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NAB LITTLE CREEK
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FINAL RECORD OF DECISION FOR SOLID WASTE MANAGEMENT UNIT 7B SMALL BOATS SANDBLAST YARD DESERT COVE JEB LITTLE CREEK VA

9/1/2013

CH2M HILL

Final

Record of Decision

SWMU 7b – Small Boats Sandblast Yard (Desert Cove)

Joint Expeditionary Base Little Creek
Virginia Beach, Virginia
September 2013

1. Declaration

This Record of Decision (ROD) presents the No Further Action determination for Solid Waste Management Unit (SWMU) 7b – Small Boats Sandblast Yard (Desert Cove), at Joint Expeditionary Base (JEB) Little Creek, Virginia Beach, Virginia, herein referred to as SWMU 7b. The former Naval Amphibious Base (NAB) Little Creek (now referred to as JEB Little Creek) was placed on the United States Environmental Protection Agency (USEPA) National Priorities List (NPL) effective May 10, 1999 (USEPA ID: VA5170022482). This 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 (SARA), 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 file for JEB Little Creek.

On October 1, 2009, Hampton Roads' first Joint Base was established. This new installation comprises the former NAB Little Creek and the former Army post Fort Story; the new name is JEB Little Creek-Fort Story. With the forming of this new command, the Department of the Navy (Navy) assumes responsibility for managing both properties and merged public meetings regarding the ongoing environmental restoration. However, separate records are maintained to ensure the integrity of ongoing efforts at both properties. When required for public notices and distributions, the former bases are identified as JEB Little Creek-Fort Story. For Environmental Restoration Program (ERP) documents, the bases are referred to separately as JEB Little Creek and JEB Fort Story. This ROD contains information associated with the ERP at JEB Little Creek and does not discuss the ERP at JEB Fort Story.

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

1.1 Description of the Selected Remedy

Based on investigation results, the completion of a Non-Time-Critical Removal Action (NTCRA), and risk management decisions made by the Navy, USEPA, and VDEQ at SWMU 7b, no CERCLA-related unacceptable risk to human health or the environment remains at SWMU 7b under current site conditions. Because there is no unacceptable CERCLA-related risk to human health and the environment at SWMU 7b, no further remedial action is required under CERCLA. No remedial action will be performed at SWMU 7b and no CERCLA-imposed restrictions on land use or exposure will be required.

1.2 Statutory Determinations

The Navy and USEPA, in consultation with VDEQ, have determined that no remedial action is necessary at SWMU 7b. The removal action at SWMU 7b, comprising the removal of contaminated sediment and placement of clean sand, has eliminated the potential for contaminant transport and mitigated the potential threat to human health and the environment. Therefore, there is no need to conduct further remedial action. Because the removal action resulted in no hazardous substances, pollutants or contaminants remaining onsite above levels that allow for unlimited use and unrestricted exposure, five-year reviews will not be required.

1.3 Authorizing Signatures

F.E. Hughlett
Captain, United States Navy
Commander
Joint Expeditionary Base Little Creek-Fort Story

19SEP13
Date

Paul Leonard, Director
Hazardous Site Cleanup Division
EPA (Region 3)

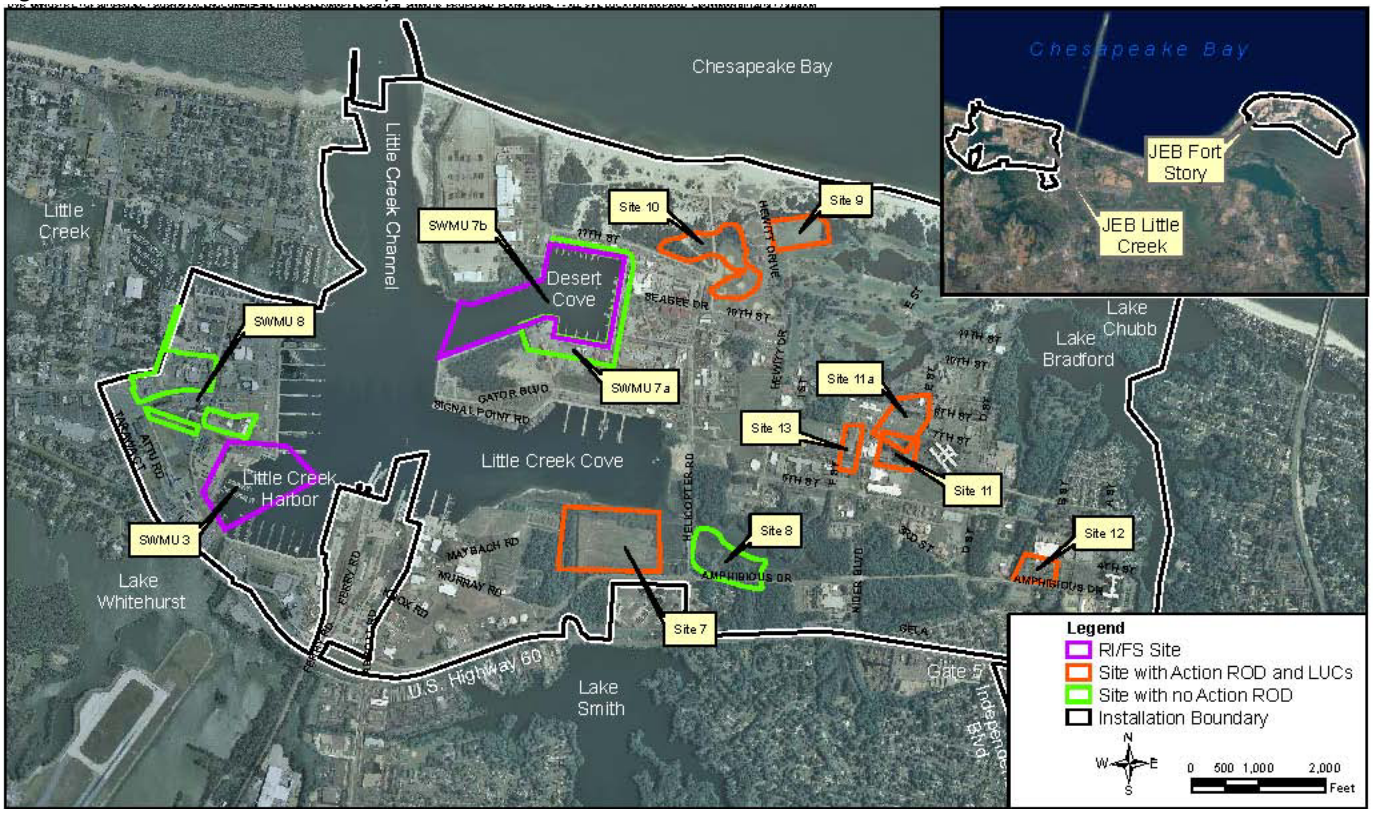
SEP 30 2013
Date

2. Decision Summary

2.1 Site Description and History

JEB Little Creek consists of 2,215 acres located in the northwest corner of Virginia Beach, Virginia, adjacent to the Chesapeake Bay (**Figure 1**). The western boundary of JEB Little Creek borders the City of Norfolk, Virginia. JEB Little Creek is primarily an industrial facility that provides logistic and support services to 18 home-ported ships and 155 shore-based resident commands. The area surrounding the facility is low-lying and relatively flat. JEB Little Creek is bounded on the north by the Chesapeake Bay, on the west by residential communities and several marinas, on the south by Shore Drive, Lake Whitehurst, Lake Smith, Norfolk International Airport, and residential development, and on the east by Lake Bradford.

Figure 1- SWMU 7b Location Map



SWMU 7, Small Boats Sandblast Yard, is located at the intersection of Intercove Road and Signal Point Road in the north-central portion of JEB Little Creek (**Figure 2**). As a result of previous investigations conducted at the site, the Navy, in partnership with USEPA and VDEQ, agreed to separate the terrestrial and aquatic portions of SWMU 7 into SWMUs 7a and 7b, respectively. SWMU 7a addresses groundwater and soil, and SWMU 7b addresses surface water and sediment. Following an Interim Removal Action in September 2004 to address lead-contaminated soil, the Navy and EPA, in consultation with the VDEQ, agreed that **no further action was required for SWMU 7a**[1], and a ROD documenting that decision was signed in June 2005 (Navy, 2005). This ROD has been prepared for SWMU 7b aquatic media (surface water and sediment).

SWMU 7 was used to sandblast and paint ships until 1996, when sandblasting activities were moved to an indoor sandblasting facility in building CB-125. Approximately 4,000 cubic yards (yd^3) of spent abrasive blast material (ABM) generated between 1960 and 1982 were stored in open piles in what is now the footprint of building CB-125 and in the area of buildings CB-317 and CB-318 while awaiting toxicity characterization prior to disposal. Results of toxicity characterization indicated the spent ABM was non-hazardous. There is no record of release

controls employed at SWMU 7 for the spent ABM; therefore, spent ABM was historically released to surrounding soils and Desert Cove.

2.2 Previous Investigations

Environmental investigations were initiated at JEB Little Creek (former NAB Little Creek) under the Navy Assessment and Control of Installation Pollutants Program in 1984. SWMU 7 (as SWMU 7, SWMU 7a, and SWMU 7b) was characterized as part of several investigations and studies between 1989 and 2012. **Table 1** provides a chronological list and summary of previous investigations and studies specific to SWMU 7b and sediment sample locations are depicted on **Figure 3**. The respective investigations are a part of the Administrative Record file for JEB Little Creek, which can be referenced for further details regarding specific sampling strategies, media investigations, and when and where sampling was performed.

