undersea Warfare Center Detachment, and a cryogenics school. Most of the surrounding area is developed and includes residences, schools, recreational areas, and shipping facilities for several large industries. Site 5 encompasses an area of approximately 23 acres in the northeastern portion of the facility (**Figure 2**).

### 2.2 Site History and Enforcement Activities

#### 2.2.1 SJCA

SJCA began operations as a naval facility in 1849. The facility was one of the largest ammunition depots in the United States and was involved in the wartime transfer of ammunitions to other naval facilities. After ordnance operations ceased at SJCA in 1977, decontamination was performed in, around, and under ordnance-handling facilities by flushing the areas with chemical solutions and water. SJCA has also been involved in non-ordnance services, including degreasing; operating various shops, such as paint, machine, vehicle and locomotive maintenance, pest control, battery, print, and electrical; operating boiler plants, wash racks, and potable and salt water fire-protection systems; providing fire-fighter training; and storing oil and chemicals.

#### 2.2.2 Site 5

Site 5, Burning Grounds, was initially identified as Solid Waste Management Unit (SWMU) 8. Operations began at the Burning Grounds in the 1930s when waste ordnance materials were disposed by open burning on three main pads. Additional debris, such as large steel plates and metal from buildings, were also disposed at the site. In mid-1977, the site was used for facility-wide ordnance equipment and material decontamination, which included filling equipment with oil and straw and burning it. After the decontamination process, the ground was reportedly covered with oil and straw, burned, disced, and burned again; samples were then collected to certify decontamination. Historical aerial photographs indicated that prior to its use as a burning ground and disposal area, Site 5 and much of the adjacent area had been used for placement of dredge spoil material that reportedly originated from Blows Creek and the Southern Branch of the Elizabeth River. Site 6 is located within the east-central portion of Site 5 (**Figure 2**). Site 6 is a former ERP Site that was closed under a NFA ROD in September 2003 after a NTCRA was completed.

Site 5 has been characterized as part of several investigations and actions since 1981. Detailed information from previous investigations conducted at Site 5 is available in the Administrative Record for SJCA. The documents detailing these environmental activities included in the Administrative Record file can be referenced for further information regarding specific sampling strategies, media investigations, and when and where the sampling was performed. Previous investigations and activities relevant to Site 5 are summarized in **Table 1**.

#### 2.2.3 Blows Creek

Blows Creek is a tidally-influenced brackish water tributary to the Southern Branch of the Elizabeth River that runs through the center of SJCA; it is considered a sub-watershed to the Southern Branch of the Elizabeth River. Several ERP sites at SJCA, in addition to Site 5, are located within the Blows Creek watershed, and were identified as potential historical sources of contaminants, including Sites 1, 3, 4, 6, 19 and AOCs 1, 8, and 12 (**Figure 2**). Therefore, Blows Creek was investigated, both independently and along with the ERP sites.

Blows Creek has been characterized as part of several investigations and actions since 2002. Detailed information from previous investigations conducted at Blows Creek and other sites within the Blows Creek watershed is available in the Administrative Record for SJCA. The documents detailing these environmental activities included in the Administrative Record file can be referenced for further information regarding specific sampling strategies, media investigations, and when and where the sampling was performed. Previous investigations conducted within Blows Creek and investigations conducted and actions taken at the sites within the Blows Creek watershed, excluding Site 5, are summarized in **Table 2**.

FIGURE 1  
SJCA Location

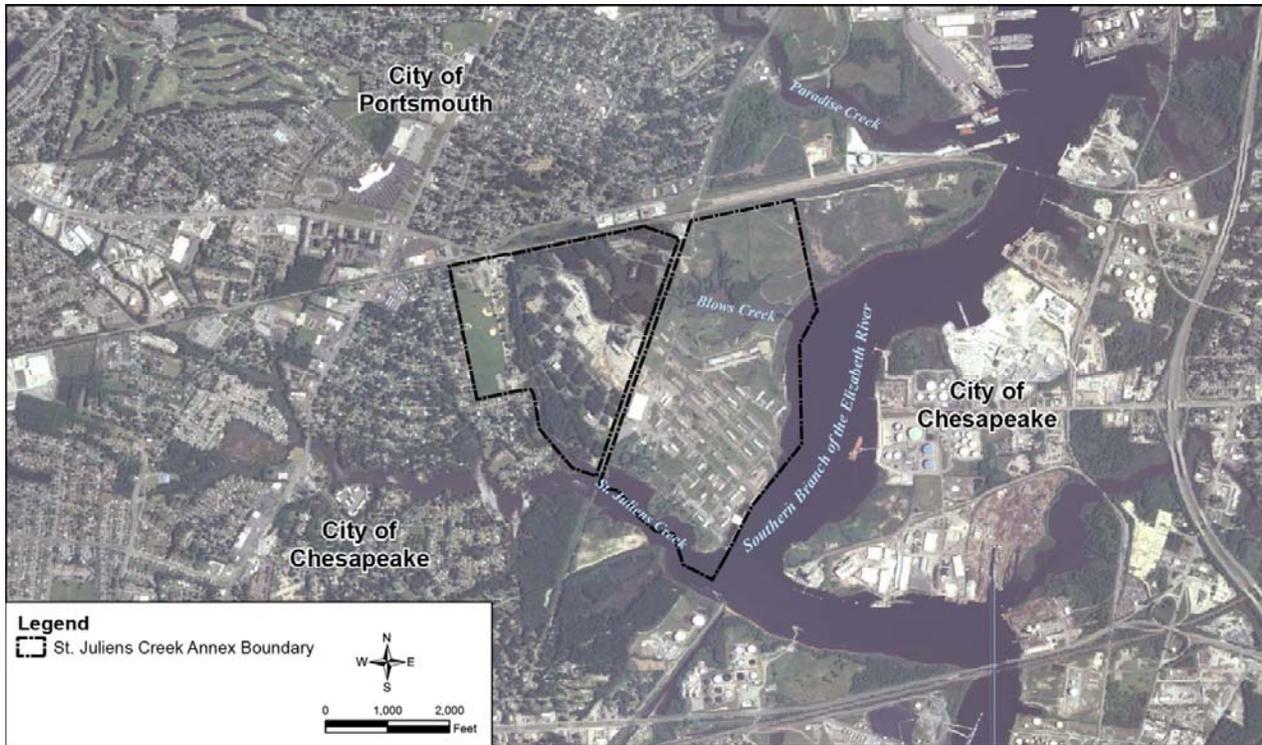
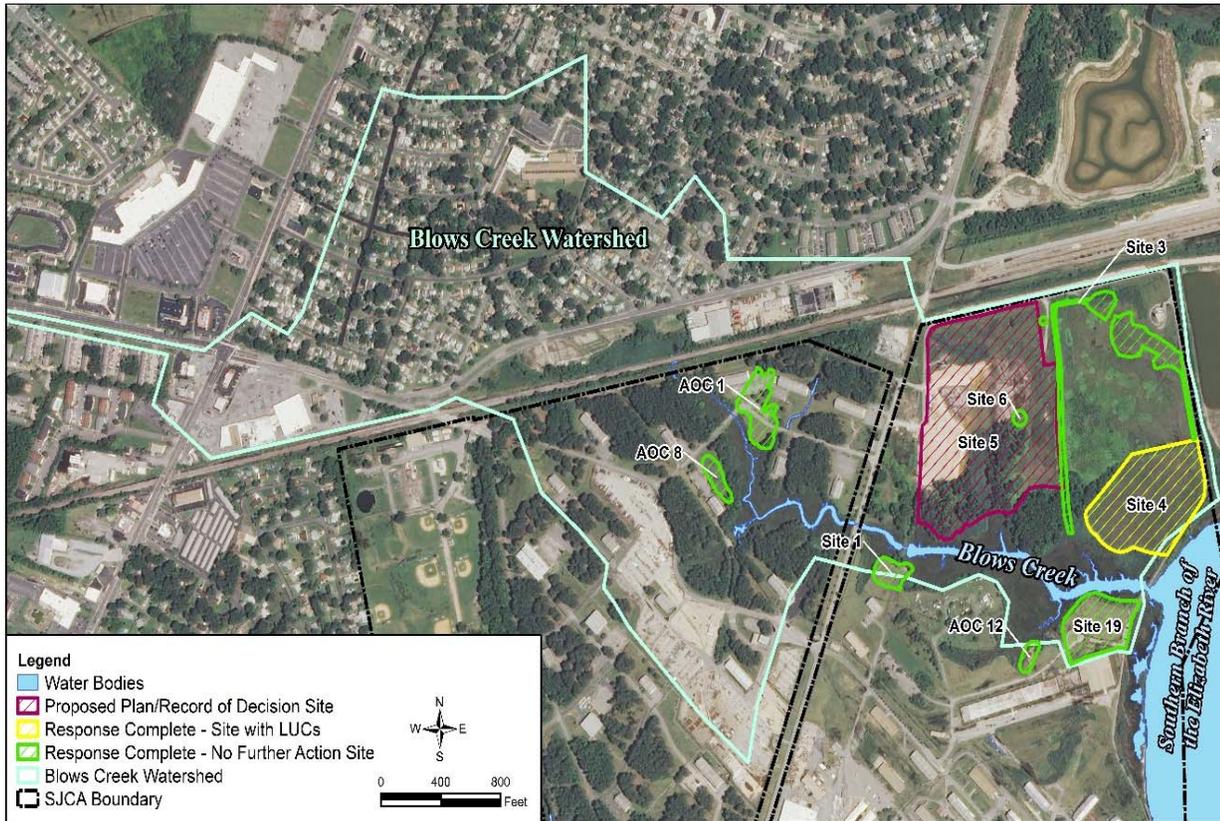


