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NAB LITTLE CREEK
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Final

Record of Decision

Site 7: Amphibious Base Landfill

Naval Amphibious Base Little Creek
Virginia Beach, Virginia

EPA ID: VA5170022482

NAVFA
Naval Facilities Engineering C

September 2009

Final

Record of Decision

Site 7, Amphibious Base Landfill

Naval Amphibious Base Little Creek, Virginia Beach, Virginia

September 2009

1 Declaration

This Record of Decision (ROD) presents the Selected Remedy for Site 7, Amphibious Base Landfill, at Naval Amphibious Base (NAB) Little Creek, Virginia Beach, Virginia. NAB Little Creek was placed on the United States Environmental Protection Agency (USEPA) National Priorities List (NPL) in May 1999 (Superfund Identification Number VA5170022482). The remedy was selected 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 upon information contained in the Administrative Record[1] file for the site.

The United States Department of the Navy (Navy) is the lead agency and provides funding for site cleanups at NAB Little Creek. The Navy and USEPA Region III, the lead regulatory agency, issue this ROD jointly. The Commonwealth of Virginia, Virginia Department of Environmental Quality (VDEQ), the supporting regulatory agency, concurs with the Selected Remedy.

1.1 Selected Remedy

The response action selected in this ROD is necessary to protect public health, welfare, and the environment from actual or threatened releases of contaminants from the site. Under current and reasonably anticipated future land use scenarios groundwater is not anticipated to be used as a potable water supply. Exposure through direct contact of landfill waste remaining in place is the only potential unacceptable risk to human health and the environment. The Selected Remedy is a containment presumptive remedy the components of which are: maintenance of the existing soil cover; groundwater long-term monitoring (LTM) to identify any potential future releases and offsite migration of contaminants; and LUCs to prevent human exposure to waste remaining in place.

LUCs at Site 7 will be implemented by the Navy to meet the following objectives:

- Prohibit digging into or disturbance of the existing soil cover and landfill contents
- Prohibit the use of the site for residential, child care, elementary or secondary school, or playground facilities

The Selected Remedy is protective of human health and the environment, complies with federal and state requirements that are applicable or relevant and appropriate to the remedial action, is cost-effective, and utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable. The Selected Remedy does not satisfy the statutory preference for treatment as the principal element. However, the large volume and heterogeneity of the landfill waste, and the relatively low concentrations of hazardous substances make treatment impracticable. The Selected Remedy, as documented in this ROD, addresses all potential risks from exposure to waste remaining in place and does not include or affect any other sites at the installation.

Because the remedy will result in pollutants or contaminants remaining onsite above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within 5 years of the initiation of the remedial action (and every 5 years thereafter), to evaluate continuing remedy

[1] **Bold blue text** identifies detailed site information available in the Administrative Record and listed in the References Table.

effectiveness and to determine if the remedy continues to be protective of human health and the environment.

1.2 ROD Data Certification Checklist

The following information is considered in selecting the remedy for Site 7:

- Current and reasonably anticipated future land use assumptions and current and potential future beneficial uses of groundwater (Section 2.5)
- Chemicals of Concern (COCs) and their respective concentrations (Section 2.6)
- Risks related to the COCs (Section 2.6, Attachment A)
- How source materials constituting principal threats will be addressed (Section 2.7)
- Estimated capital costs, annual operation and maintenance (O&M), and total present-worth costs, discount rate, and the number of years over which the remedy cost estimate is projected (Section 2.9, Table 4)
- Key factors that led to selecting the remedy (Section 2.10)
- Potential land and groundwater use that will be available at the site as a result of the Selected Remedy (Section 2.10.3)

If contamination posing an unacceptable risk to human health or the environment is discovered after execution of this ROD, the Navy will undertake all necessary actions to ensure continued protection of human health and the environment.

1.3 Site 7 Record of Decision Authorizing Signatures

W. W. Crow, CAPT, USN
By direction of the Commander
Navy Region Mid-Atlantic

9/15/2009
Date

Kathryn A. Hodgkiss, Acting Director
Hazardous Site Cleanup Division
USEPA (Region III)