Figure 2- SWMU 7b Boundary and Immediate Vicinity

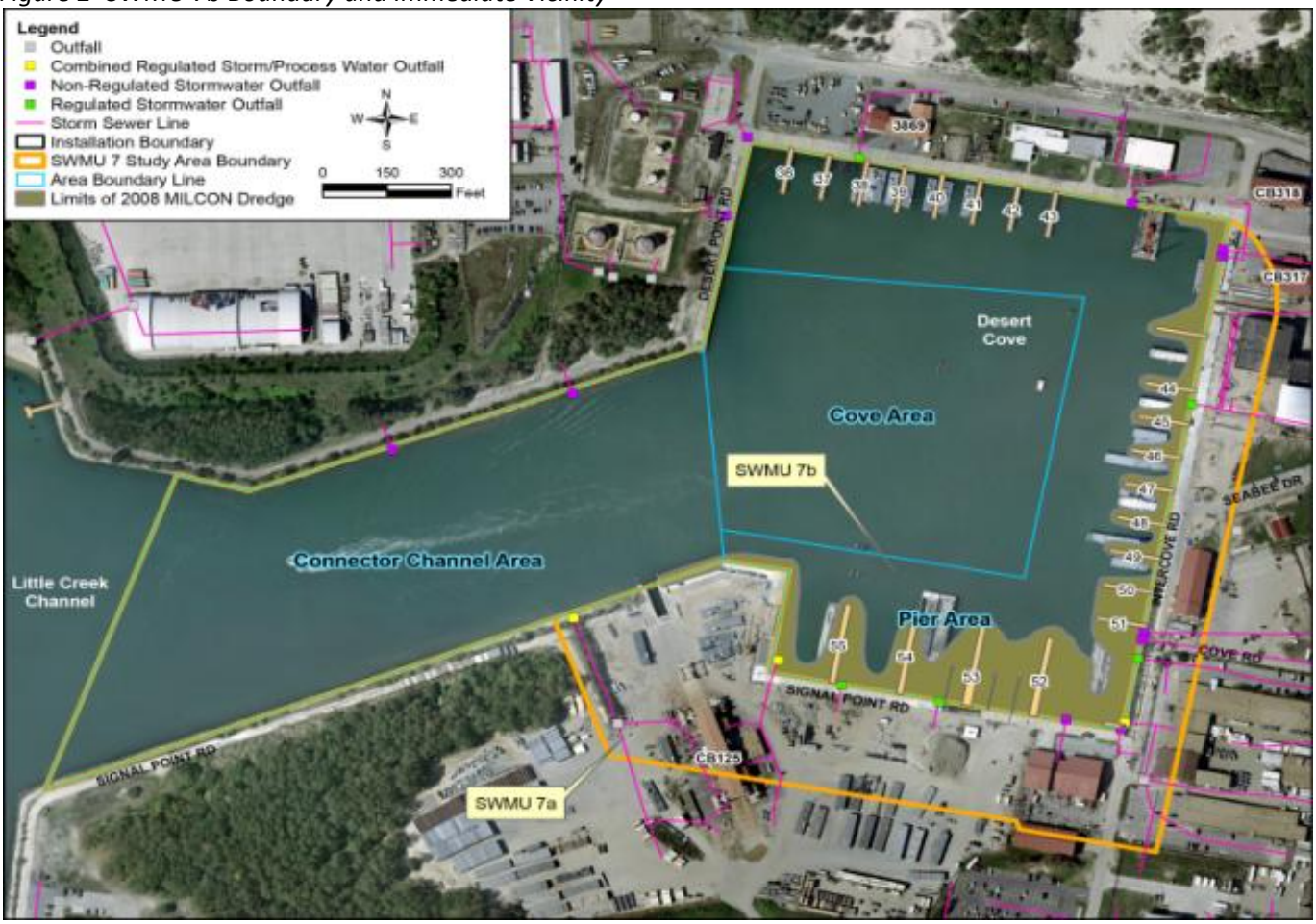


Figure 3- SWMU 7b Sediment Samples

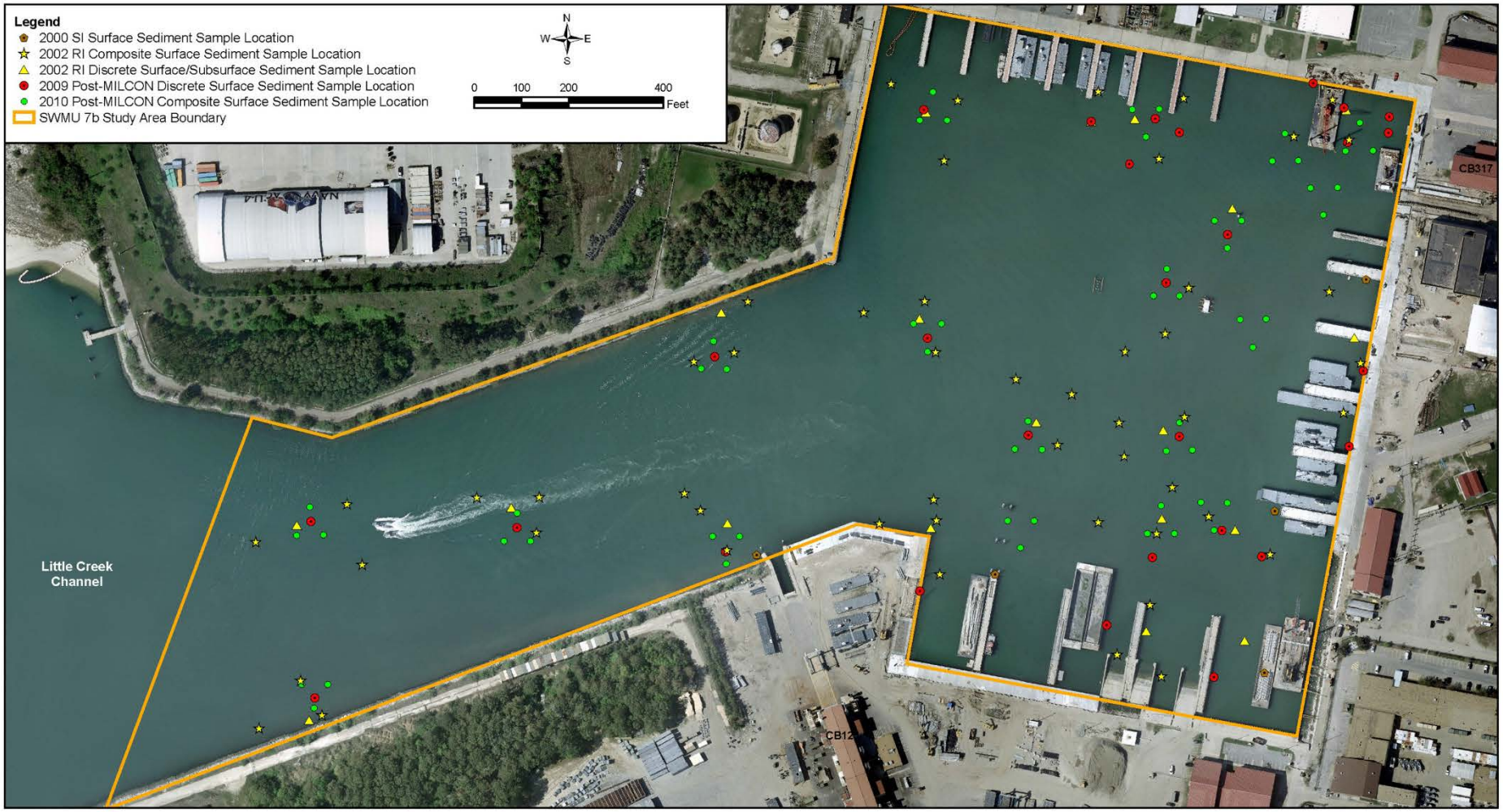


Table 1- Studies, Investigations, and Activities Summary

Study/Investigation/ Activity*	AR Document Number	Investigation Activities
Final Site Investigation (SI), SWMU 7 and SWMU 8 (CH2M HILL, 2001a)	000543	Sediment samples were collected and analyzed for metals, polycyclic aromatic hydrocarbons (PAHs), grain size, pH, and total organic carbon (TOC) to verify the presence or absence of contamination and to conduct a human health risk screening. Metals and PAHs were detected in sediment above human health screening criteria and identified as contaminants of potential concern (COPCs). Additionally, ABM was observed in sediment. A technical memorandum Preliminary Delineation of Abrasive Blast Material, SMWU 8-West Annex Sandblast Area is included as part of the SI. The memorandum documents the results of blast grit (ABM) samples collected for disposal characterization. The ABM was found to be non-hazardous. The SI recommended a Screening Ecological Risk Assessment (ERA) to identify potentially complete exposure pathways for plants and animals ("ecological receptors") and a Remedial Investigation (RI) to define the nature and extent of contamination.
Draft Screening and Baseline Ecological Risk Assessment (ERA) for SWMUs 7 and 8 (CH2M HILL, 2001b)	001031	A Screening ERA and Baseline ERA, constituting Steps 1 through 3 of the ERA process, were completed using data collected as part of the SI. Metals and PAHs in sediment exceeded ecological screening values. The Baseline ERA concluded that **potentially unacceptable risks to benthic invertebrates[2],** organisms without a backbone living on the floor of a water body (i.e., clams and polychaete worms), were identified associated with exposure to select metals and PAHs in sediment. Potential risks to upper-trophic-level aquatic receptors (humans or animals that are at the upper end of the food chain) were negligible.
Final Remedial Investigation (RI), Human Health Risk Assessment (HHRA), and Ecological Risk Assessment (ERA) for SWMU 7 – Small Boats Sandblasting Yard (CH2M HILL, 2004)	000653	During the RI/HHRA/ERA, SWMU 7b was divided into three areas – the Connector Channel, Cove, and Pier Areas – to better evaluate potential risks where exposures could vary because of differences in the magnitude of contaminant levels (**Figure 2**). Sediment samples were collected in each area and analyzed for metals, PAHs, ammonia, grain size, pH, and TOC to define the nature and extent of contamination and to evaluate potential human health and ecological risks. Because of the tidal nature of the water body and numerous stormwater outfall drainage locations, surface water samples were not collected, as it could not be determined if any detected contaminants were from SWMU 7 or non-site-related sources. Some ABM was observed in sediment throughout the Connector Channel and Cove Areas, with greater ABM concentrations noted in the Pier Area adjacent to Pier 53. Metals and PAHs were detected above human health and ecological screening levels in all three areas; however, the quantitative HHRA identified **no unacceptable human health risks from exposure to sediment[3]**. The ERA (through Step 3A) identified **potentially unacceptable ecological risks[4]** to benthic invertebrates exposed to metals (arsenic, copper, lead, mercury, selenium, silver, tin, and zinc) and PAHs in sediment. In general, COPC concentrations were highest in the Pier Area and lowest in the Connector Channel. The RI recommended that further investigation of SWMU 7b sediment be conducted following completion of the scheduled military construction (MILCON) action which included demolition and replacement of piers and limited dredging in Desert Cove.
Final Technical Memorandum Post-MILCON Action Evaluation, SWMU 7b – Small Boats Sandblast Yard (Desert Cove) (CH2M HILL, 2012)	001618	In November 2009, surface sediment sampling was conducted to evaluate post-MILCON action conditions within the Cove, Connector Channel, and Pier Areas. The Navy and USEPA, in consultation with VDEQ, agreed that PAHs are not typically associated with sandblasting residues and are likely to be primarily attributable to the 19 stormwater outlets that convey stormwater runoff from various locations within the facility, including numerous parking areas; therefore, **further investigation of PAHs in sediment under CERCLA was not warranted[5]**. Additionally, based upon low potential risks, contaminant distributions, and urban background conditions, the Navy and USEPA, in consultation with VDEQ, agreed that **risks associated with arsenic, selenium, and silver were not unacceptable[6]** and further investigation of these chemicals in sediment was not warranted. As part of post-MILCON investigation activities, surface sediment samples were collected for analysis of copper, lead, mercury, tin, and zinc. In general, post-MILCON action COPC concentrations in the Connector Channel and Desert Cove Areas were similar to pre-action conditions. Concentrations of COPCs detected within the dredged portion of the Pier Area were generally similar to, or lower than, those previously detected, with the exception of the northeastern corner of the Pier Area. In August and September 2010, additional sediment sampling was conducted in the Cove, Connector Channel, and Pier Areas to evaluate the condition of the benthic invertebrate community at SWMU 7b and assess the correlation between the benthic invertebrate community and metals and ABM content in sediment. The data suggest that some impacts to the benthic invertebrate community are occurring in portions of the Pier Area; however, the portion of the Pier Area with the highest metals concentrations and ABM content (northeast corner) did not consistently show the most impact to the benthic invertebrate community, suggesting other factors not related to historical sandblasting activities, such as dissolved oxygen (DO), may have more impact on the survival of the benthic invertebrate community. The evaluation concluded that ecological risks in the Connector Channel and Cove Area are not unacceptable, and no further action is warranted for these areas for the protection of the environment. Potentially unacceptable risks to ecological receptors were identified in the Pier Area, particularly the northeast corner. Although physical characteristics of the site that are not related to historical sandblasting activities may be having more of an impact on the condition of the benthic invertebrate community than the ABM and metals detected in site sediment, the evaluation concluded that the magnitude of these **metals concentrations may result in unacceptable risks to ecological receptors[7]** should these physical characteristics change over time; therefore, site remediation at SWMU 7b is warranted. It was recommended that the remedial action objectives (RAOs) established for the site focus on the reduction of metals concentrations and not the establishment of a comparable (to an urban reference condition) benthic invertebrate community.