FIGURE 2  
Site Locations



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TABLE 1  
Site 5 Studies, Investigations, and Activities Summary

Study/Investigation/ Activity*	Administrative Record Document Number	Investigation Activities
Initial Assessment Study (Naval Engineering Environmental Support Activity, 1981)	000091	Archival records were collected and evaluated and an inspection of the site was performed. The <b>evaluation indicated</b> <sup>2</sup> that waste ordnance disposal and equipment decontamination operations, where equipment was filled with straw and oil and ignited, were performed at the burning grounds. The visual examination of the site revealed ordnance residue, such as old cartridge ends and spacers, as well as non-ordnance residue, such as broken glass.
Phase II Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA) (A.T. Kearney, Inc. and K.W. Brown and Associates, Inc., 1989)	000090	Site 5 was initially identified for further investigation during the Phase II RFA, when a faint hydrocarbon odor was noted at the site. The RFA <b>recommended additional investigation</b> <sup>3</sup> because of the high potential for a release to soil and groundwater from the historical activities at the site and the shallow depth of groundwater, a moderate to high potential for a release to surface water due to the close proximity of Blows Creek, and a moderate to high potential for release of subsurface gas based on the waste disposal activities.
Aerial Photographic Site Analysis (EPA, 1995)	001492	Eight aerial photographs dated between 1937 and 1995 were used to conduct a <b>historical aerial photograph review</b> <sup>4</sup> to assess conditions and changes at Site 5. The historical aerial review identified ground scarring, stained soils, disturbed ground, small trenches, historical excavation activities, outside storage of construction materials, containers, and potential debris.
Relative Risk Ranking System Data Collection Report (CH2M HILL, 1996)	000095	Surface soil and groundwater samples were collected and analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), inorganics, total phosphorus, and explosives. SVOCs, pesticides, and PCBs were <b>detected</b> <sup>5</sup> .
Remedial Investigation/ Human Health Risk Assessment / Ecological Risk Assessment Report for Sites 3, 4, 5, and 6 (CH2M HILL, 2003)	000170 (Text) 000171 (Appendices)	<p>From 1997 to 2003, a Remedial Investigation (RI) was conducted for ERP Sites 3, 4, 5, and 6. The RI field activities conducted for Site 5 included geophysical investigations, monitoring well installation, water-level monitoring, waste delineation, and the collection and analysis of surface and subsurface soil, groundwater, drainage sediment, and drainage surface water samples. Analytical data were compared to screening criteria and SJCA background levels. Based on the waste delineation activities, the RI concluded that the extent of waste was greater than previously identified and the Site 5 boundary was expanded to include the extent of the waste encountered.</p> <p>A Human Health Risk Assessment (HHRA) and an Ecological Risk Assessment (ERA) were conducted, which concluded that potential unacceptable risks to human and ecological receptors were present at Site 5 from exposure to chemicals in soil and upland drainage ditch sediment. Because surface water is transient at the site and the drainage ditches provided minimal ecological habitat, no significant risks to human health and the environment were identified for surface water. No human health risks were identified from exposure to shallow aquifer groundwater; however, only the construction worker scenario was evaluated and there were isolated detections of metals at concentrations above maximum contaminant levels (MCLs). Although unacceptable risks to human health from exposure to metals in the deep aquifer groundwater were identified, they were eliminated from further evaluation by the SJCA Partnering Team, consisting of representatives from the Navy, USEPA, and VDEQ, based on consideration of a varying combination of factors, including the sporadic frequency of detections, metals concentrations below background concentrations, and metals concentrations below the MCLs.</p> <p>The RI recommended <b>additional soil and groundwater sampling</b><sup>6</sup> to further define the nature and extent of contamination within Site 5 and additional investigation of sediment in Blows Creek to evaluate the potential for adverse effects to aquatic life (see <b>Table 2</b>, Blows Creek section).</p>
Expanded Remedial Investigation/Human Health Risk Assessment/Ecological Risk Assessment for Site 5 (CH2M HILL, 2006)	000522	Fieldwork for an Expanded RI (ERI) was conducted in December 2003 and included the collection and analysis of surface soil samples to fill spatial data gaps, better evaluate areas posing potential unacceptable human health and/or ecological risks, and evaluate potential remedial alternatives. Additionally, groundwater samples were collected from existing monitoring wells to verify screening criteria and background exceedances identified during the RI. Analytical data were compared to screening criteria and SJCA background levels. The HHRA was also revised to include residential scenarios for groundwater, and evaluate the historical RI data and the additional groundwater samples. <b>Potential unacceptable risks</b> <sup>7</sup> were identified for potable use of shallow groundwater associated with metals; however, based on the variability of the groundwater data previously collected, the SJCA Partnering Team agreed to collect two additional rounds of groundwater data.
Addendum to the Expanded Remedial Investigation/Human Health Risk Assessment/Ecological Risk Assessment for Site 5 (CH2M HILL, 2007)	000592	Two additional rounds of groundwater data were collected and evaluated in June and October 2006. Analytical data were compared to screening criteria and SJCA background levels. Potential unacceptable risks were identified for potable use of shallow groundwater associated with metals. However, <b>NFA</b> <sup>8</sup> was deemed necessary to address shallow aquifer groundwater as a result of consideration of a combination of factors, including the planned removal of the waste/burnt soil area, historical placement of dredge fill in the area, lack of a discernible plume, acceptable/minimal hazards/risks, metals concentrations inconsistently above MCLs/action levels, and metals concentrations below background concentrations.
Engineering Evaluation/Cost Analysis and Action Memorandum for Site 5 Waste/Burnt Soil Area and Impacted Surface Soil and Sediment Areas (CH2M HILL, 2007)	000568	<p>In February 2007, an Engineering Evaluation and Cost Analysis (EE/CA) was prepared to evaluate NTCRA alternatives to mitigate potential unacceptable human health and ecological risks in the waste/burnt soil area and impacted surface soil and drainage sediment. The <b>recommended alternative</b><sup>9</sup> was Excavation and Restoration/Wetland Creation. This alternative included excavation of waste/burnt soil and impacted surface soil and drainage sediment, disposal of excavated material, limited grading and backfill, and restoration as a mixed wetland/upland habitat. In addition, cleanup goals for soil and sediment were established to be protective of human health.</p> <p>A public notice was issued in <i>The Virginian-Pilot</i> on January 19, 2007, and the EE/CA was made available to the public from January 19 to February 18, 2007. No comments were received and an Action Memorandum was signed by the Navy on March 20, 2007, to implement the recommended alternative presented in the EE/CA.</p>
Change in Scope of the Response and Ceiling Increase Action Memorandum for Site 5 Waste/Burnt Soil Area and Impacted Surface Soil and Sediment Areas (CH2M HILL, 2010)	001122	In order to allow for a more flexible future land use, a supplemental Action Memorandum was prepared that documented the <b>changes to the initial recommended alternative</b> <sup>10</sup> from the EE/CA. The new site restoration plan included additional backfill within the excavated areas to achieve pre-removal-action grade and restoration with the same vegetation present prior to the NTCRA. A public notice was issued in <i>The Virginian-Pilot</i> on June 2, 2010, to inform the public of the change in scope. No feedback was provided by the public, and the Navy signed the Supplemental Action Memorandum on November 29, 2010.