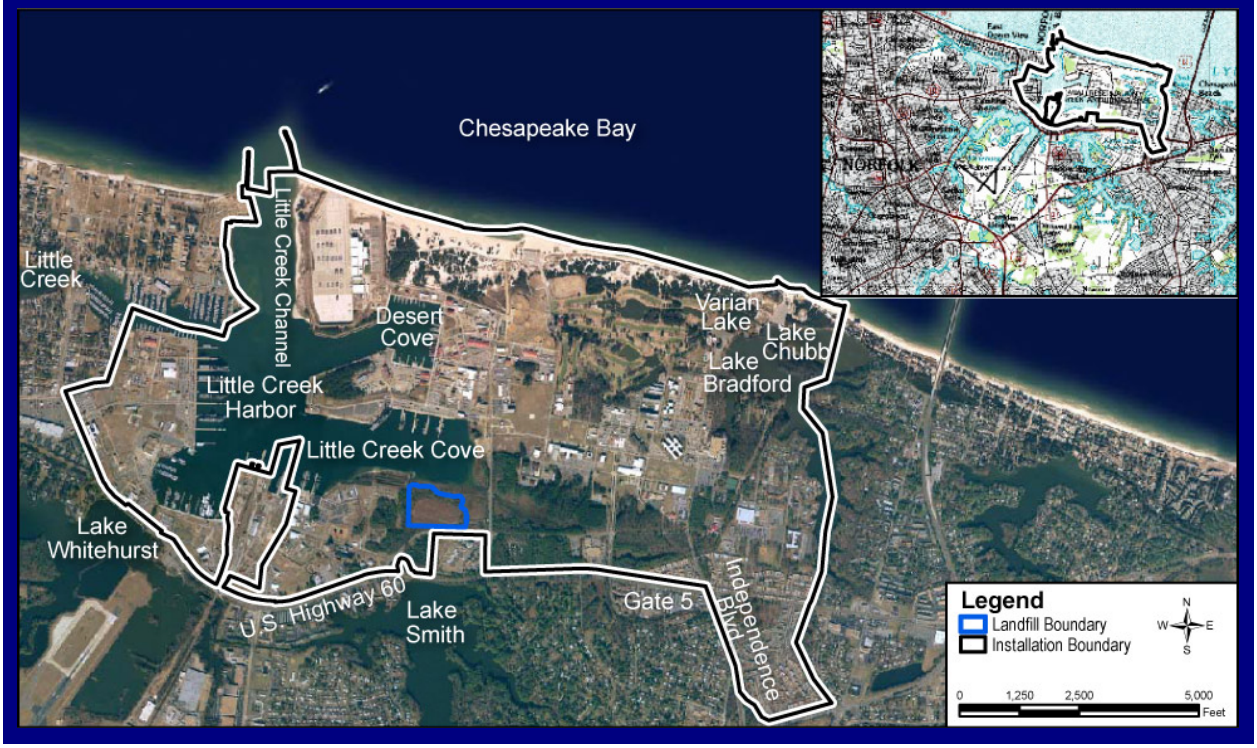
9/18/09
Date

2. Decision Summary

2.1 Site Description and History

NAB Little Creek consists of 2,215 acres in the northwest portion of Virginia Beach, Virginia, adjacent to the Chesapeake Bay (Figure 1). The installation is primarily industrial, and its personnel provide logistic facilities and support services for local commands, organizations, home-ported ships, and other U.S. and allied units to meet the amphibious warfare training requirements of the U.S. Armed Forces. NAB Little Creek is also used for recreational, commercial, and residential purposes. Land development surrounding the base is residential, commercial, and industrial.

FIGURE 1
Site Location Map



Site 7, the Amphibious Base Landfill, is approximately 38 acres and is located in the south-central part of NAB Little Creek (Figure 2). The landfill is bordered on the east by Helicopter Road, on the south by Amphibious Drive, on the north by Little Creek Cove, and on the west by an ordnance storage area. In the western portion of Site 7, a drainage canal runs south to north into Little Creek Cove. A pond is located in the northeastern portion of the landfill adjacent to Little Creek Cove. A discontinuous portion of the landfill referred to as the "Ear" is located west of the drainage canal. Two locked gates control vehicle access to the landfill across access roads on the site's eastern and western sides. The locked gate along the old western access road and dense vegetation along the western side limit access to the "Ear." The culvert providing access from the "Ear" to the landfill collapsed in 2002 and was subsequently removed during the 2006 **Non-time-critical Removal Action** (NTCRA). There is no longer access to the landfill from the west across the drainage canal and Little Creek Cove limits access from the north. A chain-link fence runs along the site's eastern and southern boundaries. Pedestrian access along the eastern and western borders is deterred by dense vegetation.

FIGURE 2
Site Layout Map

The Amphibious Base Landfill operated between 1962 and 1979. The Commonwealth of Virginia Department of Health issued a non-conforming permit on August 28, 1979 to allow disposal on an interim basis at Site 7, as conditions were not conducive for landfilling. In 1982 the permit was terminated and landfilling operations ceased. Initially, waste disposal operations were conducted as a trench-type landfill with open burning of refuse in the trenches. The landfill later operated as an area landfill, with refuse spread over the ground and covered regularly. The estimated landfill volume is approximately 500,000 cubic yards of waste from base housing and other residential activities at the installation. Waste oils and metals segregated from the waste were also reportedly disposed of in the landfill starting in 1970. After closure, the landfill continued to be used as a metal collection and transfer site, temporary storage site for wastes, and a burn area for scrap wood and trees. Open burning halted in 1984. Waste storage activities at the site ceased in 1994. Currently, 2 feet (ft) of soil covers the entire landfill area.

2.2 Previous Investigations

NAB Little Creek was placed on the USEPA's National Priorities List (NPL) in May 1999. The **Federal Facility Agreement** (FFA) was signed in November 2003 and established schedules and procedures between the Navy and USEPA for CERCLA cleanup at the installation. No enforcement actions have been recorded at Site 7. Prior to the placement of NAB Little Creek on the NPL, the environmental investigation efforts under the Navy Assessment and Control of Installation Pollutants Program began by conducting an **Initial Assessment Study** (IAS) in 1984. Subsequent investigation efforts consisted of the **Round 1 Verification Study** in 1986, an **Interim Remedial Investigation** in 1991 and a **RI/FS** in 1994. Following these investigations, the **Proposed Remedial Action Plan** (PRAP) and final **Decision Document** (DD) were issued in 1998, outlining institutional controls along with the placement of a soil/vegetative cover as the Selected Remedy for Site 7. Subsequently, approximately 610 cubic yards of debris along the shoreline was removed and a limited 24-inch soil cover was placed over the central landfill (excluding the "Ear") in 1998 in accordance with the DD. Following completion of the **remedial action**, a groundwater, surface water, and sediment LTM program was initiated.

Following NAB Little Creek's placement on the NPL in 1999, the site remedy selection decision process was re-evaluated and the **RI/Human Health Risk Assessment (HHRA)** and **Ecological Risk Assessment (ERA),** were revised to further define the nature and extent of soil, groundwater, sediment,

and surface water contamination and assess potential risks to human health and the environment. Figure 3 illustrates soil, sediment, surface water, and groundwater sample locations. A summary of the post NPL investigation efforts is provided on Table 1.