Table 1- Studies, Investigations, and Activities Summary

Study/Investigation/ Activity*	AR Document Number	Investigation Activities
SWMU 7b Engineering Evaluation/Cost Analysis (EE/CA) (CH2M HILL, 2013a) and Action Memorandum (AM) (CH2M HILL, 2013b)	001697 (EE/CA) 001706 (AM)	In January 2013, an EE/CA was prepared to **evaluate non time-critical removal action (NTCRA) alternatives**[8] to mitigate potential unacceptable ecological risks in sediment. As previously documented in the post-MILCON evaluation and further documented in the EE/CA, no action is warranted for arsenic, selenium, silver, or PAHs in sediment. Additionally, based upon urban background conditions and an evaluation of tributyl tin results, the Navy and USEPA, in consultation with VDEQ, agreed that risks associated with tin are not unacceptable and no action is warranted for this chemical in sediment. During development of **cleanup goals for SWMU 3**[9], a former sandblasting area with similar sediment contaminants of concern (COCs), regression equations developed based upon the correlation between ABM content and COC concentrations were used to calculate associated sediment concentrations using 1 percent ABM (the lowest possible integer). The resulting values fell between the probable effects level and National Oceanic and Atmospheric Administration (NOAA) effects range-median screening values. No correlation between the ABM and metals COC concentrations at SWMU 7b was established. However, based upon the similarity of SWMU 3 and SWMU 7b, and the urban nature of Desert Cove, **preliminary remediation goals (PRGs)**[10] were established as the NOAA effects range-median screening values (**Table 2**). Because ABM itself is not toxic and does not pose risk to the environment, the Navy, in partnership with USEPA and VDEQ, agreed that the presence of ABM in sediment does not drive the need for action at SWMU 7b. To define the area requiring remedial action under CERCLA, the site was broken down into 100-by-100-foot grid cells. Using all available surface sediment data, remediation quotients (RQs) were calculated as the ratio of the sediment concentration to the site-specific cleanup goal. A grid cell was defined as requiring action and included in the proposed removal action area if the RQ for one or more individual COCs exceeded 1.5 and the average RQ for the four COCs exceeded 1 (**Figure 5**). This approach was selected giving consideration to the size of the grid cells, the spatial distribution of the surface sediment data, and the recognition of the cumulative impacts caused by multiple contaminants. The use of a threshold value of 1.5 for an individual contaminant is deemed appropriate based on the potential impacts of each contaminant at these levels and the spatial distribution of the contaminants. The threshold value of 1 for the mean of the four COCs acknowledges the distribution of all of the contaminants across the grid cell and cumulative impacts posed by multiple contaminants, particularly those exceeding ecological threshold values. Based upon existing data or grid cell location within the MILCON dredge limits, three grid cells were proposed for elimination from the area requiring action. The alternative selected included mechanical dredging of impacted sediment, disposal of dredge materials in a Subtitle D landfill, and replacement with clean fill. A public notice was issued in *The Virginian-Pilot* on December 13, 2012, and the EE/CA was made available to the public from December 13, 2012 to January 13, 2013. No comments were received and the Navy signed an Action Memorandum on January 29, 2013.
NTCRA and Construction Summary Memorandum for SWMU 3 – Pier 10 Sandblast Yard and SWMU 7b – Small Boats Sandblast Yard (CH2M HILL, 2013c)	001786	In December 2012, prior to implementation of the NTCRA, removal area delineation sampling was conducted to determine the **final removal area for mitigation of ecological risk in sediment**[11]. Sediment samples were collected from within the proposed removal area grid cells as identified in the EE/CA. Surface sediment samples were collected in those grid cells recommended for elimination from the proposed removal action area to confirm COC concentrations were below cleanup criteria. In the remaining grid cells, subsurface sediment samples were collected in 1-foot intervals to determine the depth where COC concentrations were below cleanup criteria. All samples were analyzed for the site COCs (copper, lead, mercury, and zinc), and RQs were calculated to delineate the lateral and vertical extent of removal required to mitigate ecological risk in sediment. **Figure 6** presents the pre-confirmation sample locations, RQ calculations, and final removal action area. Surface sediment COC concentrations in those grid cells recommended for elimination met cleanup criteria; therefore, these grid cells were removed from the area requiring action. Within the remaining grid cells, the required vertical depth of removal was defined as the depth where sediment COCs concentrations met cleanup criteria. Beginning in April 2013, **4,040 yd^3 of sediment were dredged**[12] from the removal action area in Desert Cove. Dredged material was transported via barge to Port Weanack, where it was solidified and offloaded for transport and disposal in a landfill. As a result of engineering constraints, sediment within 5 feet of the bulkhead was left in place. Pre-and post-dredge surveys of the sediment surface elevation confirm that required dredge depths were achieved. Following dredging activities, the site was restored through placement of a clean sand layer. Within 50 feet of the bulkhead, dredged areas received approximately 2 feet of sand to return the area to bulkhead design grade; the remaining portion of the site, including the area adjacent to the bulkhead that was not dredged, received approximately 1 foot of sand. A post-sand placement bathymetric survey confirmed adequate sand placement.

Notes: *The documents listed are available in the Administrative Record and provide detailed information used to support remedy selection at SWMU 7b.

Table 2 – Sediment Cleanup Goals

COC	Cleanup Goal (mg/kg)
Copper	270
Lead	218
Mercury	0.71
Zinc	410

2.3 Community Participation

The Navy and USEPA provide information regarding the environmental cleanup at JEB Little Creek to the public through the community relations program, which includes a Restoration Advisory Board, public meetings, the Administrative Record file for SWMU 7b, and announcements published in *The Virginian-Pilot* newspaper. During the course of investigations at SWMU 7b, the Restoration Advisory Board has been apprised of all environmental activities related to the site.

In accordance with Sections 113 and 117(a) of CERCLA, the Navy provided a public comment period between July 27, 2013 to September 12, 2013, for the SWMU 7b Proposed Plan. A public meeting to present the Proposed Plan was held August 13, 2013. Public notice of the meeting and availability of documents was placed in *The Virginian-Pilot* newspaper on July 27, 2013.

The Proposed Plan was available during the public comment period at the Virginia Beach Central Library. The final Proposed Plan and other documents associated with the environmental activities conducted at SWMU 7b are available to the public in the Administrative Record file for JEB Little Creek. Appointments to review the Administrative Record file can be made by contacting:

NAVFAC Atlantic
6506 Hampton Boulevard, Norfolk, VA 23508
Phone: 757.322.4785

A copy of the Administrative Record file for the JEB Little Creek Environmental Restoration Program is available online at:
https://portal.navfac.navy.mil/portal/page/portal/navfac/navfac_ww_pp/navfac_hq_pp/navfac_env_pp/env_restoration_installations/lant/midlant/jeblcfs

2.4 Scope and Role of Response Action

SWMU 7b is one of 12 ERP sites being addressed under CERCLA at JEB Little Creek (**Figure 1**). In addition to SWMU 7b, the Pier 10 Sandblast Yard (SWMU 3) is currently in the Remedial Investigation/Feasibility Study (RI/FS) stage of the CERCLA process.

The following sites have a Final ROD in place:

- SWMU 7a: No Action ROD
- SWMU 8: No Action ROD
- Site 7: Action ROD for maintenance of the existing soil cover, land use controls (LUCs), and groundwater monitoring
- Site 8: No Action ROD
- Sites 9 and 10: Action ROD for LUCs and groundwater monitoring
- Site 11: Action ROD for enhanced reductive dechlorination (ERD) with LUCs and post-treatment groundwater monitoring
- Site 11a: Action ROD for ERD with LUCs and post-treatment groundwater monitoring
- Site 12: Action ROD for bio-augmentation with LUCs and post-treatment groundwater monitoring
- Site 13: Action ROD for enhanced anaerobic bioremediation with LUCs and post-treatment groundwater monitoring

Seventeen sites were identified in the Federal Facility Agreement (FFA) in 2003 as requiring further evaluation through desktop audits or site screening process investigations. Sixteen of the sites were evaluated and closeout

documentation was prepared (**Table 3**). Site 11a was recommended for further investigation, and a ROD was signed in September 2011.The FFA also identified 105 sites for which no action under CERCLA is required due to the determination that the site poses no threat or potential threat to public health, welfare, or the environment or the site is addressed by other environmental programs. Seven Military Munitions Response Program (MMRP) sites were identified for Preliminary Assessment. Of the seven sites, two were determined to require no action under CERCLA following completion of the Preliminary Assessment (**Table 3**). The five remaining sites were identified for further evaluation through desktop audits or site screening process investigations. Each site was evaluated and closeout documentation was prepared (**Table 3**). Details of these investigations are presented in the **Site Management Plan**[13] for JEB Little Creek, which is updated annually and available in the Administrative Record file.

There are no principal threats at SWMU 7b. Non-principal threats were addressed during removal of contaminated sediment and no further action is warranted for SWMU 7b. No further action is intended to be the final decision for SWMU 7b, and does not include or affect any other sites at JEB Little Creek.

Table 3 - Site and Preliminary Screening Area Closeout Summary

Site/Preliminary Screening Area	Investigation Activity	Determination	Closeout Documentation
FFA Sites			
SWMU 30 – Leaking Above Ground Diesel Tank	Desktop audit and site visit.	Aboveground storage tank (AST) and surrounding berm is in good condition. Further assessment will be conducted under Spill Prevention, Control, and Countermeasures Plan/AST Program.	Final June 2003 Tier I Partnering Team Meeting Minutes, Consensus Statement.
SWMU 96 – Scrap Metal Storage Area	Desktop audit and site visit.	Currently an active equipment storage area operated under facility protocols for maintaining best management practices. No evidence of a CERCLA release. No further action required.	Final Closeout Report Appendix B Sites SWMUs 96, 97, 98, and 119, NAB Little Creek, Virginia Beach, Virginia. September 2004.
SWMU 97 – Vehicle Maintenance Facility Storm Drain		Active storm drain operated under the facility Virginia Pollutant Discharge Elimination System permit. No evidence of a CERCLA release. No further action required.	
SWMU 98 – Elevated Causeways Mechanic Shop Material Dispensing Area		No evidence of a CERCLA release. No further action required.	
SWMU 119 – Former Special Warfare Group 2 Electronics Shop	Groundwater samples collected.	No evidence of a CERCLA release or potential unacceptable risks. No further action is required.	
Area of Concern (AOC) H – Buildings 3109 and 3360 at Golf Course (Pesticide Mixing Area)	Soil samples collected.	No evidence of a CERCLA release or potential unacceptable risks. No further action is required.	Final Close-Out Report Appendix B Sites AOCs – H, I, J, and Site 14, NAB Little Creek, Virginia Beach, Virginia. March 2004
AOC I – Eagle Haven Golf Course Pond	Soil and sediment samples collected.		
AOC J – Former "Burn Area" between IF Sites 9 and 10	Soil and groundwater samples collected.		
Installation Restoration Site 14 – Old Pole Yard and Transformer Storage Area	Soil samples collected.		
SWMU 18 – Personal Watercraft Transmission Garage Spent Battery Shop, Collection Area	Desktop audit and site visit.	No evidence of a CERCLA release. No further action required.	Final April 2005 Tier I Partnering Team Meeting Minutes, Consensus Statement.
SWMU 116 – Morale, Welfare, and Recreation Boat Maintenance Facility			
AOC D – Polychlorinated Biphenyl (PCB) Transformer Leak			