TABLE 1  
Site 5 Studies, Investigations, and Activities Summary

Study/Investigation/ Activity*	Administrative Record Document Number	Investigation Activities
NTCRA Construction Completion Report for Site 5 (AGVIQ-CH2M HILL, 2012)	001316 - 001318	<p>NTCRA activities began in January 2008 and were completed in July 2012. In September 2012, a Construction Completion Report (CCR) was prepared to document the <b>completion of the NTCRA<sup>11</sup></b>, which consisted of excavation and offsite disposal of waste/burnt soil and impacted soil and sediment with chemicals of concern (COC) concentrations exceeding the cleanup goals.</p> <p>The limits of excavation varied across the site based on the type of media (soil or sediment) and whether or not the NTCRA was driven by human health or ecological risks as follows:</p> <ul style="list-style-type: none"> <li>• The horizontal and vertical extents of excavation in the waste/burnt soil area were determined based on visual inspection during the NTCRA and/or confirmation sampling.</li> <li>• The human health risk-based areas were excavated to a depth of 1 foot, followed by confirmation sampling. Confirmation samples were collected to confirm the excavations were adequate and that the cleanup goals were met. In accordance with the confirmation sampling work plan (CH2M HILL, 2007c), the confirmation sample analytical results were compared to the cleanup goals established in the EE/CA. When the maximum concentration detected at a particular location exceeded a cleanup goal, the 95 percent upper confidence limit (UCL) of the mean for all of the samples was calculated, and if the 95 percent UCL of the mean was below the cleanup goal, no additional removal was required and no additional samples were collected.</li> <li>• The ecological risk-based areas were excavated to a depth of 1 foot and did not require confirmation sampling because the site-wide average concentrations of the COCs remaining in place in surface soil and sediment following implementation of the NTCRA reduced the potential risks to an acceptable level, as documented in the EE/CA and Action Memorandum.</li> </ul> <p>A total of 32,960 tons of waste and contaminated soil and sediment was disposed. The site was restored with clean fill and graded to provide positive stormwater drainage and prevent ponding. Topsoil was placed and then seeded in disturbed grass areas, and wetland vegetation was replanted in the pre-existing wetland area, to return Site 5 to the same hydrologic, topographic, and vegetative conditions as were present prior to the NTCRA.</p>
Site 5 Supplemental Remedial Investigation Report (CH2M HILL, 2015)	001452	<p>Following completion of the NTCRA, a NFA Proposed Plan was drafted in 2012 and submitted to USEPA and VDEQ for review. During the review, USEPA raised concerns about potential hazards from exposure to cobalt in shallow aquifer groundwater if used as a potable water supply because a more conservative provisional toxicity value for cobalt had been adopted by USEPA since the risk assessment documented in the Addendum to the ERI had been performed (CH2M HILL, 2007); using the current toxicity value, the hazard associated with cobalt would be higher. Based on these concerns, it was deemed necessary to collect additional groundwater samples and re-evaluate the cause for and risk associated with select metals in the shallow aquifer groundwater.</p> <p>In 2014, a Supplemental RI was conducted to determine whether the current concentrations of metals in the shallow aquifer groundwater pose unacceptable risk, and if so, whether they are the result of a CERCLA site release that requires remedial action. The Supplemental RI field activities included water-level monitoring, groundwater sampling, and surface water monitoring for pH. Groundwater analytical data were compared to screening criteria and SJCA background levels.</p> <p>The HHRA identified potentially unacceptable risks to human health associated with hypothetical future resident use of the shallow aquifer groundwater as a potable water supply from exposure to aluminum, arsenic, beryllium, hexavalent chromium, cobalt, iron, and manganese. However, the SJCA Partnering Team determined <b>NFA<sup>12</sup></b> was necessary to address shallow aquifer groundwater as a result of a combination of factors, including:</p> <ul style="list-style-type: none"> <li>• Removal of the waste/burnt soil area</li> <li>• Relatively low pH in rainfall</li> <li>• Data evaluation indicating the CERCLA site release (waste disposal and burning) has not significantly impacted the shallow aquifer groundwater</li> <li>• Metals concentrations being the result of naturally occurring site conditions</li> <li>• Acceptable/minimal hazards/risks</li> </ul>

\* The documents listed are available in the Administrative Record and provide detailed information used to support remedy selection at Site 5.

TABLE 2  
Blows Creek and Blows Creek Watershed Sites Studies, Investigations, and Activities Summary

Study/ Investigation/ Activity*	Administrative Record Document Number	Investigation Activities
<b>Site 1 and AOCs 1, 8, and 12 (Upland Areas within the Blows Creek Watershed)</b>		
Site Screening Assessment (CH2M HILL, 2002)	000156	During the Site Screening Assessment (SSA) field investigation, surface water and sediment samples were collected and analyzed from Site 1, and surface and subsurface soil samples were collected and analyzed and geophysical surveys were conducted at AOCs 1, 8, and 12. Based on the results, further investigation was recommended for Site 1 because the extent of waste at the site was unknown, and for AOC 1 because of elevated compounds detected in surface soil. AOCs 8 and 12 were <b>determined to require NFA<sup>13</sup></b> , based on review of aerial photographs, site visits, and evaluation of the data collected, which all determined that AOCs 8 and 12 do not pose an unacceptable risk to human health or the environment.
Site Screening Assessment Report Addendum: Site 1 – Waste Disposal Area A (CH2M HILL, 2002)	000183	Based on the recommendation of the SSA report, additional fieldwork to investigate potential contamination at Site 1 was conducted. In September 2002, three test pits were excavated within the site boundary, and no significant debris was encountered in any of the test pits. Therefore, consensus was reached that <b>NFA was required<sup>14</sup></b> .
Site Investigation Report, Sites 8, 19, 21 and AOC 1 (CH2M HILL, 2004)	000220	Based on the recommendation of the SSA report, further investigation was conducted at AOC 1. Soil samples were collected from within AOC 1, and a human health risk screening of the data determined that no unacceptable risk to humans was present as a result of exposure to constituents at AOC 1. In addition, an ecological risk screening determined that there was minimal ecological habitat for potential receptors. The site investigation report concluded that <b>NFA was required<sup>15</sup></b> for AOC 1.
<b>Site 3 (Upland Area within the Blows Creek Watershed)</b>		
NTCRA and Site 3 Confirmation Closeout Report (CH2M HILL, 2004)	000224	NTCRA activities within Site 3 were conducted in two phases. Phase I was conducted from August 2002 through September 2002. During Phase I, approximately 3,300 cubic yards of waste and soil were removed from the northern portion of Site 3. The Phase II removal action was conducted from October 2003 through March 2004. Approximately 9,497 cubic yards of waste, soil, and upland drainage ditch sediment/soil were removed during the Phase II removal. Pre-excavation confirmation samples were collected and showed that <b>all potential risk to human and ecological receptors had been mitigated<sup>16</sup></b> by the NTCRA.
Record of Decision, Site 3: Waste Disposal Area C (NAVFAC, 2006)	000523	The <b>selected remedy<sup>17</sup></b> documented in the ROD for Site 3 was NFA. The NTCRAs eliminated potentially unacceptable risks associated with waste, soil, and upland drainage ditch sediment/soil.
<b>Site 4 (Upland Area within the Blows Creek Watershed)</b>		
Record of Decision, Site 4: Landfill D (NAVFAC, 2004)	000258	Unacceptable risk to human and ecological receptors was present from exposure to waste and COCs (inorganics and polycyclic aromatic hydrocarbons [PAHs]) in soil within Site 4 and mercury in the eastern drainage ditch of Site 4. The <b>selected remedy<sup>18</sup></b> documented in the ROD was soil cover, removal of wetland debris, removal of the eastern drainage ditch sediment, and land use controls (LUCs).
Remedial Action and Construction Closeout Report, Site 4: Landfill D Soil Cover (Design/Build) (JV I, 2005)	000470	The Remedial Design (RD) for Site 4 was completed in November 2004. The <b>RA<sup>19</sup></b> was conducted from March 2005 to October 2005. Surface debris was removed from the wetland area adjacent to Blows Creek, a minimum 2-foot soil cover was installed, and 1 foot of sediment from the floor and sidewalls of the eastern drainage ditch was removed in order to meet the cleanup goals established for mercury.
Remedial Action Completion Report, Site 4: Landfill D (NAVFAC, 2006)	000572	The Remedial Action Completion Report (RACR), finalized in 2006, documented <b>completion of the RA<sup>20</sup></b> and demonstrated the achievement of the Remedial Action Objectives.
<b>Site 6 (Upland Area within the Blows Creek Watershed)</b>		
NTCRA and Site 6 Closeout Report and Site 3 Removal Summary (CH2M HILL, 2002)	000175	The NTCRA for Site 6 was implemented in 2002 to remove approximately 180 cubic yards of soil and concrete from within Site 6. All surface soil and all remnants of the concrete caged unit and associated subsurface soil were removed. Following the removal, groundwater and subsurface soil confirmation sampling was conducted and confirmed that the removal of the surface soil <b>eliminated any potential risks<sup>21</sup></b> posed to human or ecological receptors at Site 6. The excavation was backfilled with clean fill.
Record of Decision, Site 6: Small Arms Unit (NAVFAC, 2003)	000189	The <b>selected remedy<sup>22</sup></b> documented in the ROD for Site 6 is NFA. The NTCRA removed all soil posing potentially unacceptable risk to human and ecological receptors.
<b>Site 19 (Upland Area within the Blows Creek Watershed)</b>		
NTCRA and Construction Closeout Report, Site 19- Removal Action (JV I, 2006)	000527	The <b>NTCRA<sup>23</sup></b> for Site 19 consisted of excavation of impacted soil within Site 19 and backfilling with clean soil. The NTCRA activities were completed in May 2006 and approximately 500 tons of soil were removed and disposed offsite. Excavation areas were delineated based on pre-removal confirmation samples.
Closeout Report for Site 19 (CH2M HILL, 2006)	000557	Following the NTCRA, <b>NFA<sup>24</sup></b> was deemed necessary. Site 19 poses no unacceptable risk to human health or the environment and no restrictions on land use are necessary.