FIGURE 3
Previous Sampling Locations

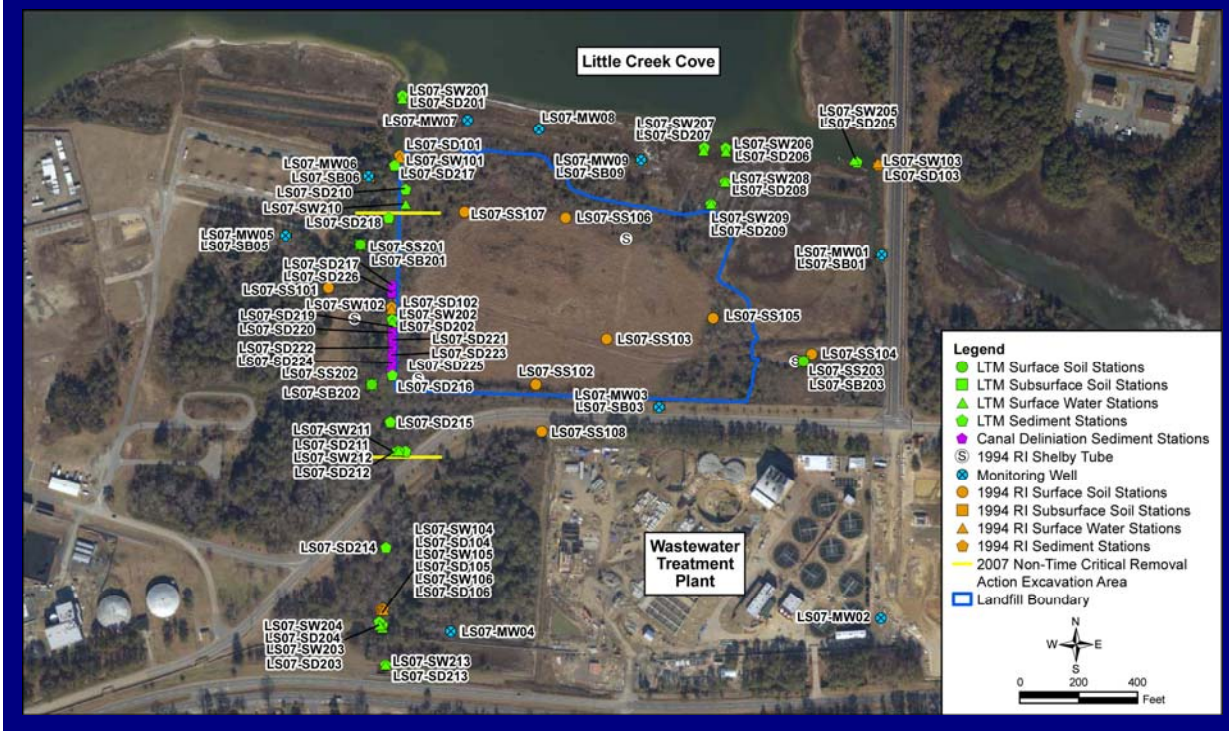


TABLE 1
Previous Investigation Summary

Investigation Report	Results Summary
Revised Remedial Investigation/Human Health Risk Assessment/ Ecological Risk Assessment, November 2004	Soil, sediment, surface water, and groundwater were sampled for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), metals, and pesticides/ polychlorinated biphenyls (PCBs). Organics and inorganics were detected in site media above regulatory risk based screening criteria and/or basewide background. Arsenic, iron, manganese, and thallium were detected in groundwater above Maximum Contaminant Levels (MCLs). The **HHRA** concluded direct contact with waste and waste-impacted soil and ingestion of waste-contaminated soil by future human receptors may present potential unacceptable risk above USEPA's acceptable levels. Additionally, dermal contact with and/or ingestion of groundwater by future industrial workers, construction workers, and residents may result in a cancer risk and/or non-cancer hazard above USEPA's threshold levels. Potential **ecological risks** associated with sediment and surface water in Little Creek Cove and vegetated wetlands were considered negligible, based on the frequency and magnitude of screening value exceedances. However, copper, lead, Aroclor®-1260, and five pesticides were identified as chemicals of potential concern (COPCs) in sediment and surface water in the central portion of the western drainage canal and the ERA recommended further investigation and the potential for remedial action to address risks in the western drainage canal. A summary of the HHRA and ERA for Site 7 is presented in Section 2.5.

Table 1 continued on next page

TABLE 1 (cont.)
Previous Investigation Summary

Investigation Report	Results Summary
Long-Term Monitoring Report, August 2005	Eleven rounds of surface water, sediment, and groundwater data were collected and analyzed for VOCs, SVOCs, pesticides/PCBs, metals, cyanide, total organic carbon, and/or wet chemistry (alkalinity, bicarbonate, chloride, and sulfide) between June 1998 and February 2004. VOCs, SVOCs, metals, and cyanide were detected in groundwater, surface water, and sediment. Pesticides and PCBs were detected in sediment. **Statistical evaluations** of sediment data indicated metals and pesticides/PCBs in sediment exhibited significant changes (increasing and decreasing) over time, among locations, and/or across seasons. These changes were primarily observed in the western tidal canal and pond area and may be attributed to a combination of migration of contaminated sediment with tidal fluctuations and runoff from the landfill. There were no significant changes in surface water and groundwater determined to be attributable to a landfill release.
Engineering Evaluation/ Cost Analysis, March 2005	Evaluated **removal alternatives** to mitigate the ecological risks associated with the western drainage canal. Based on a comparison of cost, effectiveness, and implementability, the EE/CA recommended that contaminated sediments be excavated and replaced with clean fill. The **lateral extent of removal** was defined based on existing data. The Navy, USEPA, and VDEQ agreed to remove a 12-inch layer of sediment from the central portion of the canal. The area was then backfilled with clean material to its original grade establishing an uncontaminated biological zone. Therefore, confirmation samples were not necessary. Following completion of the interim removal action, the Navy in partnership with USEPA and VDEQ, agreed that ecological risk at Site 7 would be acceptable.
Debris Delineation, November 2005	A series of site visits, followed by test pitting, were conducted to delineate the **extent of debris** and assess the need for maintenance actions to improve the existing soil cover at Site 7. Results of the debris delineation revealed inadequate soil cover (less than 24 inches) overlaying landfill materials outside of the 1998 soil cover area. The Navy, in partnership with USEPA and VDEQ, agreed maintenance actions were warranted to remove surface debris where practicable and to ensure a minimum of 24 inches of soil cover throughout the footprint of the landfill.
Non-Time Critical Removal Action, January 2008	2,858 tons of sediment and debris were removed from the western drainage canal. The canal was backfilled with 1 foot of clean fill to its original depth, and the eastern bank was stabilized using concrete matting and vegetation to prevent landfill contents from infiltrating into the canal. During the NTCRA, the landfill soil cover was also extended west of the 1998 soil cover to the edge of the canal.
Focused Feasibility Study, August 2008	Two remedial alternatives to address potential human heath risks and ecological risks were considered—no action and a containment presumptive remedy. Based on the results of the 2004 RI/HHRA/ERA and the remedial actions, removal actions and soil cover extension activities conducted to date; components of the containment presumptive remedy were maintenance of the existing soil cover, LUCs, and groundwater LTM. Additional data collection efforts were conducted to determine the extent of disposal activity on the landfill "Ear." **Test pits** were excavated to confirm the presence or absence of subsurface debris west of the drainage canal. Surface debris was scattered and there was minimal subsurface debris present. Although the test pitting activities did not indicate landfilling consistent with trench, burn, and bury activities in the "Ear" area, the Navy, in partnership with USEPA and VDEQ, agreed to include this area within the LUC boundary However, soil cover was not warranted for the "Ear." The 2004 **HHRA was revised** to include groundwater data collected from the "Ear" to reflect overall groundwater risk within the LUC boundary.
Landfill Operations and Maintenance, February 2009	**O&M** activities were conducted to extend the soil cover over the remaining portions of the landfill identified during the debris delineation as lacking adequate cover. Approximately 85 tons of concrete and vegetative debris and 10 tons of scrap metal were removed from the site and an 18-inch layer of clean fill (17,346 yd3) and 6-inch layer of topsoil (4,934 yd3) were placed over the landfill and seeded. Biodegradable coconut fiber logs and concrete matting were placed along the northern boundary to provide slope stabilization and control erosion and surface runoff until a vegetative cover could be established. Surface debris was also removed from the Site 7 "Ear."
Proposed Plan, February 2009	In February 2009 the Proposed Plan presenting the **preferred alternative**, maintenance of the existing soil cover, LUCs, and LTM of groundwater was presented to the public. The public meeting was held on February 9, 2009. Representatives from the Navy, USEPA, and VDEQ attended the meeting. Community members were not present at the meeting.