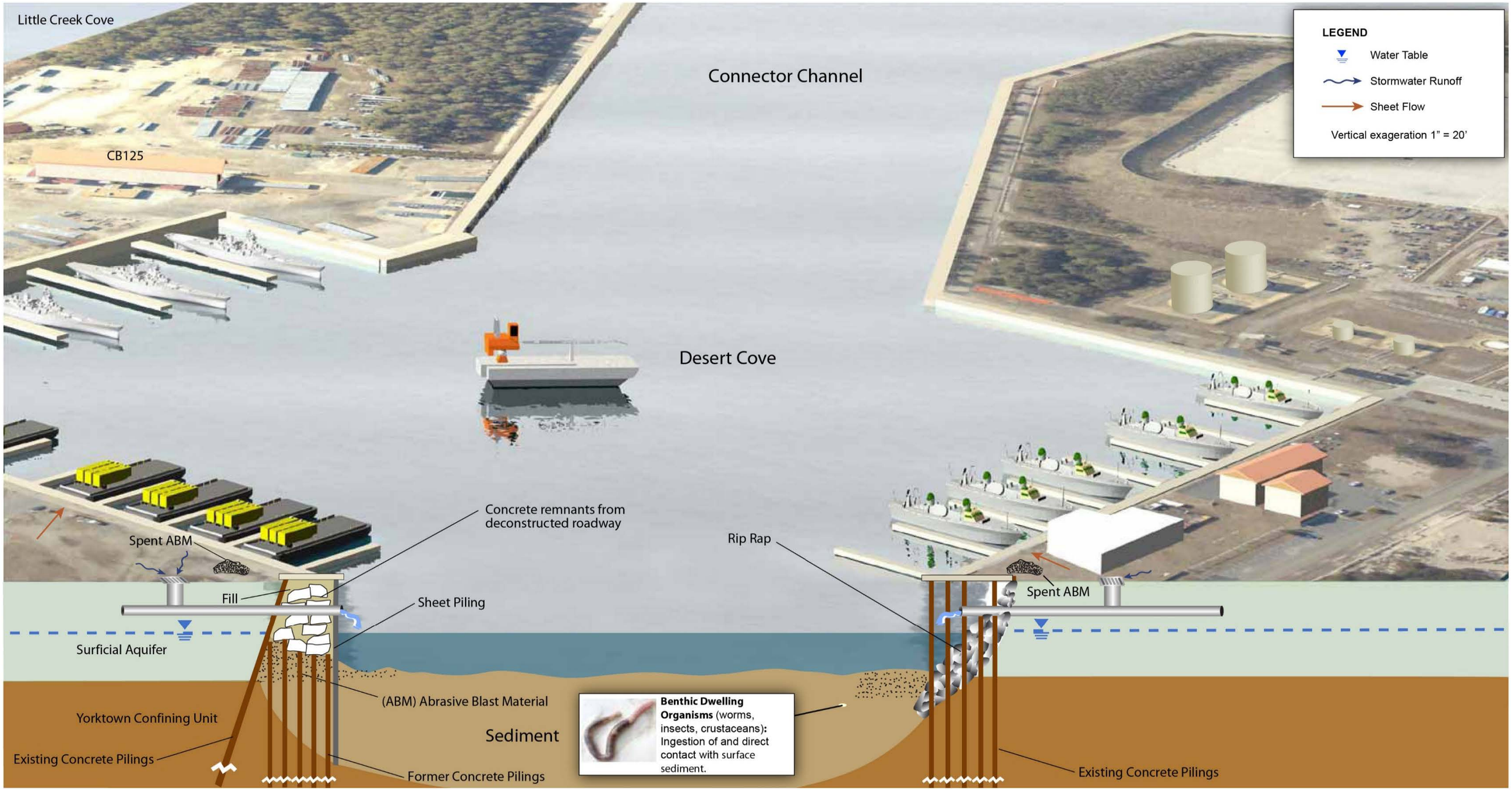
Table 3 - Site and Preliminary Screening Area Closeout Summary

Site/Preliminary Screening Area	Investigation Activity	Determination	Closeout Documentation
SWMU 5 – Port Ops Boat Painting Area	Soil and groundwater samples collected.	No evidence of a CERCLA release or potential unacceptable risks. No further action is required.	Final Site Screening Assessment Closeout Report SWMUs 5, 6, 13, and Site 6, NAB Little Creek, Virginia Beach, Virginia. January 2006.
SWMU 6 – Seabee Area – CB-124	Soil and groundwater samples collected.		
SWMU 13 – Former Pesticide Shop	Soil and groundwater samples collected.		
Installation Restoration Site 6 – Special Boat Unit Battery Storage Yard	Soil and groundwater samples collected.		
MMRP Sites			
Chemical Defense Area	Desktop evaluation.	No evidence of a CERCLA release or potential unacceptable risks were identified during the archive search. Additionally, significant redevelopment and fill of the area has occurred. Area removed from further study.	Final Preliminary Assessment, NAB Little Creek. September 2007.
1942 Pistol Range	Desktop evaluation.	No evidence of a CERCLA release or potential unacceptable risks. The site is currently under several feet of concrete that makes up the landing craft air cushion pad. Area removed from further study.	
Anti-Aircraft Target Rifle Range	Desktop evaluation and site visit.	Site screening area does not pose a threat or potential threat to public health, welfare, or the environment. Area removed from further study.	Final Site Screening Process Closeout Report, Anti-Aircraft Target Rifle Range, 1944 Pistol Range, and 1953 Pistol Range, NAB Little Creek, JEB Little Creek-Fort Story, Virginia Beach, Virginia. September 2010.
1944 Pistol Range			
1953 Pistol Range			
Depth Charge Testing Area	Desktop evaluation.	Site screening area does not pose a threat or potential threat to public health, welfare, or the environment. Area removed from further study.	Final Site Screening Process Closeout Report, Depth Charge Testing Area, NAB Little Creek, JEB Little Creek-Fort Story, Virginia Beach, Virginia. September 2010.
Former Morale, Welfare, and Recreation Skeet Range	Soil and groundwater samples collected.	Site screening area does not pose a threat or potential threat to public health, welfare, or the environment. Area removed from further study.	Final Site Screening Process Report, Former Morale, Welfare, and Recreation Skeet Range, NAB Little Creek, JEB Little Creek-Fort Story, Virginia Beach, Virginia. January 2011.

2.5 Site Characteristics

Figure 4 presents a conceptual site model (CSM) of site conditions prior to the completion of the non-time critical removal action (NTCRA). SWMU 7b encompasses approximately 53 acres and consists of Desert Cove and the Connector Channel, which connects the site to Little Creek Channel and ultimately the Chesapeake Bay. SWMU 7b is a tidal marine environment which receives stormwater runoff or process water discharge through one of the 22 outfalls (11 non-regulated stormwater, 8 regulated stormwater, and 3 regulated process water) surrounding Desert Cove. All drainage to the cove is from on-Base areas, consisting mainly of stormwater from building rooftops and asphalt parking areas. SWMU 7b sediment generally consists of fine silty sand material. Due to the configuration of the entrance channel to Desert Cove relative to Little Creek Channel, the sediment deposition rate within the cove is low.

Figure 4- SWMU 7b Conceptual Site Model



Note: CSM representative of pre-NTCRA site conditions

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The entire shoreline of SWMU 7b consists of bulkhead and rip-rap for erosion control. In 2008, a military construction (MILCON) action was completed in which the Navy demolished and replaced Piers 44 through 51, constructed a new quaywall along the eastern and southern edges of the cove, and dredged limited areas surrounding the former piers. Prior to the MILCON action, the area was last dredged in 1953.

2.6 Current and Potential Future Land and Water Uses

SWMU 7 (SWMUs 7a and 7b) is actively used by the facility for heavy equipment storage, small ship mooring, ship maintenance (i.e., sandblasting in Building CB-125), and training. Recreational swimming, fishing, and crabbing are not permitted in Desert Cove. Columbia aquifer groundwater is not currently used as a potable water supply at or near JEB Little Creek because of its general poor quality (naturally present iron and manganese above secondary drinking water standards) and low yield (generally less than 3 to 5 gallons per minute). Potable water is supplied to the base and surrounding community by the City of Virginia Beach. Groundwater wells at the base golf course located approximately 4,800 feet east of SWMU 7b provide water from the Yorktown aquifer for irrigation of the golf course. The current and reasonably anticipated future land use of the SWMU 7 area is not expected to change.

2.7 Summary of Site Risks

Detailed results of the Human Health Risk Assessment (HHRA) and Ecological Risk Assessment (ERA) conducted at SWMU 7b are presented in the RI/HHRA/ERA Report (CH2M HILL, 2004) and Post-MILCON Action Evaluation (CH2M HILL, 2012) available in the Administrative Record file. Because of the tidal nature of the water body and the 22 outfalls (11 non-regulated stormwater, 8 regulated stormwater, and 3 regulated process water) discharging into the cove, any contamination detected in the surface water of Desert Cove or the Connector Channel may or may not be associated with historical sandblasting activities at SWMU 7; therefore, surface water was not evaluated in the HHRA or ERA. No potentially unacceptable risk to human health from exposure to sediment was identified. Potential ecological risks were identified associated with chemical transport via groundwater to Desert Cove, although the ERA concluded that groundwater is not a significant transport route from the site to the Desert Cove system. Potential risks to ecological receptor exposure to sediment were identified. The following subsections briefly summarize the findings of the human health and ecological risk assessments.

2.7.1 Human Health Risk Summary

An HHRA was conducted to evaluate the **potential human health risks**[14] from **current receptor**[15] and **hypothetical future receptor**[16] exposure to sediment at SWMU 7 using reasonable maximum exposure (RME) point concentrations, which assumes the highest level (maximum concentrations) of human exposure that could reasonably be expected to occur.

The potential for non-cancer hazards, the hazard quotient (HQ), is evaluated by calculating the ratio of exposure to toxicity. An HQ greater than 1 indicates that a receptor's exposure to a particular chemical may present an unacceptable non-cancer hazard. In addition, hazard indices (HIs) are generated by adding the HQs for all chemicals that affect the same target organ or cause adverse health effects within a medium or across all media to which an individual may reasonably be exposed. HI values greater than 1 indicate the potential for unacceptable non-cancer hazards due to site exposure.

For known or suspected carcinogens, the likelihood of any type of cancer resulting from exposure to contamination is generally expressed as an upper bound probability of 10^{-4} (a 1 in 10,000 chance of one extra cancer occurring because of exposure) using information on the relationship between dose and response. Acceptable exposure levels are generally considered as concentrations that represent a lifetime cancer risk to an individual of between 10^{-4} and 10^{-6} (a 1 in 1,000,000 chance of one extra cancer occurring because of exposure). The 10^{-6} risk level is used as the point of departure for determining performance standards for alternatives when applicable or relevant and

appropriate requirements (ARARs) are not available or are not sufficiently protective because of the presence of multiple contaminants at a site, or multiple pathways of exposure.

Current **exposure scenarios**[17] evaluated consisted of adult/adolescent trespassers and other workers (e.g., scuba divers) exposure to surface sediment. Hypothetical future exposure scenarios evaluated consisted of adult/adolescent trespassers, other workers, and maintenance workers exposure to combined surface and subsurface sediment. The exposure pathways evaluated were ingestion of and dermal contact with sediment. Under current land use, exposure to site sediment would not result in any RME non-cancer hazards (adult trespasser/visitor cumulative HI = 0.0079, adolescent trespasser/visitor cumulative HI = 0.011, and other worker cumulative HI = 0.0036) or cancer risks (adult trespasser/visitor cumulative cancer risk = 1.6×10^{-6}, adolescent trespasser/visitor cumulative cancer risk = 8.6×10^{-7}, and other worker cumulative cancer risk = 7.7×10^{-7}) above USEPA's acceptable levels. Under future land use, exposure to site sediment would not result in any RME non-cancer hazards (adult trespasser/visitor cumulative HI = 0.0075, adolescent trespasser/visitor cumulative HI = 0.010, other worker cumulative HI = 0.0034, and maintenance worker cumulative HI = 0.0014) or cancer risks (adult trespasser/visitor cumulative cancer risk = 1.6×10^{-6}, adolescent trespasser/visitor cumulative cancer risk = 8.0×10^{-7}, other worker cumulative cancer risk = 7.2×10^{-7} , and maintenance worker cumulative cancer risk = 3.0×10^{-7}) above USEPA's acceptable levels. Therefore, the Navy and USEPA, in consultation with the VDEQ, agreed there are no unacceptable risks associated with exposure to sediment and no further action is necessary for the protection of human health at SWMU 7b.

2.7.2 Ecological Risk Summary

An ERA (Steps 1 through 7 of the ERA process) was completed to evaluate **potential risks**[18] to **plants and animals ("ecological receptors")**[19] through direct exposure to surface sediment and exposure via the food web. During the ERA, SWMU 7b was divided into three areas—the Connector Channel, Cove, and Pier Areas (**Figure 2**)—to better evaluate potential risks where exposures could vary because of differences in the magnitude of contaminant concentrations.