TABLE 2  
Blows Creek and Blows Creek Watershed Sites Studies, Investigations, and Activities Summary

Study/ Investigation/ Activity*	Administrative Record Document Number	Investigation Activities
<b>Blows Creek</b>		
Baseline Ecological Risk Assessment , Blows Creek Watershed (CH2M HILL, 2006)	000562	Based on the recommendations of the RI/HHRA/ERA Report for Sites 3, 4, 5, and 6, a BERA was conducted for Blows Creek to identify potential risks associated with possible historical contributions to Blows Creek from upland Navy ERP Sites, including Sites 3, 4, 5, 6, and 19. The investigation activities included collection and analysis of sediment and fish tissue samples. Results indicated that the majority of chemicals identified as posing a potential risk in Blows Creek did not exceed the 95 percent upper tolerance limits (UTLs) for St. Juliens Creek sediment or dredge fill soil at most locations, and concentrations of mercury in Blows Creek did not pose any potential risk to ecological receptors. The BERA noted that Site 4 soil and sediment were previously identified as a potential source of contamination to Blows Creek; however, the remedial action conducted at Site 4 in 2006 removed contaminated soil and sediment. Therefore, Site 4 no longer represents a potential source of hazardous substances to Blows Creek. The BERA concluded that Blows Creek <b>does not pose an unacceptable risk</b> <sup>25</sup> to benthic-dwelling organisms based on the low frequency and magnitude of these exceedances and the fact that bioassay results did not show a clear relationship between chemical concentration and bioassay organism response, which suggests that the bioassay organisms are not being impacted by the presence of chemicals in sediment.

\* The documents listed are available in the Administrative Record and provide detailed information used to support remedy selection at Blows Creek.

## 2.3 Community Participation

The Navy and USEPA provide information regarding the cleanup of SJCA to the public through the community involvement program, which includes a Restoration Advisory Board (RAB) that was formed in 1999, public meetings, the Administrative Record file for Site 5 and other ERP Sites associated with Blows Creek (Sites 1, 3, 4, 6, 19, and AOCs 1, 8 and 12), the information repository, and announcements published in the local newspapers. The RAB has been apprised of all environmental activities related to Site 5 and Blows Creek.

In accordance with Sections 113 and 117(a) of CERCLA, the Navy provided a public comment period and public meeting for the Proposed Plan. The public comment period for the Proposed Plan was November 15, 2015, to December 30, 2015, and the public meeting was held on December 3, 2015, at the Major Hillard Public Library. The public notice of the meeting and availability of documents was placed in the *Virginian-Pilot* newspaper on November 15, 2015.

The Proposed Plan was available during the public comment period at the Major Hillard Public Library. The Proposed Plan and other documents associated with the environmental activities conducted for Site 5 and Blows Creek are available to the public in the Administrative Record file. Appointments to review the Administrative Record file can be made by contacting:

Ms. Terri Davis  
Public Affairs Office  
Norfolk Naval Shipyard  
Code 1160, Building 1500  
Portsmouth, VA 23709-5000  
Phone: 757.396.9550

Access to the Administrative Record file for the SJCA ERP is also available online at:

<http://go.usa.gov/Dyn4>

## 2.4 Scope and Role of Response Action

Site 5 is one of 59 ERP sites that are part of the comprehensive environmental investigation and cleanup activities currently being performed at SJCA under the CERCLA program. Blows Creek has been investigated in association with many of the 59 ERP sites. The status of all the ERP sites at SJCA can be found in the current version of the SMP, which is located in the Administrative Record. The determination that **NFA**<sup>26</sup> is required for 47 of the sites is documented in the Federal Facility Agreement for SJCA. Closure of the other sites is summarized in **Table 3**. This ROD documents the NFA determination for Site 5 and Blows Creek, which is the final SJCA ERP site to be addressed under CERCLA.

TABLE 3  
Environmental Restoration Program Site Closure Summary (Excluding Sites Documented in the Federal Facility Agreement)

Site ID (USEPA Designation)	Name/Description	Closeout Approach	Closeout Documentation
Site 2 (OU-2)	Waste Disposal Area B	<b>Action ROD</b> <sup>27</sup> for soil cover, sediment excavation, monitored natural attenuation, enhanced reductive dechlorination (ERD), and LUCs (NAVFAC, 2011)	Record of Decision for Site 2: Waste Disposal Area B, signed by Navy and USEPA, concurrence letter by VDEQ
Site 3 (OU-3)	Waste Disposal Area C	<b>No-action ROD</b> <sup>17</sup> (CH2M HILL, 2006)	Record of Decision, Site 3: Waste Disposal Area C, signed by Navy and USEPA, concurrence letter by VDEQ

TABLE 3  
Environmental Restoration Program Site Closure Summary (Excluding Sites Documented in the Federal Facility Agreement)

Site ID (USEPA Designation)	Name/Description	Closeout Approach	Closeout Documentation
Site 4 (OU-5)	Landfill D	<b>Action ROD<sup>18</sup></b> for soil cover and LUCs (NAVFAC, 2004)	Record of Decision, Site 4: Landfill D, signed by Navy and USEPA, concurrence letter by VDEQ
Site 6* (OU-8)	Small Arms Unit	<b>No-action ROD<sup>22</sup></b> (NAVFAC, 2003)	Record of Decision, Site 6: Small Arms Unit, signed by Navy and USEPA, concurrence letter by VDEQ
Site 8 (NA**)	Cross and Mine	<b>No-action determination<sup>15</sup></b> following the Site Investigation (CH2M HILL, 2004)	Concurrence for NFA Signature Page in Site Investigation Report Sites 8, 19, 21, and AOC 1, signed by Navy, USEPA, and VDEQ
Site 19 (OU-7)	Building 190	<b>No-action determination<sup>24</sup></b> following a NTCRA (CH2M HILL, 2006)	Statutory Determination in Closeout Report for Site, signed by Navy, USEPA, and VDEQ
Site 21 (OU-12)	Industrial Area	<b>Action ROD<sup>28</sup></b> for in situ chemical reduction, ERD, and LUCs (NAVFAC, 2011)	Record of Decision for Site 21: Industrial Area, signed by Navy and USEPA, concurrence letter by VDEQ
AOC K (NA**)	Former Sewage Treatment Plant	<b>No-action determination<sup>29</sup></b> following the SSA (CH2M HILL, 2004)	Concurrence for NFA Signature Page in Site Screening Assessment Report Addendum at AOCs 13, 14, and K, signed by Navy, USEPA, and VDEQ
AOC 1 (NA**)	E Street and Marsh Road Ground Scarring	<b>No-action determination<sup>15</sup></b> following the Site Investigation (CH2M HILL, 2004)	Concurrence for NFA Signature Page in Site Investigation Report Sites 8, 19, 21, and AOC 1, signed by Navy, USEPA, and VDEQ
AOC 13 (NA**)	Pentachlorophenol Dip Tank	<b>No-action determination<sup>29</sup></b> following the SSA (CH2M HILL, 2004)	Concurrence for NFA Signature Page in Site Screening Assessment Report Addendum at AOCs 13, 14, and K, signed by Navy, USEPA, and VDEQ
AOC 14 (NA**)	Building 89	<b>No-action determination<sup>29</sup></b> following the SSA (CH2M HILL, 2004)	Concurrence for NFA Signature Page in Site Screening Assessment Report Addendum at AOCs 13, 14, and K, signed by Navy, USEPA, and VDEQ
Area UXO 1 (NA**)	Wharf Area Sediments	<b>No-action determination<sup>30</sup></b> following the Expanded Site Inspection (CH2M HILL, 2013)	NFA Declaration in Expanded Site Inspection Report Munitions Response Program Area UXO 1, signed by Navy, USEPA, and VDEQ

\*Site 6 was identified as a NFA site in the FFA because the ROD was signed prior to the FFA.

\*\* NA – not applicable

## 2.5 Site Characteristics

### 2.5.1 Site 5

Site 5 is located in the northeastern portion of SJCA (**Figure 2**). Site 5 consists of mixed land cover including a forested area in the southern portion, wetlands in the central and southern portions, and open fields. The southern wetland area extends beyond the border of Site 5 to Blows Creek (**Figure 3**). The wetland area within Site 5 is

predominantly supported by surface water runoff and does not typically maintain standing water, except during and after storm events. The topography is generally level and slopes gently towards Blows Creek, with elevations ranging from 8 ft amsl in the northern portion of the site to 0 ft amsl in the southern portion of the site at Blows Creek. Precipitation averages 43 inches annually and is slightly higher from June to August because of the prevalence of thunderstorms. The [average pH of rain](#)<sup>31</sup> in Virginia is 4.3 (extremely acidic), which is about 10 times more acidic than natural pH of precipitation; however, the pH can vary from week to week (and rainstorm to rainstorm) from 3.5 to 5.0. Surface water at Site 5 drains either naturally via overland flow or through unlined man made drainage ditches to Blows Creek. Vegetated drainage ditches (1 to 3 feet deep) reduce runoff onto the site from adjacent areas.

Site 5 is located in the [dredge fill and Munden-Tetotum soil types](#)<sup>32</sup>. The Navy, USEPA, and VDEQ agreed to evaluate all of Site 5 soil as [dredge fill soil](#)<sup>7</sup>. The dredge fill reportedly originated from the Southern Branch of the Elizabeth River and Blows Creek. There are sporadic areas of low pH in the groundwater and soil at Site 5, which is consistent with pH levels facility-wide. The majority of the low pH levels within SJCA are located in the dredge fill and Munden-Tetotum soil types.