2.3 Scope and Role of Operable Unit

Site 7 is one of 12 Environmental Restoration Program (ERP) sites addressed under CERCLA at NAB Little Creek. In addition to Site 7, the following sites are currently in the RI/FS stage of the CERCLA process:

- Site 11a—Building 3033 Former Waste Oil Tank
- SWMU 3—Pier 10 Sandblast Yard
- SWMU 7b—Small Boats Sandblast Yard Piers 51-59 (sediment)

The following sites have a final ROD in place:

- SWMU 7a—No Action for soil and groundwater
- SWMU 8—No Action for soil and groundwater
- Site 8—No Further Action for soil, groundwater, sediment, and surface water
- Sites 9 and 10—Action ROD for LUCs and groundwater monitoring
- Site 11—Action ROD for enhanced anaerobic bioremediation with LUCs and post-treatment groundwater monitoring
- Site 12—Action ROD for enhanced anaerobic bioremediation with LUCs and post-treatment groundwater monitoring
- Site 13—Action ROD for enhanced anaerobic bioremediation with LUCs and post-treatment groundwater monitoring

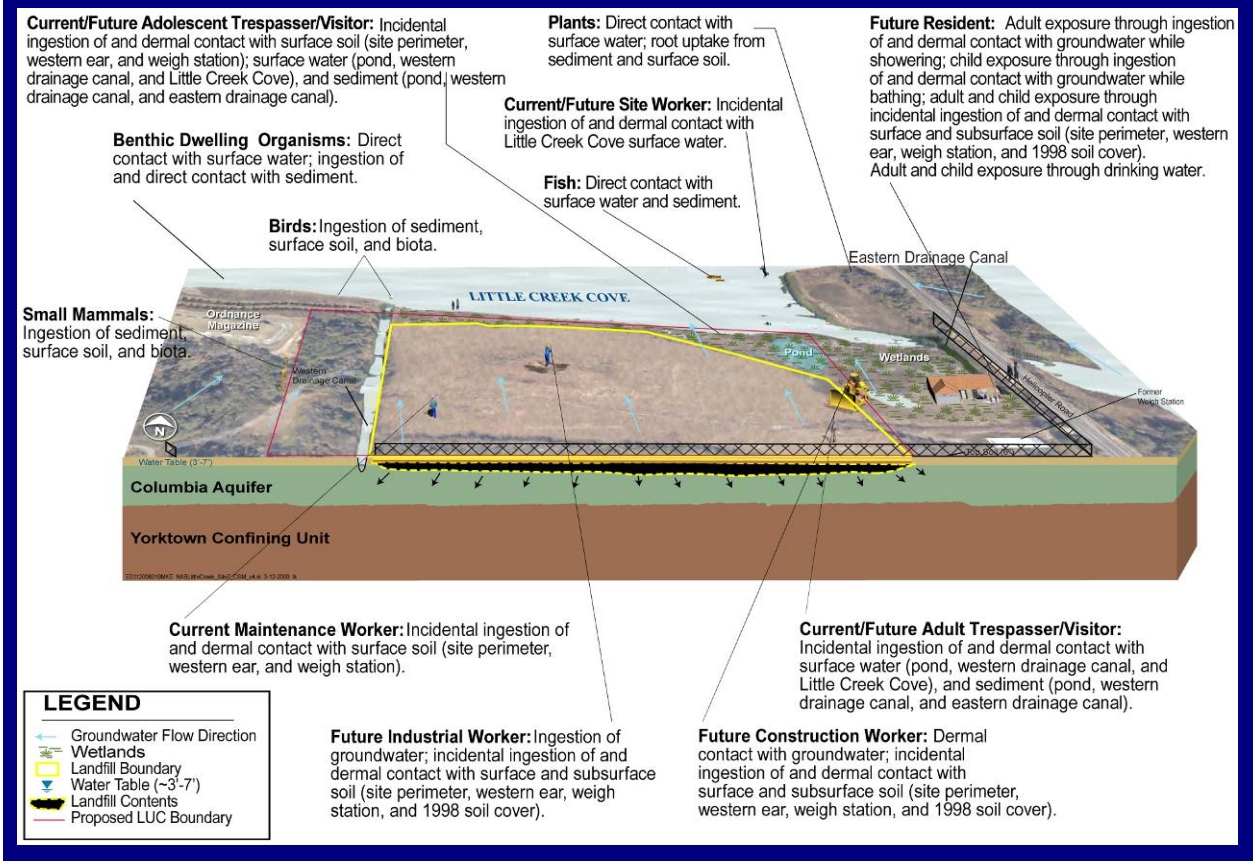
Seventeen sites requiring further evaluation through desktop audits or site screening process investigations were identified in the NAB Little Creek FFA. Each site was evaluated and closeout documentation was prepared. Additionally, the FFA identified 105 sites for which no action under CERCLA is required. Information on the status of all ERP sites at NAB Little Creek can be found in the current version of the SMP in the Administrative Record.