Potential risks to aquatic and wildlife receptors were evaluated using maximum exposure scenarios (Step 2), and subsequently refined using average media concentrations (Step 3). The average concentration estimates provide a representative estimate of exposures and risks to receptor populations (the focus of the assessment endpoints) rather than individual organisms. Facility-specific sediment reference samples were also considered, as was bioavailability, or the degree to which a chemical in an environmental medium can be assimilated by an organism, and existing benthic invertebrate [organisms without a backbone living on or in the bottom sediments of a water body (i.e., clams and polychaete worms] community conditions.

Potential unacceptable ecological risks are identified as HQs greater than or equal to 1. HQs are calculated by dividing the estimated exposure concentration by the corresponding medium-specific screening toxicity value (direct exposure) or by dividing the exposure dose by the corresponding ingestion toxicity value (food web exposure). Based on the ERA, potential risks were calculated for aquatic receptors exposed to surface sediments at SWMU 7b.

Food Web Exposure – Wildlife Receptors

As part of the 2004 RI, food web modeling was conducted to evaluate potential risks to wildlife. Modeled food web exposure estimates were compared to No Observed Adverse Effects Level (the highest level that did not result in toxic effects) and Lowest Observed Adverse Effects Level (the lowest concentration that resulted in toxic effects) ingestion toxicity values. Because of the limited habitat available in the Desert Cove system, which is characterized by bulkhead or rip-rap shorelines and lack of vegetated areas, only the osprey (a large fish-eating raptor that forages in relatively deep, open water areas) was evaluated as a potential receptor for this pathway. Average exposure doses for this bird did not exceed the No Observed Adverse Effects Levels. Thus, potential risks from the food web pathway are considered not unacceptable. No additional evaluation of the pathway was conducted as part of the post-MILCON evaluation.

Direct Exposure Assessment – Aquatic Receptors

Various species of fish may use the Desert Cove system, at least periodically, but the duration and magnitude of potential exposures are expected to be limited given the poor habitat quality (the shoreline is primarily rip-rap or bulkhead and there is little vegetation present); therefore, they are not considered to be a significant receptor at the site. Based on habitat and salinity, amphibians and reptiles are also not expected to be significant receptors at the site. Several pathways were identified by which aquatic receptors could be exposed to contaminants in the Desert Cove system. The key aquatic receptors evaluated in the ERA were benthic invertebrates. Benthic invertebrates can be exposed to contaminants in bulk sediment and/or sediment pore water through direct contact and/or ingestion. Pore water data were not collected as part of SWMU 7b investigation activities; therefore, only direct contact with sediment was evaluated.

The benthic invertebrate community found in the Desert Cove system is generally typical of what is expected for this geographical area and type of habitat (urban harbor). The dominant organisms (i.e. polychaete worms) are generally characterized as tolerant of pollutants and low dissolved oxygen (DO), and are surface dwellers, inhabiting the sediment/water interface (deeper-dwelling organisms were generally rare to absent, likely the result of low oxygen conditions observed at depths more than a few centimeters below the sediment surface).

Potentially unacceptable risks (defined as mean HQ greater than or equal to 1) to benthic invertebrates from direct exposure to surface sediment in the Connector Channel, Cove, and/or Pier Area were identified. Potentially unacceptable risks were associated with arsenic, copper, lead, mercury, selenium, silver, tin, zinc, and PAHs. In general, sediment concentrations and, subsequently, potential risks, were highest in the Pier Area and lowest in the Connector Channel (**Table 4**).

Although concentrations of polycyclic aromatic hydrocarbons (PAHs), arsenic, selenium, and silver resulted in HQs greater than 1 based upon direct exposure evaluations, the Navy and USEPA, in consultation with VDEQ, agreed that potential ecological risks associated with PAHs, arsenic, selenium, and silver in sediment were not unacceptable and did not require further investigation or action under CERCLA, based on the following:

- PAHs are likely primarily attributable to the 19 stormwater outfalls that convey stormwater runoff from various locations within the facility, including numerous parking areas, and not attributable to historical sandblasting activities at SWMU 7b.
- Arsenic was identified as a contaminant of potential concern (COPC) in the Cove and Pier Area during the 2004 RI, where only the discrete (representative of sediment from a single location) Site Investigation (SI) (5 samples collected in 2000) and RI (36 samples collected in 2002) sediment samples were used to derive the list of COPCs. When considering both the discrete and composite (several samples combined to represent sediment over an area) RI samples, the site-wide maximum HQ for arsenic, based on the effects range-low screening value, in surface sediment is 1.54 and the site-wide mean HQ is less than 1. Arsenic was detected in 41 of 41 collected surface sediment samples; however, the maximum detected concentration of arsenic (12.6 milligrams per kilogram [mg/kg]) is below the probable effects level (41.6 mg/kg) and effects range-median (70 mg/kg) screening values. Although arsenic was not measured as part of the background sediment investigation, the similarity of the mean (8.00 mg/kg) and maximum (12.6 mg/kg) concentrations suggests that this chemical is present at levels representative of the urban nature of the water body rather than from historical sandblasting activities.
- Selenium was identified as a COPC in the Connector Channel, Cove, and Pier Areas during the 2004 RI, where only the discrete SI (5 samples collected in 2000) and RI (36 samples collected in 2002) sediment samples were used to derive the list of COPCs. When considering both the discrete and composite RI samples, the site-wide maximum HQ for selenium, based on the apparent effects threshold [effects range-low, effects range-median, threshold effects level, and probable effects level screening values have not been developed for selenium], in surface sediment is 2.50 and the site-wide mean HQ, calculated using ½ the detection limit for non-detected sample locations, is less than 1. All detected concentrations of selenium (maximum of 2.5 mg/kg) exceed the

apparent effects threshold (1 mg/kg); however, selenium was only detected in 10 of 41 (about 25 percent) of the surface sediment samples. Detected concentrations were noted in the Connector Channel, Cove, and Pier Areas with a low range in detected concentrations (minimum of 1.3 J mg/kg to maximum of 2.5 mg/kg), likely indicative of urban conditions and not a result of historical sandblasting activities.

- Silver was identified as a COPC in the Pier Area during the 2004 RI, where only the discrete RI sediment samples were used to derive the list of COPCs. When considering both the discrete and composite RI samples, the site-wide maximum HQ for silver, based on the effects range-low screening value, in surface sediment is 7.80 and the site-wide mean HQ is less than 1. Silver was detected in 7 of 41 (about 15 percent) of surface sediment samples and was not detected in subsurface sediment. The four sample locations that exceeded screening values (effects range-low, effects range-median, threshold effects level, and/or probable effects level) were located within the area since removed by the 2008 MILCON action.

Connector Channel

The Navy and USEPA, in consultation with the VDEQ, agreed that potential risks in the Connector Channel are not unacceptable, and do not require action under CERCLA based on the following:

- Although surface sediment HQs based upon the threshold effects level and effects range-low exceed 1 for copper, lead, mercury, tin, and zinc (**Table 4**), the magnitude of the HQs are low (maximum mean HQ of 2.79 for copper based upon the threshold effects level). Additionally, surface sediment mean HQs based upon the probable effects level and effects range-median are below 1.
- With the exception of mercury, maximum detected concentrations were below maximum background values. Although the maximum detected mercury concentration exceeded the maximum background value, the mean background ratio for mercury is below 1, indicating mercury concentrations across the Connector Channel are similar to urban background conditions.
- Except for one sample for which Acid-Volatile Sulfide was below the detection limit, all Simultaneously Extracted Metals/Acid-Volatile Sulfide ratios were less than 1 indicating low metal bioavailability.

Cove

The Navy and USEPA, in consultation with the VDEQ, agreed that potential risks in the Connector Channel are not unacceptable, and do not require action under CERCLA based on the following:

- Although surface sediment HQs based upon the threshold effects level and effects range-low exceed 1 for copper, lead, mercury, tin, and zinc (**Table 4**), the magnitude of the HQs are low (maximum mean threshold effects level HQ of 4.40 for copper and maximum effects range-low mean HQ of 2.60 for zinc). With the exception of zinc (mean probable effects level HQ of 1.44), surface sediment mean HQs based upon the probable effects level and effects range-median are below 1.
- Maximum concentrations of copper and tin are below their respective maximum background values. Mean background values for lead, mercury, and zinc were less than 2 times mean background values and with the exception of mercury, exceeded background in less than 30% of samples collected.