The groundwater within the unconfined Columbia aquifer occurs at relatively shallow depths (less than 1 foot to approximately 6 feet below the ground surface) and discharges locally to nearby surface water. The Yorktown aquifer is also present at Site 5 and within the Blows Creek watershed. A more detailed description of the [groundwater aquifers and potable water supply](#)<sup>6</sup> at SJCA and nearby locales is provided in the RI/HHRA/ERA Report.

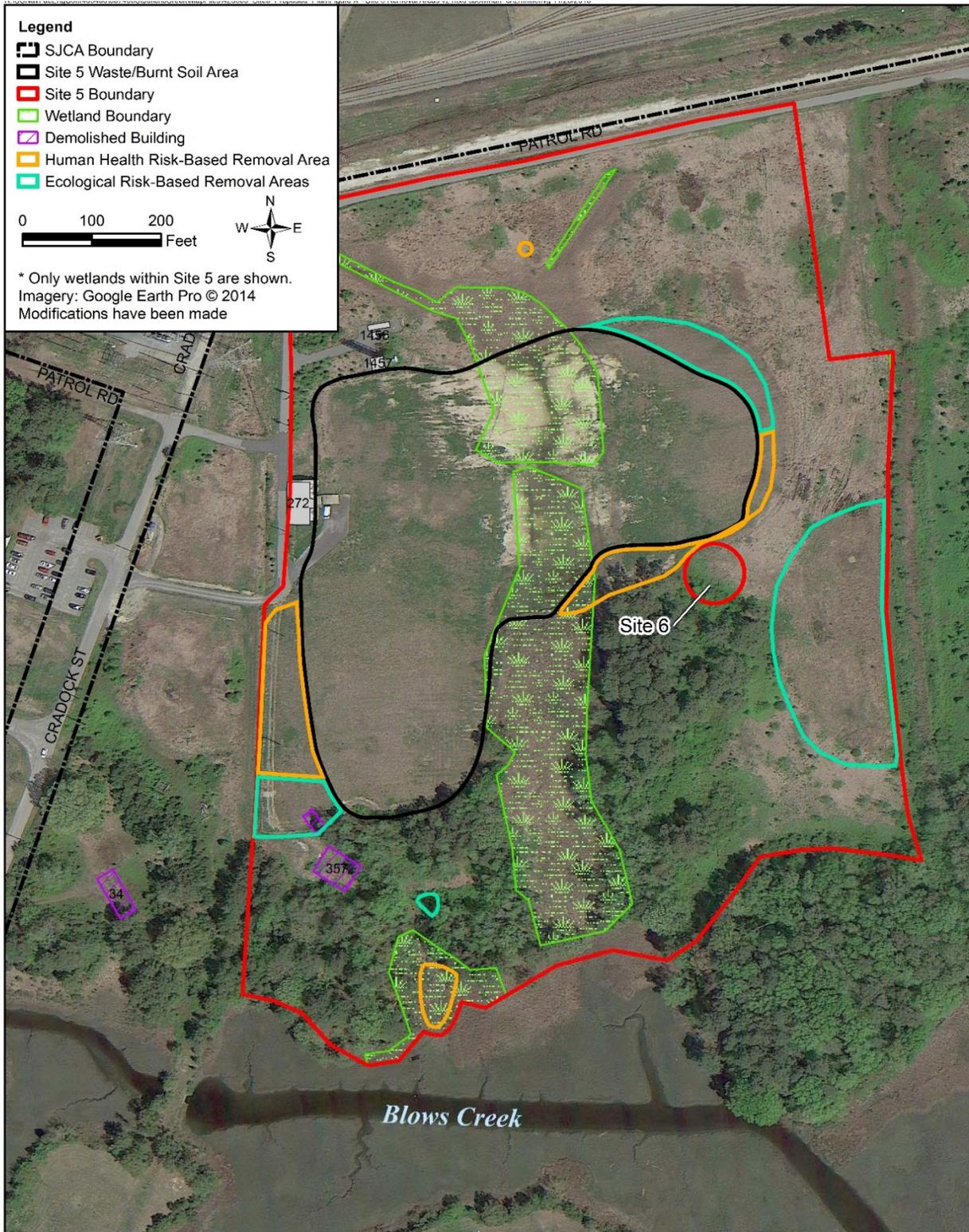
### 2.5.2 Blows Creek

Blows Creek is approximately 4,400 feet in length, measured from the point just north of the facility boundary to the mouth of Blows Creek (**Figure 2**). Aquatic habitats within the Blows Creek watershed are comprised of the main body of Blows Creek and the fringing wetland within the area of tidal influence. The headwaters to Blows Creek originate in the Craddock District, which is a mixed residential/light industrial area located to the north/northwest of SJCA. However, the Blows Creek watershed is dominated by military and residential land uses. Military land use is estimated to comprise 60 percent of the total land use in the Blows Creek drainage basin, while residential land use is estimated to comprise 30 percent of total land use. Fringing marsh surrounds most of the Blows Creek watershed that occurs on military property, while residential development dominates the very upper reaches of this watershed. Commercial/ industrial land uses are estimated to comprise only 10 percent of the total land use in the Blows Creek watershed.

More than 90 percent of Blows Creek is located on SJCA property. Blows Creek is a tributary to the Southern Branch of the Elizabeth River. The Southern Branch of the Elizabeth River passes through highly developed areas upstream and adjacent to SJCA, discharges into the James River (about 7 miles to the north), and ultimately discharges to the southern reaches of the Chesapeake Bay.

The topography of the Blows Creek watershed is relatively flat. Much of the soil within the northeastern portion of the basin, including portions of Site 5, is comprised of dredge fill materials, which are likely to have originated from the Southern Branch of the Elizabeth River. The areas within the Blows Creek watershed not dominated by residential and industrial development consist of mostly mixed upland forest and open field habitats that support a variety of terrestrial species. A more detailed description of the terrestrial and aquatic ecosystems present at Site 5 and within the Blows Creek watershed is provided in the BERA.

FIGURE 3  
Site 5 Removal Areas



## 2.6 Current and Potential Future Land and Water Uses

Currently, Site 5 is seldom used, primarily for radar testing; there are three uninhabited buildings in the northwestern portion of the site that have historically been used for training (Buildings 1456 and 1457) and storage (Building 272). Site 5 currently consists of an open field with a wetland in the central portion and there is currently no planned future land use for Site 5. Blows Creek flows from the central portion of SJCA to the southeast corner of SJCA, where it discharges into the Southern Branch of the Elizabeth River. The land within the portion of the Blows Creek watershed within SJCA is used for military purposes and the water provides aquatic habitats. The land and water use within the Blows Creek watershed is not expected to change in the future. However, future land use such as recreational and operational activities may be implemented for Site 5 and/or Blows Creek.

SJCA and the surrounding area receive treated water purchased through contract from the City of Portsmouth. Groundwater in the vicinity of and at SJCA is not used as a source of domestic water supply. The nearest groundwater well to SJCA is approximately 1-mile upgradient of SJCA in the Potomac aquifer (which is located approximately 500 feet below ground surface), and is used for industrial activities. There are no potential downgradient sources for groundwater use in both the Columbia and Yorktown aquifers (the two aquifers that pertain to environmental investigation at SJCA) because groundwater discharges to the surface water bodies located within or immediately downgradient of SJCA (i.e., Blows Creek, St. Juliens Creek, Southern Branch of Elizabeth River). No surrounding water bodies serve as a water supply to the surrounding areas. However, the Navy acknowledges the Commonwealth of Virginia's and USEPA's expectation to return usable groundwater to its [beneficial use](#)<sup>33</sup> wherever practicable.

## 2.7 Summary of Site Risks

Potential human health and ecological risks at Site 5 were evaluated and documented in the RI/HHRA/ERA for Sites 3, 4, 5, and 6, Expanded RI/HHRA/ERA for Site 5, Addendum to the Expanded RI/HHRA/ERA for Site 5, and Supplemental RI. Potential unacceptable risks to human health and ecological receptors were identified for exposure to soil, upland drainage ditch sediment, and/or groundwater at Site 5, and are discussed in the following subsections. No unacceptable risks were identified from exposure to surface water at Site 5. Potential ecological risks for Blows Creek were evaluated and documented in the BERA for Blows Creek. The following subsections briefly summarize the findings of the human health and ecological risk assessments.

### 2.7.1 Human Health Risk Summary

A HHRA was completed to evaluate potential human health risks from current and future human exposure to soil, groundwater, sediment, and surface water at Site 5. The following [receptor scenarios](#)<sup>7</sup> were evaluated in the HHRA for soil and sediment at Site 5: current/future adult and adolescent trespasser, future adult and child resident, future lifetime resident, and future adult other (industrial or site) worker. For groundwater at Site 5, future adult resident, future child resident, future lifetime resident, and future construction worker exposure scenarios were evaluated.