2.4 Site Characteristics

NAB Little Creek and the surrounding area contain industrial, commercial, recreational, and residential land uses. The area surrounding this 2,215-acre base is low-lying and relatively flat, with several fresh water lakes (Lake Bradford, Chubb Lake, Little Creek Reservoir/Lake Smith, and Lake Whitehurst) located on or adjacent to the base. Little Creek Reservoir/Lake Smith located upgradient of the base, serves as a secondary drinking water supply for parts of the City of Norfolk. NAB Little Creek encircles three saltwater bodies: Little Creek Cove, Desert Cove, and Little Creek Harbor, which are connected to the Chesapeake Bay via Little Creek Channel (Figure 2).

Site 7 consists of the Amphibious Base Landfill and the discontinuous portion of the landfill referred to as the “Ear” located west of the drainage canal. The conceptual site model (CSM) is presented in Figure 4. Currently, there is a vegetated 24-inch soil cover over the landfill contents that comprises approximately 22 acres of the site. The topography is generally level. Surface runoff flows radially off the landfill, reaching Little Creek Cove via several surface drainage features. Approximately 11 acres of tidally influenced wetlands are present along the northern and eastern portions of the site. A canal running through the western portion of the site separates the landfill from the “Ear” and connects Lake Smith/Little Creek Reservoir with Little Creek Cove. This canal is tidally influenced throughout its entire length on the site; a weir near the base boundary prevents tidal flow from reaching Lake Smith/Little Creek Reservoir. The “Ear” is forested with dense vegetation in areas adjacent to the former access road. Currently there is no access to the landfill from the “Ear.” A berm is situated along the eastern edge of the drainage canal and diverts surface drainage from the “Ear” toward Little Creek Cove.

FIGURE 4
Site 7 Conceptual Site Model



Shallow Columbia aquifer groundwater at the site ranges from 3 to 7 ft below ground surface (bgs) and generally flows north, discharging to Little Creek Cove. A tidal study conducted as part of the 1994 RI indicated shallow groundwater may also intermittently flow toward the tidally influenced western and eastern drainage canals. A clay confining unit (Yorktown Confining Unit) encountered across NAB Little Creek at a depth of approximately 19 to 24 ft bgs, separates the Columbia Aquifer from the underlying Yorktown Aquifer, impeding downward migration of contaminants to the Yorktown Aquifer. Because of the proximity of the site to the Chesapeake Bay, groundwater in the Yorktown Aquifer beneath the site is assumed to flow north and discharge into the Chesapeake Bay.

The primary mechanism for contaminant transport from the site is believed to be leaching of contaminants from waste/waste-contaminated soil through precipitation and infiltration to groundwater as groundwater migrates through Site 7 and discharges to Little Creek Cove. The transport mechanism has been limited through the placement of a 24-inch soil cover. Currently, groundwater at NAB Little Creek is not used as a potable water source. Potable water is supplied to the Base and surrounding community by the City of Virginia Beach. Groundwater wells at the Base golf course, approximately 3/4 of a mile northeast of Site 7, provide water from the Yorktown Aquifer for irrigation of the golf course.

2.5 Current and Potential Future Land and Resource Uses

Site 7 and the area surrounding are industrial and include a wastewater treatment plant to the south, and the Base's Duration Force Vehicle Compound and an ammunition magazine to the west. Currently, a helicopter-landing pad is situated on the landfill cover. Future land use such as industrial, recreational, and operational activities may be implemented provided the activities are consistent with protection of human health and the environment.

The Commonwealth of Virginia considers all groundwater to be of potential beneficial use (potable). Groundwater is not currently used as a potable water source at or in the vicinity of NAB Little Creek as potable water is supplied by the City of Virginia Beach. Groundwater is not anticipated to be used as a potable water supply in the future because of its general poor quality (iron and manganese above secondary MCLs), and low yield (generally less that 3 to 5 gallons per minute). Groundwater will be monitored to evaluate any potential releases from the landfill and offsite migration of contaminants.

2.6 Summary of Site Risks

Detailed results of the HHRA and ERA for soil, surface water, and sediment at Site 7 are presented in the 2004 RI/HHRA/ERA. The 2004 HHRA was revised for groundwater and is presented in the 2008 Focused Feasibility Study (FFS). In summary, potential human health risks are associated with exposure to waste, waste-contaminated soil, and potable use of groundwater (Attachment A, Tables A-1, A-2, A-4, and A-5). Prior to taking any actions at the site, potential ecological effects were identified to lower-trophic level receptors from exposure to sediment in the western drainage canal (Attachment A, Table A-3). Subsequent to the NTCRA, all ecological risks attributable to Site 7 are considered acceptable. The January 2008 **Construction Completion Report** (CCR) documents the NTCRA successfully removed contaminated sediments in accordance with the work plan. Soil, groundwater, and sediment risk management decisions are documented in the FFS and summarized below.

2.6.1 Human Health Risk Assessment Summary

The HHRA characterized risks for current maintenance workers, adult/adolescent trespassers, and site workers and potential future land use exposures for the adult/adolescent trespassers, site workers, industrial workers, construction workers, and adult/child residents. Potential **cancer risks and non-cancer hazards** were calculated based on reasonable maximum exposure (RME) and central tendency exposure (CTE) point concentrations. The RME scenario assumes the highest level (maximum concentrations) of human exposure that could reasonably be expected to occur, whereas the CTE scenario reflects a more realistic human exposure to levels (average concentrations) across the site.

For known or suspected carcinogens, acceptable exposure levels are generally concentrations at levels that represent an excess upper bound lifetime cancer risk to an individual of between 10^{-4} (a 1 in 10,000 chance of developing cancer) and 10^{-6} (a 1 in 1,000,000 chance of developing cancer) using information on the relationship between dose and response. 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.

The potential for non-cancer hazards is evaluated by determining the ratio of exposure to toxicity or the hazard quotient (HQ). An HQ greater than 1 indicates that a receptor's exposures may present an unacceptable risk. In addition, a hazard index (HI) is generated by adding the HQs for all constituents that affect the same target organ (for example, the liver) 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 risk due to exposure. A summary of cancer risk and non-cancer hazards exceeding USEPA threshold levels is provided in Table 2.