Table 4 – Summary of Unacceptable Ecological Risks

Receptor	Media	Assessment Endpoint	COPC	Units	Frequency of Detection	EPC			Threshold Effects Level					Effects Range-Low or Apparent Effects Threshold					Probable Effects Level					Effects Range-Median					Urban Background				
						Maximum Concentration Detected	95% UCL (Norm)	Arithmetic Mean	Screening Toxicity Value	Frequency of Exceedance	Maximum Hazard Quotient	95% UCL Hazard Quotient	Mean Hazard Quotient	Screening Toxicity Value	Frequency of Exceedance	Maximum Hazard Quotient	95% UCL Hazard Quotient	Mean Hazard Quotient	Screening Toxicity Value	Frequency of Exceedance	Maximum Hazard Quotient	95% UCL Hazard Quotient	Mean Hazard Quotient	Screening Toxicity Value	Frequency of Exceedance	Maximum Hazard Quotient	95% UCL Hazard Quotient	Mean Hazard Quotient	Maximum Background	Mean Background	Frequency of Exceedance	Maximum Ratio	Mean Ratio
						Pre-MILCON Action																											
			Pier Area - SI/RI Samples1																														
Benthic Invertebrates	Sediment	Protection of aquatic receptor (invertebrate) communities from the toxic effects (on survival, growth, and reproduction) of site-related chemicals in the sediment.	*Arsenic*	MG/KG	11 / 11	12.0	Not Evaluated	8.10	Not Evaluated					8.20	5 / 11	1.46	Not Evaluated	0.99	Not Evaluated					Not Evaluated					Not Evaluated				
			Copper	MG/KG	11 / 11	142		86.3						34.0	9 / 11	4.18		2.54															
			Lead	MG/KG	11 / 11	1,810		233						46.7	10 / 11	38.8		4.98															
			Mercury	MG/KG	8 / 11	0.50		0.27						0.15	6 / 11	3.35		1.83															
			Selenium	MG/KG	3 / 11	1.83		0.86						1.00	3 / 11	1.83		0.86															
			Silver	MG/KG	6 / 11	7.80		1.94						1.00	4 / 11	7.80		1.94															
			Tin	MG/KG	7 / 7	10.5		5.06						3.40	4 / 7	3.07		1.49															
			Zinc	MG/KG	10 / 11	915		381						150	8 / 11	6.10		2.54															
			PAH (Total)	UG/KG	11 / 11	105,690		27,864						4,022	9 / 11	26.3		6.93															
			Cove - SI/RI Samples																														
			Arsenic	MG/KG	7 / 7	12.6	Not Evaluated	9.71	Not Evaluated					8.20	5 / 7	1.54	Not Evaluated	1.18	Not Evaluated					Not Evaluated					Not Evaluated				
			Copper	MG/KG	7 / 7	117		83.6						34.0	7 / 7	3.44		2.46															
			Lead	MG/KG	7 / 7	125		76.4						46.7	7 / 7	2.67		1.64															
			Mercury	MG/KG	7 / 7	3.18		0.76						0.15	7 / 7	21.2		5.07															
			Selenium	MG/KG	1 / 7	2.38		0.87						1.00	1 / 7	2.38		0.87															
			Silver	MG/KG	1 / 7	0.38		0.20						1.00	0 / 7	0.38		0.20															
			Tin	MG/KG	7 / 7	8.25		5.86						3.40	6 / 7	2.43		1.72															
			Zinc	MG/KG	7 / 7	491		348						150	7 / 7	3.27		2.32															
			PAH (Total)	UG/KG	7 / 7	67,441		19,515						4,022	7 / 7	16.8		4.85															
			Connector Channel - SI/RI Samples																														
			Arsenic	MG/KG	6 / 6	9.20	Not Evaluated	6.28	Not Evaluated					8.20	1 / 6	1.12	Not Evaluated	0.77	Not Evaluated					Not Evaluated					Not Evaluated				
			Copper	MG/KG	6 / 6	70.9		51.0						34.0	5 / 6	2.08		1.50															
			Lead	MG/KG	6 / 6	38.4		30.9						46.7	0 / 6	0.82		0.66															
			Mercury	MG/KG	5 / 6	0.24		0.15						0.15	3 / 6	1.57		0.99															
			Selenium	MG/KG	4 / 6	1.70		1.12						1.00	4 / 6	1.70		1.12															
			Silver	MG/KG	0 / 6	--		0.22						1.00	-- / --	--		0.22															
			Tin	MG/KG	5 / 5	2.63		1.97						3.40	0 / 5	0.77		0.58															
			Zinc	MG/KG	6 / 6	222		164						150	5 / 6	1.48		1.09															
			PAH (Total)	UG/KG	6 / 6	18,175		5,536						4,022	1 / 6	4.52		1.38															
			Post-MILCON Evaluation																														
			Pier Area - SI/RI/Post-MILCON Samples[1]																														
			Copper	MG/KG	33 / 33	252	115	102	18.7	33 / 33	13.5	6.17	5.47	34.0	32 / 33	7.41	3.39	3.01	108	15 / 33	2.33	1.07	0.95	270	0 / 33	0.93	0.43	0.38	184	155	1 / 33	1.37	0.66
			Lead	MG/KG	33 / 33	587	134	104	30.2	32 / 33	19.4	4.43	3.43	46.7	28 / 33	12.6	2.87	2.22	112	8 / 33	5.24	1.19	0.92	218	3 / 33	2.69	0.61	0.47	67.6	45.2	18 / 33	8.68	2.29
			Mercury	MG/KG	33 / 33	4.10	0.72	0.50	0.13	30 / 33	31.5	5.50	3.87	0.15	29 / 33	27.3	4.77	3.35	0.70	3 / 33	5.86	1.02	0.72	0.71	3 / 33	5.77	1.01	0.71	0.20	0.15	26 / 33	20.5	3.25
			Tin	MG/KG	20 / 33	29.9	10.1	7.96	No screening toxicity value					3.40	18 / 33	8.79	2.97	2.34	No screening toxicity value					No screening toxicity value					9.80	8.61	7 / 33	0.90	0.27
			TBT	UG/KG	11 / 11	7.60	5.67	4.86	48.0	0 / 11	0.16	0.12	0.10	3,400	0 / 11	0.002	0.002	0.001											No background established				
			Zinc	MG/KG	33 / 33	1,440	575	497	124	33 / 33	11.6	4.64	4.01	150	32 / 33	9.60	3.83	3.31	271	29 / 33	5.31	2.12	1.83	410	19 / 33	3.51	1.40	1.21	421	290	17 / 33	3.42	1.71
			Cove - SI/RI/Post-MILCON Samples																														
			Copper	MG/KG	23 / 23	117	88.1	82.3	18.7	23 / 23	6.26	4.71	4.40	34.0	23 / 23	3.44	2.59	2.42	108	1 / 23	1.08	0.82	0.76	270	0 / 23	0.43	0.33	0.30	184	155	0 / 23	0.64	0.53
			Lead	MG/KG	23 / 23	255	91.7	74.1	30.2	23 / 23	8.44	3.04	2.45	46.7	20 / 23	5.46	1.96	1.59	112	3 / 23	2.28	0.82	0.66	218	1 / 23	1.17	0.42	0.34	67.6	45.2	7 / 23	3.77	1.64

Table 4 – Summary of Unacceptable Ecological Risks

Receptor	Media	Assessment Endpoint	COPC	Units	Frequency of Detection	EPC			Threshold Effects Level					Effects Range-Low or Apparent Effects Threshold					Probable Effects Level					Effects Range-Median					Urban Background				
						Maximum Concentration Detected	95% UCL (Norm)	Arithmetic Mean	Screening Toxicity Value	Frequency of Exceedance	Maximum Hazard Quotient	95% UCL Hazard Quotient	Mean Hazard Quotient	Screening Toxicity Value	Frequency of Exceedance	Maximum Hazard Quotient	95% UCL Hazard Quotient	Mean Hazard Quotient	Screening Toxicity Value	Frequency of Exceedance	Maximum Hazard Quotient	95% UCL Hazard Quotient	Mean Hazard Quotient	Screening Toxicity Value	Frequency of Exceedance	Maximum Hazard Quotient	95% UCL Hazard Quotient	Mean Hazard Quotient	Maximum Background	Mean Background	Frequency of Exceedance	Maximum Ratio	Mean Ratio
			Mercury	MG/KG	23 / 23	0.76	0.36	0.31	0.13	23 / 23	5.85	2.77	2.37	0.15	23 / 23	5.07	2.40	2.05	0.70	1 / 23	1.09	0.51	0.44	0.71	1 / 23	1.07	0.51	0.43	0.20	0.15	19 / 23	3.80	1.99
			Tin	MG/KG	19 / 23	14.8	7.80	6.59	No screening toxicity value					3.40	17 / 23	4.35	2.29	1.94	No screening toxicity value					No screening toxicity value					9.80	8.61	4 / 23	0.44	0.22
			TBT	UG/KG	1 / 1	3.40	--	3.40	48.0	0 / 1	0.07	--	0.07	3,400	0 / 1	0.001	--	0.001										No background established				
			Zinc	MG/KG	23 / 23	974	444	390	124	23 / 23	7.85	3.58	3.15	150	23 / 23	6.49	2.96	2.60	271	23 / 23	3.59	1.64	1.44	410	5 / 23	2.38	1.08	0.95	421	290	5 / 23	2.31	1.35
			Connector Channel - SI/RI/Post-MILCON Samples																														
			Copper	MG/KG	21 / 21	82.4	59.6	52.2	18.7	20 / 21	4.41	3.19	2.79	34.0	17 / 21	2.42	1.75	1.53	108	0 / 21	0.76	0.55	0.48	270	0 / 21	0.31	0.22	0.19	184	155	0 / 21	0.45	0.34
			Lead	MG/KG	21 / 21	50.4	34.9	30.8	30.2	11 / 21	1.67	1.15	1.02	46.7	1 / 21	1.08	0.75	0.66	112	0 / 21	0.45	0.31	0.28	218	0 / 21	0.23	0.16	0.14	67.6	45.2	0 / 21	0.75	0.68
			Mercury	MG/KG	19 / 21	0.35	0.19	0.15	0.13	12 / 21	2.67	1.43	1.19	0.15	10 / 21	2.31	1.24	1.03	0.70	0 / 21	0.50	0.27	0.22	0.71	0 / 21	0.49	0.26	0.22	0.20	0.15	6 / 21	1.74	1.00
			Tin	MG/KG	15 / 20	5.64	2.96	2.55	No screening toxicity value					3.40	4 / 20	1.66	0.87	0.75	No screening toxicity value					No screening toxicity value					9.80	8.61	0 / 20	0.17	0.09
			TBT	UG/KG	1 / 1	4.30	--	4.30	48.0	0 / 1	0.09	--	0.09	3,400	0 / 1	0.001	--	0.001										No background established				
			Zinc	MG/KG	21 / 21	283	202	176	124	17 / 21	2.28	1.63	1.42	150	14 / 21	1.89	1.35	1.18	271	2 / 21	1.04	0.74	0.65	410	0 / 21	0.69	0.49	0.43	421	290	0 / 21	0.67	0.61

1 - 2000/2002 samples within the area impacted by the MILCON action are not included
Shaded cells indicate HQ or ratio >1
COPCs in italics not identified as COCs based upon risk management considerations presented in Section 2.7.2.

Pier Area

As documented in a **signed consensus agreement**[20], the Navy and USEPA, in consultation with the VDEQ, agreed that potential risks associated with tin and tributyltin (TBT)[1] in the Pier Area are not unacceptable. Detected concentrations of total tin in the Pier Area are representative of urban background conditions with only 21 percent of samples exceed the maximum background concentration and the mean concentration of tin detected between 2000 and 2010 is below the mean background concentration (Table 4). Additionally, although the maximum HQ for total tin (when compared to the National Oceanic and Atmospheric Administration Screening Quick Reference Tables screening value of 3.4 mg/kg) for total tin detected between 2000 and 2010 is 8.79 and the mean HQ is 2.34 (Table 4), indicative of potentially unacceptable risks, calculated risks associated with the TBT fraction of tin (TBT was the primary additive to many marine paints used to prevent the growth of organisms on ship hulls and is considered to be the most toxic form of tin to aquatic organisms) are below 1 when detected and extrapolated concentrations of TBT are compared to the National Oceanic and Atmospheric Administration Screening Quick Reference Tables screening value (maximum HQ = 0.001 and mean HQ = 0.0004) and threshold effects level screening value of 0.048 mg/kg (maximum HQ = 0.070 and mean HQ = 0.028) (**Table 5**).

Non-Time Critical Removal Action

A NTCRA was completed in the northeast corner of the Pier Area from April to May 2013 to mitigate potential ecological risks associated with benthic invertebrate exposure to site contaminants of concern (COCs) (copper, lead, mercury, and zinc) in sediment. Prior to conducting the removal action, pre-removal action sediment sampling was conducted to define the final lateral and vertical extents of removal required to mitigate potentially unacceptable ecological risks at SWMU 7b. Sediment data were compared to site-specific cleanup goals, established as the NOAA effects range-median screening values, and the removal action area was defined as described in **Table 1** and presented on **Figures 5** and **6**. Approximately 4,040 cubic yards of sediment were dredged from the removal action area in Desert Cove. Dredged material was transported via barge to Port Weanack, where it was solidified and offloaded for transport and disposal in Waste Management's Charles City Landfill. Prior to and immediately following dredging, **surveys**[21] of the sediment surface elevation were conducted to confirm that required dredge depths were achieved. Following successful completion of dredging, a minimum of 6 inches of clean sand was placed across the removal action area to address any residual contamination that may remain. A post-sand placement sediment surface elevation survey was completed to check for adequate sand placement. Because pre-removal action sampling defined the area requiring action to mitigate potential ecological risk at SWMU 7b and pre- and post-dredge sediment surface elevation surveys confirmed successful removal of all contaminated sediment, no post-dredge confirmation sampling was required. The Navy and USEPA, in consultation with VDEQ, agreed the 2013 NTCRA mitigated all potentially unacceptable ecological risks attributable to SWMU 7b.

[1] Total tin is composed of both its inorganic forms (such as elemental tin) and its organic forms (such as TBT), with inorganic forms predominating in environmental media. Inorganic tin and its salts are generally considered to be of low toxicity. There are hundreds of known organic forms of tin but almost none occur naturally and relatively few are highly toxic. Tri-organic (consisting of three organic components) tin compounds are considered to be the most toxic forms of tin, with TBT considered to be the most toxic of the tri-organic compounds to aquatic life.