HHRAs for the upland sites within the Blows Creek watershed (i.e., AOC 1 and Sites 3, 4, 6, and 19) were previously documented in other SJCA reports and resulted in NFA for each of the upland sites. A HHRA was not conducted specifically for Blows Creek media because the results of the investigation of the upland sites within the Blows Creek watershed and conclusion of the BERA eliminated the need. Results of investigations of the upland sites (AOC 1 and Sites 1, 3, 4, 6, and 19) indicated these sites had not impacted Blows Creek (**Table 2**). The ecological risk screening values used in the BERA for the potential site-related contaminants are more conservative (lower) than the human health risk screening values for those contaminants. Therefore, results of the BERA, coupled with the upland sites' investigation results, eliminated the need for an HHRA.

### Soil

Potential unacceptable risks were identified for surface soil at Site 5 from exposure to metals (arsenic, copper, lead, and iron). However, iron was eliminated as a contributor to potential risk in soil because it is an essential nutrient and, even under the most conservative child resident scenario, the exposure levels were below the Recommended

TABLE 4  
Site 5 Cleanup Goals and Confirmation Sample Results Summary

COC	Cleanup Goal (mg/kg)	Maximum Detection of COC following completion of NTCRA (mg/kg)	95% UCL of the Mean Concentration detected following completion of NTCRA (mg/kg)
Arsenic	22	40.5	13.7
Copper	3,043	240	Not Calculated*
Lead	400	412	89.7

mg/kg = milligram per kilogram

\*Value not calculated since maximum detected concentration did not exceed the cleanup goal.

Daily Allowance and maximum level of daily intake. No unacceptable risks were identified from exposure to subsurface soil at Site 5.

A NTCRA was conducted to mitigate the potential unacceptable human health risks associated with metals (arsenic, copper, and lead) in surface soil at Site 5 within the waste/burnt soil area and human health risk-based removal area (**Figure 3**). Cleanup goals were determined using risk-based calculations to ensure that site conditions after the NTCRA would not pose an unacceptable risk to human health under any future land-use scenario. Initially, individual analytical results were compared to the cleanup goals. If any individual results for a COC exceeded the cleanup goal, the 95% UCL of the mean for all of the results for the COC was calculated, and if the result was below the cleanup goal, the cleanup goal was met. Site-specific cleanup goals were met as confirmed by post-removal confirmation samples (**Table 4**). Therefore, no potential unacceptable risk to human health from exposure to soil at Site 5 remains.

### Groundwater

Potential unacceptable risks were identified from exposure to metals (arsenic, cobalt, iron, and manganese) in shallow aquifer groundwater (**Table 5**). Additionally, arsenic was detected at a concentration that exceeded the MCL and lead was detected at a concentration that exceeded the action level. Comparison of metal concentrations at the site to groundwater background values identified iron and manganese as being associated with groundwater background conditions and eliminated them from further consideration as site-related COCs. Therefore, arsenic, cobalt, and lead were initially identified as COCs. However, based on the multiple lines of evidence presented below for the groundwater data collected during the Supplemental RI, arsenic, cobalt, and lead were eliminated as COCs.

#### *Arsenic*

The following lines of evidence were used to demonstrate arsenic in groundwater is a naturally occurring substance and eliminate arsenic from further consideration as a site-related COC:

- Although total arsenic concentrations were detected above the MCL (10 µg/L), the concentrations only slightly exceeded the MCL (10.1 µg/L at SJS05-MW02S and 11 µg/L at SJS05-MW05S) and are similar in magnitude to the SJCA 95 percent background UTL (8 µg/L); therefore, arsenic is naturally present in site groundwater
- The dissolved arsenic concentrations were below the MCL
- The location where the highest arsenic concentration was detected was a well that is crossgradient of the area where waste disposal and burning operations occurred, and in an area where no other historical contaminant releases are known to have occurred; therefore, the arsenic concentrations are considered background and not a result of CERCLA site-related operations
- Although arsenic was identified as a potential risk driver because the reasonable maximum exposure (RME) hazard indexes (HIs) and the RME excess lifetime cancer risk slightly exceed 1 and  $1 \times 10^{-4}$  (HI = 2 and Cancer Risks =  $2 \times 10^{-4}$ ), the central tendency exposure (CTE) HIs are less than 1, and the CTE excess lifetime cancer risk is less than  $1 \times 10^{-4}$

TABLE 5  
Summary of Unacceptable Human Health Risks in Shallow Aquifer Groundwater

Receptor	Exposure Route	Cancer Risk	Chemicals with Cancer Risks >10 <sup>-4</sup>	Hazard Index	Chemicals with Hazard Index >1
<b>Reasonable Maximum Exposure (RME)</b>					
Future Resident (Adult)	Ingestion	NA		9	Cobalt (4), Iron (2), Manganese (2)
	Dermal Contact	NA		0.4	
	Inhalation	NA		NA	
	Total	NA		10	
Future Resident (Child)	Ingestion	NA		15	Arsenic (2), Cobalt (7), Iron (3), Manganese (3)
	Dermal Contact	NA		0.4	
	Total	NA		16	
Future Lifetime Resident (Child/Adult)	Ingestion	2E-04	Arsenic (2E-04)	NA	
	Dermal Contact	2E-06		NA	
	Total	2E-04		NA	
Future Construction Worker	Dermal Contact	6E-08		0.4	
	Total	6E-08		0.4	
<b>Central Tendency Exposure (CTE)</b>					
Future Resident (Adult)	Ingestion	NA		4	Cobalt (2)
	Dermal Contact	NA		0.1	
	Total	NA		4	
Future Resident (Child)	Ingestion	NA		6	Cobalt (3)
	Dermal Contact	NA		0.3	
	Total	NA		6	
Future Lifetime Resident (Child/Adult)	Ingestion	5E-05	Arsenic (5E-05)	NA	
	Dermal Contact	7E-07		NA	
	Total	6E-05		NA	

### *Cobalt*

The following lines of evidence were used to demonstrate cobalt in groundwater is a naturally occurring substance and eliminate cobalt from further consideration as a site-related COC:

- The highest detected concentrations in groundwater of total cobalt (23.3 µg/L and 40.9 µg/L), which is a natural element found in the environment, were similar in magnitude to the SJCA 95 percent background UTL of 15.8 µg/L; therefore, cobalt is naturally present
- Cobalt concentrations in the groundwater within the waste disposal/burning area were not elevated, and cobalt was not identified as a COC in the soil; therefore, the waste disposal/burning area does not appear to be the source of cobalt in groundwater
- The highest detected concentrations of cobalt were located within the area of shallow aquifer groundwater that has low pH; the low pH is attributed to factors such as the relatively low pH in the rainfall, and it is the low pH that is mobilizing naturally present cobalt

### *Lead*

The following lines of evidence were used to eliminate lead from further consideration as a site-related COC:

- The detected concentration of total lead (17.2 µg/L) that exceeded the action level of 15 µg/L is only slightly above the action level; however, the dissolved lead concentration at that location is below the action level and lead was not identified as a COC in the HHRA
- The Integrated Exposure Update Biokinetic (IEUBK) model demonstrated a typical child, exposed to average concentrations of lead in site groundwater, will have a blood lead level less than the level associated with adverse health effects (i.e., 10 micrograms per deciliter)
- The location of the detection that exceeded the action level was a well that is sidegradient of the area where waste disposal and burning operations occurred, and in an area where no other historical contaminant releases are known to have occurred; therefore, the lead concentrations are considered background and not a result of CERCLA site-related operations

Based on these considerations, the evaluation of the data indicates that the release from the CERCLA site operation (waste disposal and burning) has not significantly impacted the shallow aquifer groundwater at Site 5, and that the concentrations of metals in the shallow aquifer groundwater are the result of naturally occurring site conditions (e.g., naturally occurring substances in their unaltered forms, or altered solely through naturally occurring process or phenomenon, in a location where they are naturally found). Therefore, the Navy and USEPA, in consultation with VDEQ, agree that CERCLA does not provide the authority to take remedial action pursuant to CERCLA Section 104(a)(3)(A) and NFA is warranted to address these constituents in shallow aquifer groundwater at Site 5.

### **Sediment**

Potential unacceptable risks were identified from exposure to metals (arsenic and iron) in upland drainage ditch sediment. However, evaluation of the data using sediment exposure values was not representative of existing conditions because the evaluation assumes that the sediment is wet, which results in a higher adherence factor compared to soil. The upland drainage ditches are generally dry and the material sampled was not wet. Therefore, the data were re-evaluated using soil exposure values and only arsenic was identified as a potential risk driver. The NTCRA mitigated the potential unacceptable human health risks associated with arsenic in sediment at Site 5 within the waste/burnt soil area and human health risk-based removal area (**Figure 3**). Cleanup goals were met during the NTCRA, as confirmed by post-removal confirmation samples (**Table 4**). Therefore, no potential unacceptable human health risk from exposure to sediment at Site 5 remains.

## Surface Water

No unacceptable human health risks were identified for surface water at Site 5.