Groundwater (excluding LS07-MW06 on the "Ear" due to the presence of the canal as a groundwater divide), surface water, and sediment data from LTM Rounds 5, 6, and 7 were used to complete the 2004 risk assessment. The LTM sampling was conducted in February/March 2001, October 2001, and February 2002, respectively. The groundwater, surface water, and sediment data collected before these dates were not included in the risk assessment because these more recent samples are most representative of the current condition of site media. Soil data collected during the 1994 RI/FS and during the February 2002 LTM event were included in the risk assessment.

Based on the March 2008 test pitting results, the 2004 **HHRA for groundwater was revised** to include groundwater data collected from LS07-MW06 located on the "Ear" area. The receptor scenarios and groundwater data set, including LS07-MW06, were used to recalculate risk associated with exposure to groundwater. Monitoring well LS07-MW05, also located on the "Ear" area, was not sampled during the

Revised 2004 RI/HHRA/ERA field activities and was not included in the LTM program. Therefore, LS07-MW05 was not included in the revised groundwater risk assessment.

Waste/Waste-Contaminated Soil

Exposures to surface and subsurface soil were evaluated separately for four different areas within Site 7: the weigh station area, the "Ear" to the west of the landfill, the perimeter of the site, and the area of the landfill covered with clean fill. All non-cancer hazards and cancer risks based on conservative RME calculations for the current-use scenarios are within USEPA's acceptable risk ranges. Additionally, RME cancer risks associated with future exposure to site soil are within or below USEPA's acceptable risk range for all future receptor exposure scenarios evaluated. The RME non-cancer HI for the future resident, industrial worker, and construction worker are greater than 1.0 for site perimeter soil (Table 2). However, there are no unacceptable non-cancer HIs associated with exposure to site perimeter soil for future receptors based on more realistic CTE calculations and concentrations of vanadium were below the background upper tolerance limit. Therefore, with the exception of exposure to waste remaining in place, under the CTE scenario there are **no unacceptable risks** associated with site perimeter soil.

Surface Water and Sediment

RME cancer risks and non-cancer hazards are below or within USEPA's acceptable risk levels; therefore, **no unacceptable risks** are associated with exposure to surface water or sediment at Site 7.

Groundwater

RME cancer risks and non-cancer hazards associated with future construction workers exposed to site groundwater are below USEPA's threshold risk levels. Based on RME calculations, cancer risks and non-cancer hazards associated with future residents (adult and child) and industrial worker's potable use of groundwater at Site 7 are above USEPA's threshold levels due to the presence of arsenic, iron, and manganese (Table 2). However, there is no unacceptable non-cancer HI associated with exposure to iron in groundwater based on CTE calculations. Additionally, the **potential risks** associated with arsenic, iron, and manganese are being risk managed and are considered acceptable based on the following:

- Arsenic
  - During the most recent round of sampling (February 2004) arsenic was detected below the MCL in all but one monitoring well (LS07-MW06)
  - Elevated arsenic in the area of LS07-MW06 has likely resulted from natural reducing conditions, supported by field observations and measurements collected in the vicinity of this monitoring point
  - The concentrations of arsenic are above the background upper tolerance limit, but below the maximum background concentration for NAB Little Creek
  - There is no discernable arsenic plume. The area in which arsenic is present at a concentration above the MCL is located within the 100-year floodplain, and any drinking water well applications for this area would likely be denied
- Iron and manganese
  - Iron and manganese are essential human nutrients
  - Concentrations are statistically similar to background levels

2.6.2 Ecological Risk Summary

Prior to the NTCRA conducted in 2006, an ERA was conducted to assess potential risks to ecological receptors through direct **exposure to soil, surface water, and sediment; and exposure via the food web**. Groundwater directly discharges to surface water at Site 7; therefore, a direct measurement of surface water was used during the ERA and groundwater was not evaluated. In surface soil, lead, vanadium, and zinc exceeded background concentrations and ecological screening values. These exceedances were primarily located in the vicinity of the weigh station area. Mean HQs for these constituents are less than one. Thus, risks to lower trophic level receptors exposed to site soil were determined to be acceptable. Additionally, no unacceptable risks were identified, based on food web exposures, for upper trophic level receptors exposed to site soil because there were no HQs greater than one.

TABLE 2
Summary of Human Health Risks Above USEPA Threshold Levels

Receptor	Media	Pathway	Chemical of Concern	EPC* (µg/L)	RME Cancer Risk[1]	RME Non-Cancer Hazard (HI)	CTE Cancer Risk[1]	CTE Non-Cancer Hazard (HI)	Cancer Toxicity Factor (CSF) mg/kg-day-1	Non-Cancer Toxicity Factor (RfD) mg/kg-day
Future Resident Adult	Ground-water	Ingestion	Arsenic	2.8	NA	2.9	NA	0.43	1.5E+0	0.0003*
			Iron	12,000	NA	0.46	NA	0.16	NA	0.7**
			Manganese	1,100	NA	1.6	NA	0.47	NA	0.02*
		Dermal	Arsenic	28	NA	0.013	NA	0.0014	1.5E+0	0.0003*
			Iron	12,000	NA	0.0024	NA	0.00052	NA	0.7**
			Manganese	1,100	NA	0.2	NA	0.038	NA	0.0008*
	Site Perimeter Soil	Ingestion	Vanadium	202	NA	0.028	NA	0.0098	-	-
		Dermal			NA	1.4	NA	0.086	-	-
Future Resident Child	Ground-water	Ingestion	Arsenic	28	6.3E-04	6	8.0E-05	1.4	1.5E+0	0.0003*
			Iron	12,000	NA	1.1	NA	0.54	NA	0.7**
			Manganese	1,100	NA	3.6	NA	1.6	NA	0.02*
		Dermal	Arsenic	28	3.6E-06	0.04	2.0E-07	0.0031	1.5E+0	0.0003*
			Iron	12,000	NA	0.007	NA	0.0012	NA	0.7**
			Manganese	1,100	NA	0.06	NA	0.086	NA	0.0008*
	Site Perimeter Soil	Ingestion	Vanadium	202	0.0E-00	2.6	NA	0.051	-	-
		Dermal			0.0E-00	1.9	NA	0.063	-	-
Future Industrial Worker	Ground-water	Ingestion	Arsenic	28	1.5E-04	0.92	9.2E-06	0.29	1.5E+0	0.0003*
	Site Perimeter Soil	Ingestion	Vanadium	202	0.0E-00	0.2	NA	0.0091	-	-
		Dermal			0.0E-00	1.3	NA	0.045	-	-

Notes:

EPC – Exposure Point Concentration
HI – Hazard Index
CSF – Cancer Slope Factor
RfD – Reference Dose
*Source: Integrated Risk Information System (IRIS)
**Source: National Center for Environmental Assessment (NCEA)
***The RME EPCs were calculated as the 95 percent upper confidence limit (95% UCL) of the arithmetic mean concentration. The maximum detected concentration was used in place of the 95% UCL when the calculated 95% UCL was greater than the maximum detected value. Maximum concentrations that differed from the EPC were arsenic (max conc. = 31 µg/L), iron (max conc. = 16,000 µg/L), and manganese (max conc. = 1,600 µg/L).