Table 5 – Summary of Ecological Risk Assessment for Tin and Tributyltin

Sample ID	Total Tin	Detected TBT	Ratio TBT to Total Tin	Extrapolated TBT	Total Tin	TBT	
					HQ - NOAA SQUIRT	HQ - NOAA SQUIRT	HQ - Threshold Effects Level
LW07-SD02-00	NA	NA	--	--	--	--	--
LW07-SD03-00	NA	NA	--	--	--	--	--
LW07-SD04-00	NA	NA	--	--	--	--	--
LW07-SD05-00	NA	NA	--	--	--	--	--
LW07-SD05-00P*	NA	NA	--	--	--	--	--
LW07-H1-SD201-00-02C	**6.20**	NA	--	0.0011	1.82	0.0003	0.0220
LW07-H1-SD201P-00-02C*	**5.50**	NA	--	0.0009	1.62	0.0003	0.0195
LW07-H1-SD202-00-02C	**6.70**	NA	--	0.0011	1.97	0.0003	0.0237
LW07-H5-SD201-00-02C	**1.60**	NA	--	0.0003	0.47	0.0001	0.0057
LW07-H5-SD202-00-02C	1.50 U	NA	--	--	--	--	--
LW07-K1-SD201-00-02C	**2.80**	NA	--	0.0005	0.82	0.0001	0.0099
LW07-K1-SD202-00-02C	**2.60**	NA	--	0.0004	0.76	0.0001	0.0092
LW07-K6-SD201-00-02C	**3.20**	NA	--	0.0005	0.94	0.0002	0.0113
LW07-K6-SD202-00-02C	**3.30**	NA	--	0.0006	0.97	0.0002	0.0117
LW07-L5-SD201-00-02C	**5.60**	NA	--	0.0010	1.65	0.0003	0.0198
LW07-L5-SD202-00-02C	**6.00**	NA	--	0.0010	1.76	0.0003	0.0213
LW07-L6-SD201-00-02C	**5.40**	NA	--	0.0009	1.59	0.0003	0.0191
LW07-M1-SD201-00-02C	**6.60**	NA	--	0.0011	1.94	0.0003	0.0234
LW07-M1-SD202-00-02C	**5.10**	NA	--	0.0009	1.50	0.0003	0.0181
LW07-M3-SD201-00-02C	**14.5**	NA	--	0.0025	4.26	0.0007	0.0514
LW07-M3-SD202-00-02C	**9.10**	NA	--	0.0015	2.68	0.0005	0.0322
LW07-H1-SD301-00-09D	8.67 B	0.0058	0.00067	--	--	0.0017	0.1208
LW07-K1-SD301-00-09D	7.81 B	0.0036	0.00046	--	--	0.0011	0.0750
LW07-K1-SD302-00-09D	10.8 B	0.0052	0.00048	--	--	0.0015	0.1083
LW07-K1-SD303-00-09D	8.34 B	0.0048	0.00058	--	--	0.0014	0.1000
LW07-K1-SD304-00-09D	7.40 B	0.0056	0.00076	--	--	0.0016	0.1167
LW07-L5-SD301-00-09D	8.40 B	0.0048	0.00057	--	--	0.0014	0.1000
LW07-M1-SD301-00-09D	**22.8**	0.0052	0.00023	--	6.71	0.0015	0.1083
LW07-M1-SD302-00-09D	**12.7**	0.0020	0.00016	--	3.74	0.0006	0.0417
LW07-M1-SD303-00-09D	11.7 B	0.0076	0.00065	--		0.0022	0.1583
LW07-M1-SD304-00-09D	**29.9**	0.0033	0.00011	--	8.79	0.0010	0.0688
LW07-SD301-00-09D	**29.7**	0.0056	0.00017**	--	8.74	0.0016	0.1167
LW07-SD301P-00-09D*	**23.9**	0.0034		--	7.03	0.0010	0.0708
LW07-SD302-00-09D	6.84 B	NA	--	--	--	--	--
LW07-SD303-00-09D	4.60 B	NA	--	--	--	--	--
LW07-SD304-00-09D	5.90 B	NA	--	--	--	--	--
LW07-SD305-00-09D	8.69 B	NA	--	--	--	--	--
LW07-SD306-00-09D	6.38 B	NA	--	--	--	--	--
LW07-SD307-00-09D	3.90 B	NA	--	--	--	--	--
LW07-H1-SD401-00-10C	**7.04**	NA	--	0.0012	2.07	0.0004	0.0249
LW07-K1-SD401-00-10C	**6.72**	NA	--	0.0011	1.98	0.0003	0.0238
LW07-L5-SD401-00-10C	**6.68**	NA	--	0.0011	1.96	0.0003	0.0237
LW07-M1-SD401-00-10C	**10.3**	NA	--	0.0018	3.03	0.0005	0.0365
LW07-SD401-00-10C	**5.81**	NA	--	0.0010	1.71	0.0003	0.0206
LW07-SD402-00-10C	**7.77**	NA	--	0.0013	2.29	0.0004	0.0275
LW07-SD402P-00-10C*	**4.86**	NA	--	0.0008	1.43	0.0002	0.0172
LW07-SD403-00-10C	**19.7**	NA	--	0.0033	5.79	0.0010	0.0698
LW07-SD404-00-10C	**12.2**	NA	--	0.0021	3.59	0.0006	0.0432
Average TBT to Total Tin Ratio (detects only)			0.00017				

Concentrations in milligrams per kilogram (mg/kg)
NA - not analyzed
Bold indicates detection.
* Duplicate sample
** Average of parent and duplicate sample.

Figure 5– SWMU 7b Proposed Removal Area

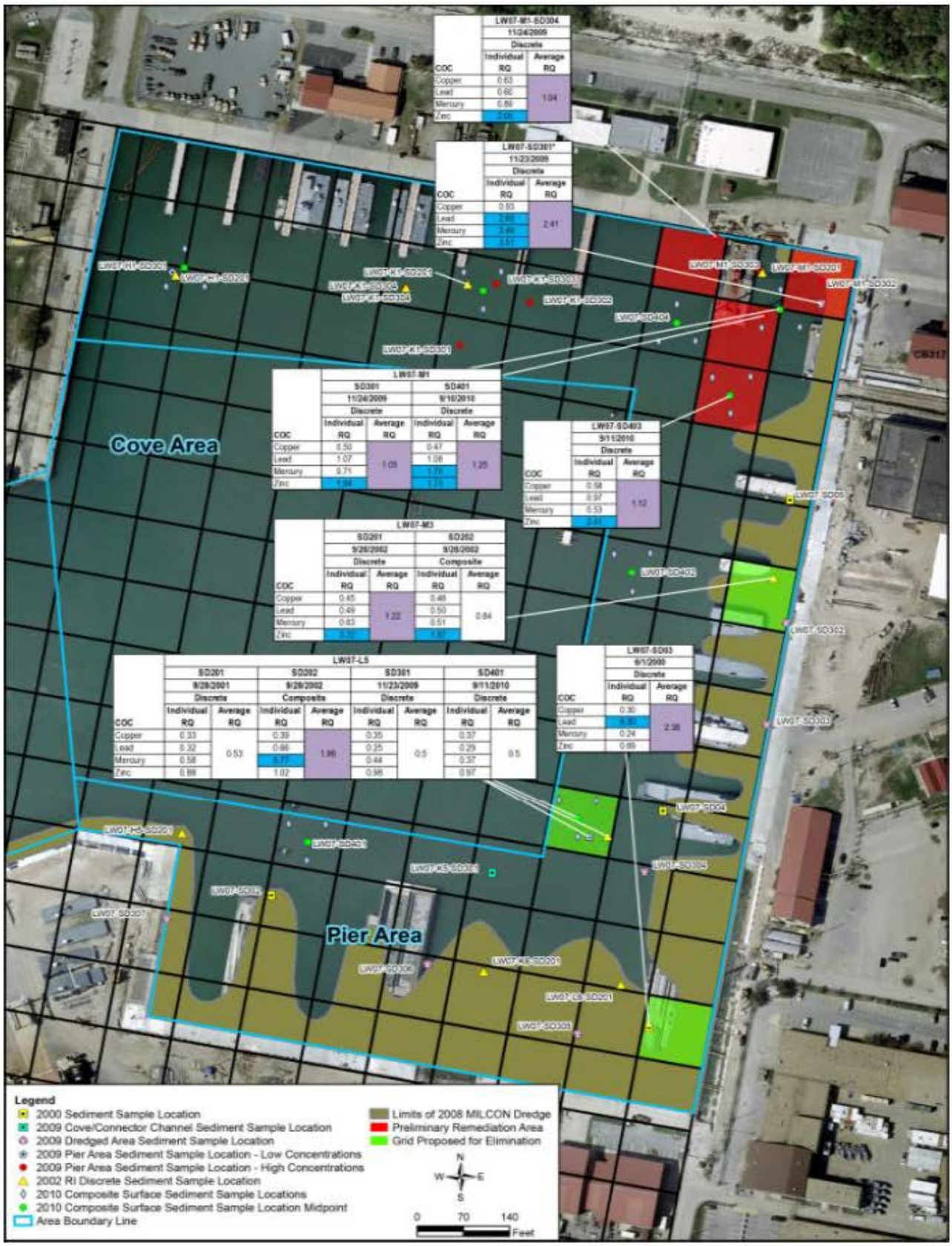
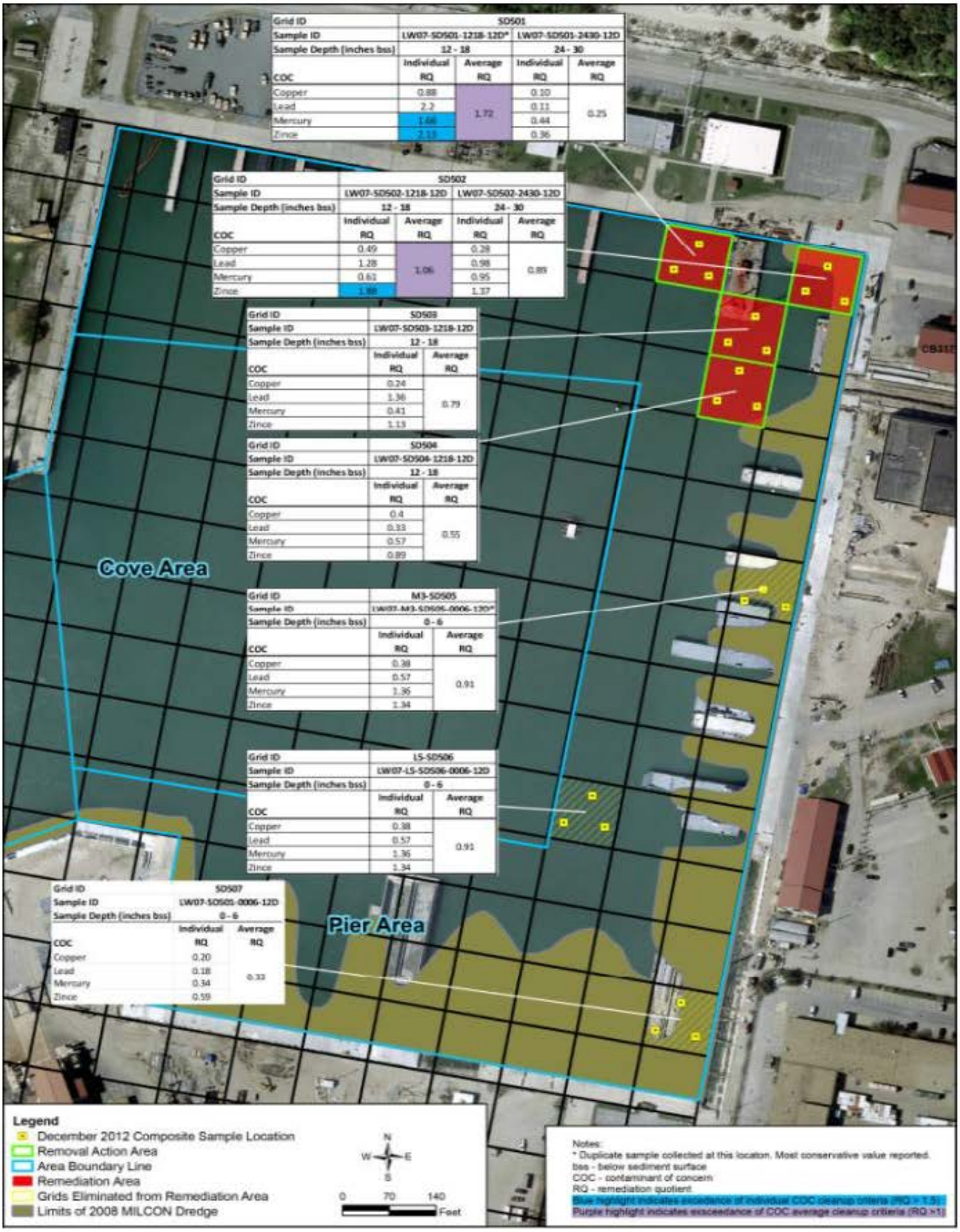