### 2.7.2 Ecological Risk Summary

A BERA was completed in order to identify potential unacceptable ecological risks for ecological receptors exposed to surface soil, surface water, and sediment at Site 5, and for surface water (including groundwater discharged to surface water) and sediment in Blows Creek. The following receptors were evaluated in the BERA for surface soil, surface water, and sediment at Site 5: lower trophic level receptors (plant and soil invertebrates); aquatic receptors (invertebrates and fish); avian and mammalian insectivores, omnivores, piscivores, and carnivores; and mammalian herbivores. The BERA evaluated the avian piscivores and benthic-dwelling organisms receptors for surface water and sediment in Blows Creek.

## Surface Soil

Potentially unacceptable risks to lower trophic level receptors (plant and soil invertebrates), avian insectivores, and mammalian insectivores were identified for exposure to the following chemicals of potential concern (COPCs) in surface soil: metals (aluminum, antimony, arsenic, barium, beryllium, chromium, cobalt, copper, cyanide, iron, lead, mercury, nickel, selenium, silver, thallium, vanadium, and zinc) and pesticides (4,4-dichlorodiphenyldichloroethene [DDE] and 4,4-dichlorodiphenyltrichloroethane [DDT]). The NTCRA mitigated the potential unacceptable ecological risks associated with exposures to surface soils by removing contaminated soil within the ecological risk-based removal areas to a depth of 1 foot and replacing it with clean fill (**Figure 3**). This action reduced the site-wide average concentrations of the COPCs remaining in place (in combined surface soil and sediment) to an acceptable level, as documented in the EE/CA and Action Memorandum. Therefore, no potential unacceptable risks to ecological receptors from exposure to surface soil remain at Site 5.

## Sediment

Potentially unacceptable risks to aquatic receptors (invertebrates and fish) were identified at Site 5 from exposure the following COPCs in sediment: metals (arsenic, barium, beryllium, chromium, copper, cyanide, iron, lead, mercury, thallium, and zinc) and pesticides (4,4-Dichlorodiphenyldichloroethane [DDD], 4,4-DDE, 4,4-DDT, dieldrin, and endrin aldehyde). The NTCRA mitigated these potential risks by removing sediment to a depth of 1 foot within the ecological risk-based removal areas and replacing it with clean fill (**Figure 3**). This action reduced the site-wide average concentrations of the COPCs remaining in place (in combined surface soil and sediment) to an acceptable level, as documented in the EE/CA and Action Memorandum. Therefore, no potential unacceptable risks to ecological receptors from exposure to sediment remain at Site 5.

Sediment data collected in Blows Creek during the BERA were evaluated along with data from background and site-specific (Sites 1, 4, and 5) investigations to evaluate potential risks to benthic-dwelling organisms and avian piscivores.

SVOCs (primarily PAHs), pesticides, PCBs, and several metals were detected in Blows Creek sediment at concentrations exceeding ecological screening values, indicating the potential for adverse effects to benthic-dwelling organisms. However, based on the low frequency and magnitude of these exceedances, and the fact that bioassay results did not show a clear relationship between chemical concentrations in sediment and bioassay organism response, which suggests that the bioassay organisms are not being impacted by the presence of site-related chemicals in sediment, it was concluded that there were no unacceptable risks to benthic-dwelling organisms.

Elevated mercury concentrations detected in sediment from the upper reaches of Blows Creek and near the mouth of Blows Creek adjacent to the Site 4 drainage ditch indicated a potential for adverse effects to avian piscivores (belted kingfisher) during a preliminary screening, which used modeled fish tissue concentrations. However, risks estimated using mercury concentrations measured in actual fish tissue collected from the creek did not indicate the potential for adverse effects to avian piscivores. Therefore, the BERA concluded that there are no unacceptable risks to avian piscivores from the presence of mercury in Blows Creek sediment. Additionally, mercury

concentrations detected within Blows Creek sediment were below the 95 percent UTL concentrations detected in both the nearby St. Juliens Creek and the dredge fill soils (which represent background conditions).

In addition, NTCRAs have been completed at Sites 3, 5, 6, and 19, and a RA has been completed at Site 4 within the Blows Creek watershed. These actions removed contaminated soil and sediment in upland areas that had the potential to act as a future source of contamination to Blows Creek if left in place.

### Surface Water

Because surface water is transient at Site 5, and the drainage ditches provide minimal ecological habitat, no unacceptable ecological risks were identified for surface water at Site 5. Therefore, no action is necessary to address potential ecological risks from exposure to surface water at Site 5. In addition, the BERA conducted for Blows Creek concluded that no unacceptable risks were attributable to Blows Creek surface water, and no action was warranted.

## 2.8 No Further Action Determination

Exposure to soil, groundwater, surface water, and sediment at Site 5, and surface water and sediment in Blows Creek, poses no unacceptable site-related risk to human health or the environment (**Table 6**). Metals in shallow aquifer groundwater are naturally occurring and a result of natural processes; therefore, CERCLA does not provide authority to take action to reduce metals concentrations in the groundwater. As a result, the Navy, in partnership with the USEPA Region 3 and VDEQ, agrees that NFA is required under CERCLA for Site 5 and Blows Creek. No further remedial response action and no restrictions on any land use are necessary under CERCLA at Site 5 or Blows Creek.

## 2.9 Documentation of Significant Changes

The Proposed Plan for Site 5 and Blows Creek was released for public comment on November 15, 2015. No comments were received during the public meeting on December 3, 2015 and no additional written comments, concerns, or questions were received from community members during the public comment period. It was determined that no significant changes to the Proposed Plan were necessary or appropriate.

TABLE 6  
Summary of No Further Action Rationale

Media	Risk	COPC/COC	NFA Rationale
Soil (Site 5)	Human Health	arsenic, copper, iron, lead (surface soil)	Surface soil was removed during the NTCRA. Confirmation samples confirmed site-specific cleanup goals were met, either due to the COC concentrations in individual samples not exceeding the cleanup goal (i.e., copper) or, for COCs with individual detections exceeding the cleanup goal (i.e., arsenic and lead), the 95 percent UCL of the mean of all of the analytical results for the COC being below the cleanup goal ( <b>Table 4</b> ).
	Ecological	metals and pesticides (surface soil)	No unacceptable risks were identified from exposure to subsurface soil. Soil was removed to a depth of 1 foot and replaced with clean fill during the NTCRA. This action resulted in the site-wide average concentrations of the COPCs remaining in place (in combined surface soil and sediment) being reduced to an acceptable level, as documented in the EE/CA and Action Memorandum.
Sediment (Site 5)	Human Health	arsenic	Sediment was removed during the NTCRA. Confirmation samples confirmed site-specific cleanup goals were met. While the maximum concentration of arsenic exceeded the cleanup goal, the 95 percent UCL of the mean of all of the arsenic analytical results was below the cleanup goal ( <b>Table 4</b> ).
	Ecological	metals and pesticides	Sediment was removed to a depth of 1 foot and replaced with clean fill during the NTCRA. This action reduced the site-wide average concentrations of metals and pesticides remaining in place in the combined surface soil and sediment to an acceptable level, as documented in the EE/CA and Action Memorandum.

TABLE 6  
Summary of No Further Action Rationale

Media	Risk	COPC/COC	NFA Rationale
Sediment (Blows Creek)	Human Health	---	No unacceptable risks identified.
	Ecological	---	No unacceptable risks identified.
Groundwater (Site 5)	Human Health	arsenic, cobalt, lead, iron, manganese	Comparison of metal concentrations at the site to groundwater background values identified iron and manganese as being naturally occurring and eliminated them from further consideration as site-related COCs.
			Multiple lines of evidence (see Section 2.7.1 Groundwater sub-section) indicate release from CERCLA site-related operations (waste disposal and burning) has not significantly impacted shallow aquifer groundwater, and concentrations of metals (arsenic, cobalt, and lead) in shallow aquifer groundwater are the result of naturally occurring site conditions.
Surface Water (Site 5)	Human Health	---	No unacceptable risks identified.
	Ecological	---	No unacceptable risks identified.
Surface Water (Blows Creek)	Human Health	---	No unacceptable risks identified.
	Ecological	---	No unacceptable risks identified.

### 3. Responsiveness Summary

The participants in the Proposed Plan public meeting held on December 3, 2015, included representatives of the Navy, USEPA, and VDEQ. No questions or comments were received during the public meeting. There were no additional written comments, concerns, or questions received from community members during the public comment period.