[1] The RME and CTE Cancer Risks for the lifetime resident (adult and child) are reflected in the child resident scenario.

Potential ecological risks associated with sediment and surface water in Little Creek Cove and the adjacent vegetated wetlands were low based upon the frequency and magnitude of screening value exceedances. The highest potential ecological risks in sediment and surface water were in the central portion of the western drainage canal, although the habitat value of this drainage canal is minimal. Copper, lead, Aroclor®-1260, and five pesticides were identified as COPCs in sediment with the maximum concentrations focused in the northern part of the canal reach. Data do not indicate these constituents are migrating to areas with better quality habitat (e.g., Little Creek Cove). The ERA concluded the low potential risks in Little Creek Cove and adjacent wetlands are acceptable; however, the ERA recommended further investigation and the potential for remedial action to address risks in the western drainage canal.

In 2006, a 12-inch layer of sediment was removed from the canal between the southern and northernmost areas where COPC concentrations were above ecological screening values. Following removal of sediment, the canal was backfilled with clean material to bring the depth profile of the canal back to its original condition and to establish an uncontaminated biological zone; therefore, confirmation samples were not necessary. Following completion of the NTCRA, the Navy, in partnership with the USEPA and VDEQ, agreed there were no unacceptable ecological risks at Site 7.

2.6.3 Basis for Action

The response action selected in this ROD is necessary to protect public health, welfare, and the environment from actual or threatened release of hazardous substances into the environment, namely exposure to hazardous substances in the waste remaining in place at Site 7. Based on the results of the 2004 HHRA and ERA, and the completion of the NTCRA in the central portion of the canal, potential risks associated with soil, surface water, and sediment are considered acceptable. Additionally, the potential risks associated with arsenic, iron, and manganese in groundwater were risk managed and are considered acceptable.

2.7 Principal Threat Waste

Principal threat wastes are hazardous or highly toxic source materials that result in ongoing contamination to surrounding media, generally cannot be reliably contained, or present a significant risk to human health or the environment should exposure occur. There are no principal threat wastes associated with Site 7 based on the results of the HHRA and ERA, completion of the 2006 NTCRA, and groundwater risk management decisions associated with arsenic, iron, and manganese.

2.8 Remedial Action Objectives

Following the 2006 NTCRA, the only unacceptable risk associated with Site 7 is associated with exposure to landfill contents remaining on site. The site-specific Remedial Action Objective (RAO) is to prevent human and ecological receptor exposure to landfill contents through a containment presumptive remedy (2-foot soil cover and groundwater monitoring) and LUCs.

2.9 Description and Evaluation of Alternatives

Remedial alternatives to address human and ecological receptor exposure to waste remaining at Site 7 were evaluated and are described in detail in the FFS. No specific remedial technologies or process options were screened as part of the containment **presumptive remedy in the FFS process**. Two **remedial alternatives** were evaluated:

Alternative 1 - No Action
Alternative 2 - Soil Cover, LUCs, and Groundwater LTM

2.9.1 Description of Remedial Alternatives

Table 3 provides the major components, details, and cost of each remedial alternative identified for Site 7. The no action alternative does not meet the RAO and does not allow for future land use. Alternative 2

meets the RAO and would allow for current and future industrial, commercial, and operational activities providing the activities are consistent with the LUC objectives.

TABLE 3
Description of Alternatives for Site 7

Alternative	Components	Details	Cost
1 – No Action	None	No additional effort or resources expended.	Capital Cost $0 Annual O&M Cost $0 **Present-Worth Cost $0** Time Frame – 30 years
2- Soil Cover, LUCs, and Groundwater LTM	Cover Maintenance LUC LTM	Maintain existing soil cover. Implement LUCs to ensure soil cover is not altered or disturbed and site use does not change. Conduct Groundwater LTM to monitor for potential site releases and migration of contaminants.	Capital Cost $31,860 Annual O&M Cost $67,789 **Present-Worth Cost $2,728,125** Time Frame - 30 years

2.9.2 Comparative Analysis of Alternatives

Each remedial alternative was evaluated against the **nine evaluation criteria** established by the NCP. State Acceptance criteria were met by the incorporation of comments prior to the finalization of the Proposed Plan. Community Acceptance criteria were met by providing a public comment period for the Proposed Plan and holding a public meeting. Community information is presented in the Responsiveness Summary (Section 3) of this ROD.

Threshold Criteria

Overall Protection of Human Health and the Environment. Overall protection of human health and the environment addresses whether each alternative provides adequate protection of human health and the environment and describes how risks posed through each exposure pathway are eliminated, reduced, or controlled, through treatment, engineering controls, and/or institutional controls.

Alternative 1 (no action) does not achieve the RAO; and, therefore will not protect human and ecological receptors from contact with landfill contents. Additionally, it will not prevent potential future exposure to landfill contents or provide measures for determining if a site release and migration of contaminants is occurring. Alternative 2 (soil cover, LUCs, and LTM) does meet the RAO. LUCs will ensure the cover is not altered or disturbed and site use does not change. Additionally, groundwater LTM will monitor for potential future site release and migration of contaminants.

Compliance with ARARs. Complying with ARARs includes any Federal or State environmental or facility siting standards, requirements, criteria, or limitations that are determined to be legally applicable or relevant and appropriate to a CERCLA site or action. Alternative 1 does not trigger ARARs. Alternative 2 complies with all ARARS.

Primary Balancing Criteria

Long-Term Effectiveness and Permanence. Long-term effectiveness and permanence addresses the expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, after clean-up goals have been met.