Figure 6- SWMU 7b Remediation Area Delineation and Removal Boundary



2.8 No Further Action Determination

Based on investigation results, the completion of a Non-Time-Critical Removal Action (NTCRA), and risk management decisions made by the Navy, USEPA, and VDEQ at SWMU 7b, no CERCLA-related unacceptable risk to human health or the environment remains at SWMU 7b under current site conditions. Although PAHs pose potentially unacceptable risk to the environment, PAHs at SWMU 7b are likely primarily attributable to the 19 stormwater outfalls that convey stormwater runoff from various locations within the facility, including numerous parking areas, and not attributable to historical sandblasting activities. Completion of the 2013 NTCRA mitigated all potentially unacceptable ecological risks associated with sediment at SWMU 7b. Because of the tidal nature of the water body and the 22 outfalls (11 non-regulated stormwater, 8 regulated stormwater, and 3 regulated process water) that discharge into the cove, any contamination detected in the surface water of Desert Cove or the Connector Channel may or may not be associated with historical sandblasting activities at SWMU 7; therefore, potential risks associated with exposure to surface water at SWMU 7b were not evaluated. The Navy and EPA, in consultation with the VDEQ, agree there is no unacceptable CERCLA-related risk to human health and the environment at SWMU 7b and no further remedial action is required under CERCLA. No remedial action will be performed at SWMU 7b and no restrictions on land use or exposure will be imposed.

Following completion of the 2013 NTCRA, no hazardous substances, pollutants or contaminants remain onsite above levels that allow for unlimited use and unrestricted exposure, therefore, five-year reviews will not be required.

3. Responsiveness Summary

The participants in the public meeting held on August 13, 2013 included representatives of the Navy, USEPA, and the VDEQ. Navy, USEPA, and VDEQ representatives were available at the public meeting to present the Proposed Plan for SWMU 7b and answer any questions regarding the Proposed Plan as well as any other documents in the Administrative Record file for JEB Little Creek. The Navy, USEPA, and VDEQ received no written comments, concerns, or questions during the public comment period. No one from the public attended the public meeting held on August 13, 2013.

Appendix A
Acronyms and Abbreviations

Acronyms and Abbreviations

ABM	abrasive blast material
AM	Action Memorandum
AOC	area of concern
ARAR	applicable or relevant and appropriate requirement
AST	aboveground storage tank
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CSM	Conceptual Site Model
COC	contaminant of concern
COPC	contaminant of potential concern
DO	dissolved oxygen
ERA	Ecological Risk Assessment
EE/CA	Engineering Evaluation and Cost Analysis
ERP	Environmental Restoration Program
FFA	Federal Facility Agreement
FS	Feasibility Study
HHRA	Human Health Risk Assessment
HI	Hazard Index
HQ	Hazard Quotient
JEB	Joint Expeditionary Base
LUC	Land Use Control
µg/kg	micrograms per kilogram
mg/kg	milligrams per kilogram
MILCON	military construction
MMRP	Military Munitions Response Program
NAB	Naval Amphibious Base
Navy	Department of the Navy
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NOAA	National Oceanic and Atmospheric Administration
NPL	National Priorities List
NTCRA	Non-Time Critical Removal Action
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
RAO	remedial action objective
RI	Remedial Investigation
ROD	Record of Decision
RME	reasonable maximum exposure
RQ	remediation quotient
SARA	Superfund Amendments and Reauthorization Act of 1986
SI	Site Investigation
SQUIRT	Screening Quick Reference Tables [NOAA]
SWMU	Solid Waste Management Unit

TBT	tributyltin
TOC	Total Organic Carbon
USEPA	United States Environmental Protection Agency
VDEQ	Virginia Department of Environmental Quality
yd^3	cubic yard

References

Item	Reference Phrase in ROD	Location in ROD	Identification of Referenced Document Available in the Administrative Record file
1	**no further action was required for SWMU 7a**	Section 2.1	CH2M HILL. 2005. *Final Record of Decision for SWMU 7a: Small Boats Sandblast Yard. Naval Amphibious Base Little Creek, Virginia Beach, Virginia.* June. Section 2.8.
2	**potentially unacceptable risks to benthic invertebrates**	Section 2.2, Table 1	CH2M HILL. 2001b. *Draft Screening and Baseline (Steps 1-3) Ecological Risk Assessment for SWMUs 7 and 8, Naval Amphibious Base Little Creek, Virginia Beach, Virginia.* January. Section 5.4.6.2, Table 5-35.
3	**no unacceptable human health risks from exposure to sediment**	Section 2.2, Table 1	CH2M HILL. 2004. *Final Remedial Investigation/Human Health Risk Assessment/ Ecological Risk Assessment for SWMU 7, Naval Amphibious Base Little Creek, Virginia Beach, Virginia.* December. Section 7.5.2.3, Table 7-4, and Appendix H.
4	**potentially unacceptable ecological risks**	Section 2.2, Table 1	CH2M HILL. 2004. *Final Remedial Investigation/Human Health Risk Assessment/ Ecological Risk Assessment for SWMU 7, Naval Amphibious Base Little Creek, Virginia Beach, Virginia.* December. Section 8.4.2 and 8.4.3, Tables 8-43, 8-44, and 8-45.
5	**further investigation of PAHs in sediment under CERCLA was not warranted**	Section 2.2, Table 1	CH2M HILL. 2012. *Final Post-MILCON Action Evaluation, SWMU 7b – Small Boats Sandblast Yard (Desert Cove), Joint Expeditionary Base Little Creek, Virginia Beach, Virginia.* July. Section 4.0.
6	**risks associated with arsenic, selenium, and silver were not unacceptable**	Section 2.2, Table 1	CH2M HILL. 2012. *Final Post-MILCON Action Evaluation, SWMU 7b – Small Boats Sandblast Yard (Desert Cove), Joint Expeditionary Base Little Creek, Virginia Beach, Virginia.* July. Section 4.0.
7	**metals concentrations may result in unacceptable risks to ecological receptors**	Section 2.2, Table 1	CH2M HILL. 2012. *Final Post-MILCON Action Evaluation, SWMU 7b – Small Boats Sandblast Yard (Desert Cove), Joint Expeditionary Base Little Creek, Virginia Beach, Virginia.* July. Section 5.3.2 and Attachment D, Table D-17.
8	**evaluate NTCRA alternatives**	Section 2.2, Table 1	CH2M HILL. 2013. *Final Engineering Evaluation/ Cost Analysis for Solid Waste Management Unit 7b – Small Boats Sandblast Yard, Joint Expeditionary Base Little Creek, Virginia Beach, Virginia.* January. Section 4 and 5 and Table 4-1.
9	**cleanup goals for SWMU 3**	Section 2.2, Table 1	CH2M HILL. 2012. *Final Engineering Evaluation/Cost Analysis for Solid Waste Management Unit 3 Pier 10 Sandblast Yard, Joint Expeditionary Base Little Creek, Virginia Beach, Virginia*. December. Section 2.5.
10	**preliminary remediation goals (PRGs)**	Section 2.2, Table 1	CH2M HILL. 2013. *Final Engineering Evaluation/ Cost Analysis for Solid Waste Management Unit 7b – Small Boats Sandblast Yard, Joint Expeditionary Base Little Creek, Virginia Beach, Virginia.* January. Section 2.4.

REFERENCES

Item	Reference Phrase in ROD	Location in ROD	Identification of Referenced Document Available in the Administrative Record file
11	**final removal area for mitigation of ecological risk in sediment**	Section 2.2, Table 1	CH2M HILL. 2013. *Final NTCRA and Construction Summary Memorandum for SWMU 3 – Pier 10 Sandblast Yard and SWMU 7b – Small Boats Sandblast Yard, Joint Expeditionary Base Little Creek, Virginia Beach, Virginia.* September. Figure 2-6.
12	**4,040 yd^3 of sediment were dredged**	Section 2.2, Table 1	CH2M HILL. 2013. *Final NTCRA and Construction Summary Memorandum for SWMU 3 – Pier 10 Sandblast Yard and SWMU 7b – Small Boats Sandblast Yard, Joint Expeditionary Base Little Creek, Virginia Beach, Virginia.* September. Section 3.4.
13	**Site Management Plan**	Section 2.4	CH2M HILL. 2012. *Site Management Plan for Fiscal Years 2013 through 2017, Joint Expeditionary Base Little Creek –Fort Story, Little Creek, Virginia Beach, Virginia.* October.
14	**potential human health risks**	Section 2.7.1	CH2M HILL. 2004. *Final Remedial Investigation/Human Health Risk Assessment/ Ecological Risk Assessment for SWMU 7, Naval Amphibious Base Little Creek, Virginia Beach, Virginia.* December. Appendix H.
15	**current receptor**	Section 2.7.1	CH2M HILL. 2004. *Final Remedial Investigation/Human Health Risk Assessment/ Ecological Risk Assessment for SWMU 7, Naval Amphibious Base Little Creek, Virginia Beach, Virginia.* December. Tables 7-4 and 7-5.
16	**hypothetical future receptor**	Section 2.7.1	CH2M HILL. 2004. *Final Remedial Investigation/Human Health Risk Assessment/ Ecological Risk Assessment for SWMU 7, Naval Amphibious Base Little Creek, Virginia Beach, Virginia.* December. Tables 7-4 and 7-5.
17	**exposure scenarios**	Section 2.7.1	CH2M HILL. 2004. *Final Remedial Investigation/Human Health Risk Assessment/ Ecological Risk Assessment for SWMU 7, Naval Amphibious Base Little Creek, Virginia Beach, Virginia.* December. Tables 7-4 and 7-5.
18	**potential risks**	Section 2.7.2	CH2M HILL. 2004. *Final Remedial Investigation/Human Health Risk Assessment/ Ecological Risk Assessment for SWMU 7, Naval Amphibious Base Little Creek, Virginia Beach, Virginia.* December. Section 8. CH2M HILL. 2012. *Final Post-MILCON Action Evaluation, SWMU 7b – Small Boats Sandblast Yard (Desert Cove), Joint Expeditionary Base Little Creek, Virginia Beach, Virginia.* July. Attachment D.
19	**ecological receptors**	Section 2.7.2	CH2M HILL. 2004. *Final Remedial Investigation/Human Health Risk Assessment/ Ecological Risk Assessment for SWMU 7, Naval Amphibious Base Little Creek, Virginia Beach, Virginia.* December. Section 8. CH2M HILL. 2012. *Final Post-MILCON Action Evaluation, SWMU 7b – Small Boats Sandblast Yard (Desert Cove), Joint Expeditionary Base Little Creek, Virginia Beach, Virginia.* July. Attachment D.
20	**signed consensus agreement**	Section 2.7.2	CH2M HILL. 2013. *Final Engineering Evaluation/ Cost Analysis for Solid Waste Management Unit 7b – Small Boats Sandblast Yard, Joint Expeditionary Base Little Creek, Virginia Beach, Virginia.* January. Appendix A.
21	**surveys**	Section 2.7.2	CH2M HILL. 2013. *Final NTCRA and Construction Summary Memorandum for SWMU 3 – Pier 10 Sandblast Yard and SWMU 7b – Small Boats Sandblast Yard, Joint Expeditionary Base Little Creek, Virginia Beach, Virginia.* September. Attachment J.

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

For access to information contained in the Administrative Record file for JEB Little Creek, please contact:

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