**Appendix A**  
**Acronyms and Abbreviations**

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## Acronyms and Abbreviations

AOC	area of concern
BERA	Baseline Ecological Risk Assessment
CCR	Construction Completion Report
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
COC	chemical of concern
COPC	chemical of potential concern
CTE	central tendency exposure
EE/CA	Engineering Evaluation/Cost Analysis
ERA	Ecological Risk Assessment
ERD	enhanced reductive dechlorination
ERI	Expanded Remedial Investigation
ERP	Environmental Restoration Program
HHRA	Human Health Risk Assessment
HI	hazard index
JV I	Agviq-CH2M HILL Joint Venture I
LUC	land use control
MCL	maximum contaminant level
mg/kg	milligram per kilogram
MRP	Munitions Response Program
NAVFAC	Naval Facilities Engineering Command
Navy	Department of the Navy
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEESA	Naval Energy and Environmental Support Activity
NFA	no further action
NNSY	Norfolk Naval Shipyard
NPL	National Priorities List
NTCRA	non-time critical removal action
OU	Operable Unit
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
RA	Remedial Action
RAB	Restoration Advisory Board
RACR	Remedial Action Completion Report
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RFA	RCRA Facility Assessment
RI	Remedial Investigation
RME	reasonable maximum exposure
ROD	Record of Decision
SJCA	St. Juliens Creek Annex
SMP	Site Management Plan
SSA	Site Screening Assessment
SVOC	semi-volatile organic compound
SWMU	solid waste management unit

## ACRONYMS AND ABBREVIATIONS

UCL	upper confidence limit
USEPA	United States Environmental Protection Agency
UTL	upper tolerance limit
UXO	unexploded ordnance
VDEQ	Virginia Department of Environmental Quality
VOC	volatile organic compound



# References

Item	Reference Phrase(s) in ROD	Location(s) in Referenced Document	Identification of Referenced Document Available in the Administrative Record file
1	status of all of the ERP sites	Section 3	CH2M HILL. 2015. Site Management Plan for Fiscal Years 2016 through 2020, St. Juliens Creek Annex, Chesapeake, Virginia. August.
2	evaluation indicated	Section VI	Naval Energy and Environmental Support Activity (NEESA). 1981. Navy Assessment and Control of Installation Pollutants: Initial Assessment Study of St. Juliens Creek Annex, Norfolk Naval Shipyard, Portsmouth, Virginia. NEESA 13-001. August.
3	recommended additional investigation	Section 7	A.T. Kearney, Inc. and K.W. Brown and Associates, Inc. 1989. <i>Phase II RCRA Facility Assessment of the St. Juliens Creek Annex Facility, Chesapeake, Virginia</i> . March.
4	historical aerial photograph review	Pages 30-43	USEPA. 1995. <i>Aerial Photographic Site Analysis, Norfolk Naval Shipyard: Annex Areas, Norfolk, Virginia</i> . February.
5	detected	Tables 4-9 and 4-10	CH2M HILL. 1996. <i>Relative Risk Ranking System Data Collection Report, St. Juliens Creek Annex, Chesapeake, Virginia</i> . April.
6	additional soil and groundwater sampling groundwater aquifers and potable water supply	Section 9 Section 4	CH2M HILL. 2003. Final Remedial Investigation/Human Health Risk Assessment/Ecological Risk Assessment for Site 5, St. Juliens Creek Annex, Chesapeake, Virginia. March.
7	Potential unacceptable risks dredge fill soil receptor scenarios	Section 4 Section 2 Sections 4 and 5	CH2M HILL. 2006. Final Expanded Remedial Investigation/Human Health Risk Assessment/Ecological Risk Assessment for Site 5, St. Juliens Creek Annex, Chesapeake, Virginia. June
8	NFA	Revised HHRA Section	CH2M HILL. 2007. Addendum to the Expanded Remedial Investigation/Human Health Risk Assessment/Ecological Risk Assessment for Site 5, St. Juliens Creek Annex, Chesapeake, Virginia. June.
9	recommended alternative	Section 6	CH2M HILL. 2007. Final Engineering Evaluation/Cost Analysis for Site 5 Waste/Burnt Soil Area, St. Juliens Creek Annex, Chesapeake, Virginia. February.
10	changes to the initial recommended alternative	Section III	CH2M HILL. 2010. Change in Scope of the Responses and Ceiling Increase Action Memorandum for Site 5 Waste/Burnt Soil Area and Impacted Surface Soil and Sediment Areas. November.

REFERENCES

Item	Reference Phrase(s) in ROD	Location(s) in Referenced Document	Identification of Referenced Document Available in the Administrative Record file
11	completion of the NTCRA	Section 4	CH2M HILL. 2012. Final Construction Completion Report Site 5 Removal Action, St. Juliens Creek Annex, Chesapeake, Virginia. December.
12	NFA	Section 7	CH2M HILL. 2015. Final Site 5 Supplemental Remedial Investigation Report, St. Juliens Creek Annex, Chesapeake, Virginia. March.
13	determined to require NFA	Sections 2, 3, 11, and 18	CH2M HILL. 2002. Final Site Screening Assessment Report, St. Juliens Creek Annex, Chesapeake, Virginia. April.
14	NFA was required	Conclusions	CH2M HILL. 2002. Site Screening Assessment Report Addendum, Site 1, Waste Disposal Area A, St. Juliens Creek Annex, Chesapeake, Virginia. April.
15	NFA was required No-action determination	Section 7	CH2M HILL. 2004. Final Site Investigation Report for Sites 8, 19, 21 and AOC 1, St. Juliens Creek Annex, Chesapeake, Virginia. June.
16	all potential risks to human and ecological receptors had been mitigated	Section 4	CH2M HILL. 2004. Final Site 3 Confirmation Closeout Report, St. Juliens Creek Annex, Chesapeake, Virginia. August.
17	selected remedy No-action ROD	Section 1.3	CH2M HILL. 2006. Final Record of Decision for Site 3, Waste Disposal Area C, St. Juliens Creek Annex, Chesapeake, Virginia. February.
18	selected remedy Action ROD	Section 1.4	Naval Facilities Engineering Command (NAVFAC). 2004. Final Record of Decision for Site 4, Landfill D, St. Juliens Creek Annex, Chesapeake, Virginia. September.
19	RA	Section 3	JV I. 2005. Final Construction Closeout Report, Site 4, Landfill Soil Cover, St. Juliens Creek Annex, Chesapeake, Virginia. December.
20	completion of the RA	Section 4	NAVFAC. 2006. Final Remedial Action Completion Report, Site 4, Landfill D, St. Juliens Creek Annex, Chesapeake, Virginia. September.
21	eliminated any potential risks	Sections 3 and 4	CH2M HILL. 2003. Site 6 Closeout Report and Site 3 Removal Summary, St. Juliens Creek Annex, Chesapeake, Virginia. March.
22	selected remedy No-action ROD	Section 1.3	NAVFAC. 2003. Final Record of Decision for Site 6, Small Arms Unit, St. Juliens Creek Annex, Chesapeake, Virginia. July.
23	NTCRA	Section 3	JV I. Final Construction Closeout Report for Site 19 Removal Action, St. Juliens Creek Annex, Chesapeake, Virginia. July.
24	NFA No-action determination	Section 2.7	CH2M HILL. 2006. Final Closeout Report for Site 19, St. Juliens Creek Annex, Chesapeake, Virginia. December.
25	does not pose an unacceptable risk	Section 6	CH2M HILL. 2006. Final Baseline Ecological Risk Assessment for Blows Creek Watershed, St. Juliens Creek Annex, Chesapeake, Virginia. December
26	NFA	Appendix C	Department of Defense (DoD). 2004. Final Federal Facility Agreement, St. Juliens Creek Annex, Chesapeake, Virginia. March. (Signed July 2004.)
27	Action ROD	Section 1.4	NAVFAC. 2011. Final Record of Decision for Site 2: Waste Disposal Area B, St. Juliens Creek Annex, Chesapeake, Virginia. January.

Item	Reference Phrase(s) in ROD	Location(s) in Referenced Document	Identification of Referenced Document Available in the Administrative Record file
28	Action ROD	Section 1.4	NAVFAC. 2011. Final Record of Decision for Site 21: Industrial Area, St. Juliens Creek Annex, Chesapeake, Virginia. October.
29	No-action determination	Sections 4.6, 5.6, and 6.6	CH2M HILL. 2004. Final Site Screening Assessment Report Addendum at AOCs 13, 14, and K, St. Juliens Creek Annex, Chesapeake, Virginia. June.
30	No-action determination	Section 8	CH2M HILL. 2013. Final Expanded Site Inspection Report Munitions Response Program Area UXO 1, St. Juliens Creek Annex, Chesapeake, Virginia. June.
31	average pH of rain	"Always On the Move"	Virginia Department of Conservation & Recreation. 2014. <i>Virginia's Natural Resources Education Guide</i> , Chapter 2, Virginia's Air Resources. <a href="http://www.deq.virginia.gov/Portals/0/DEQ/ConnectWithDEQ/EnvironmentalInformation/VirginiaNaturally/Guide/chapter2.pdf">http://www.deq.virginia.gov/Portals/0/DEQ/ConnectWithDEQ/EnvironmentalInformation/VirginiaNaturally/Guide/chapter2.pdf</a>
32	dredge fill and Munden-Tetotum soil types	Figure 1-3	CH2M HILL. 2001. Final Background Investigation Report, SJCA, Chesapeake, Virginia. October.
33	beneficial use	40 CFR 300.430 (a) (1)(iii)(f). VA. Code § 62.1-44.2.	USEPA. 1994. National Oil and Hazardous Substances Pollution Contingency Plan. 40 CFR 300.430 (a) (1)(iii)(f). VA. Code § 62.1-44.2.

Detailed site information referenced in this ROD in bold blue text is contained in the Administrative Record file.

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