Alternative 1 does not provide any long-term protectiveness and permanence and will not prevent potential future exposure to landfill contents or provide measures for determining if a site release and

migration of contaminants is occurring. Alternative 2 provides an effective long-term means by which the potential for exposure to landfill contents is prevented and ensures permanence through inspection and maintenance of the existing soil cover and implementation of LUCs. Additionally, groundwater LTM will monitor for a potential future site release and migration of contaminants.

Reduction of Toxicity, Mobility, and Volume through Treatment. Reduction of toxicity, mobility, or volume through treatment refers to the anticipated performance of the treatment technologies that may be included as part of a remedy. Neither Alternative 1 (no action) nor Alternative 2 will reduce toxicity, mobility, or volume of contamination through treatment. However, the large volume and heterogeneity of the landfill waste, and the relatively low concentrations of hazardous substances, make treatment impracticable.

Short-Term Effectiveness. Short-term effectiveness addresses the time period needed to implement the remedy and any adverse impacts that may be posed to workers, the community, and the environment during construction and operation of the remedy until cleanup levels are achieved.

The soil cover maintenance and groundwater LTM activities associated with Alternative 2 are expected to be short-term and may be carried out as necessary over an indefinite period of time. Minimal risk to site workers may be presented during implementation of soil cover maintenance and LTM activities; however, risk will be minimized through health and safety measures. For Alternative 1, no additional activities will be conducted; therefore, no short-term adverse impacts will result and no time is needed to complete this alternative.

Implementability. Implementability addresses the technical and administrative feasibility of a remedy from design through construction and operation. Alternative 2 requires soil cover maintenance, LUCs, and groundwater LTM that are easily implemented. No effort or resources are required for Alternative 1.

Present Cost. The capital, O&M, and present worth cost for Alternative 2 is $2,728,125. There is no cost for Alternative 1.

Modifying Criteria

State Acceptance. State involvement has been solicited throughout the CERCLA process and proposed remedy selection. VDEQ, as the State support agency in Virginia, has reviewed this ROD and has given concurrence on the Selected Remedy.

Community Acceptance. The public meeting was held on February 9, 2009 to present the Proposed Plan and address community questions in regards to the proposed remedial action at Site 7. Detailed information on the public meeting is provided in the Responsiveness Summary (Section 3) of this ROD.

2.10 Selected Remedy

2.10.1 Rationale for Selected Remedy

The Selected Remedy for Site 7 is maintenance of the existing soil cover and implementation of LUCs to prevent human exposure to waste remaining in place, and groundwater LTM to evaluate whether a release from the landfill and offsite migration of contaminants has occurred. This remedy was selected because it will achieve substantial risk reduction by containing waste in place, and monitoring groundwater to identify a future release of contaminants. Alternative 1—No Action, was eliminated because it does not meet the RAO, is not proactively protective of human health and the environment, and does not comply with ARARs.

2.10.2 Description of Selected Remedy

Alternative 2 consists of the maintenance of the existing 24-inch soil cover, implementation of LUCs, and groundwater LTM. Alternative 2 is considered a containment presumptive alternative. The initial limited soil cover was installed in 1998. In 2008, a 24-inch soil cover was established over the entire landfill area.

Post-ROD O&M activities at Site 7 will include soil cover maintenance and inspection, erosion and stormwater controls maintenance, and mowing; and groundwater LTM to assess any potential future releases and offsite migration of contaminants. LUCs will be placed on the site to prevent unrestricted exposure to landfill contents by restricting intrusive digging/excavation within the defined LUC boundary (Figure 5).

FIGURE 5
Preliminary Remedial Design

The objectives of the LUCs shall be to:

- Prohibit digging into or disturbing the existing soil cover or landfill contents
- Prohibit the use of the site for residential, child care, elementary or secondary school, or playground facilities

The site will be inspected periodically, and the Navy will certify the effectiveness of the LUCs. The Navy will maintain LUCs until site conditions allow for unlimited use and unrestricted exposure. Within 120 days of the ROD signature, the Navy shall prepare a Remedial Design (RD) to implement the Selected Remedy and submit to USEPA and VDEQ for review and concurrence. The LUC portion of the RD will provide for implementation and maintenance actions, including periodic inspections and reporting. The RD will also include provisions that would require a reevaluation of potential risks should an unlimited/unrestricted exposure land use or a No Action decision be sought for the site. The Navy will implement, maintain, monitor, record, review, report on, and enforce the LUCs in accordance with the RD. Although the Navy may later transfer these responsibilities to another party by contract, property transfer agreement, or through other means, the Navy shall retain ultimate responsibility for remedy integrity.

To address the potential for a release from the landfill and offsite migration of contaminants, a groundwater LTM program will be established as part of the Selected Remedy. The LTM program will be developed to identify changes in site conditions indicative of a release. Groundwater LTM plans will be documented in a Uniform Federal Policy (UFP) Sampling and Analysis Plan (SAP) following signature of the ROD. Groundwater will be monitored through monitoring wells located outside (upgradient and downgradient) the landfill boundary (Figure 4). The frequency and monitoring network will be established during implementation of the LTM program. Results will be documented in a technical memorandum. A detailed cost break-down of Alternative 2 is provided in Table 4.

TABLE 4
Detailed Cost Estimate for Selected Remedy

Site:	Site 7	**Description:**	
Location:	Little Creek NAB, Amphibious Base Landfill	Land Use Controls, Long Term Monitoring, and Landfill Operation and Maintenance	
Phase:	Focused Feasibility Study		
Date:	August 17, 2007		

ASSUMPTIONS

1) Survey and Plat Notification to City
- Survey of approximately 40 acres
- Preparation of survey plate and notification of City of Virginia Beach

2) Long Term Monitoring
- Quarterly inspections of the landfill
  - -option to reduce inspection frequency from quarterly to semi-annual after 5 year review
- Annual groundwater sampling of 7 MWs for TCL VOCs, TCL SVOCs, TCL PCBs, and TAL Metals (total and dissolved).
- 5 Year review due to waste left in place

3) Landfill Operation and Maintenance
- Semi-annual mowing
- Gate, fence, and sign repair
- Access road repair
- Landfill maintenance (vegetation, soil cover, and drainage features)

CAPITAL COSTS

Description	Qty	Unit	Unit Cost	Total Cost	Notes
Survey and Plat Notification to City	1	EA	$26,550	$26,550	Recent quote
SUBTOTAL				$26,550	
Contingency	20%			$5,310	
SUBTOTAL				$31,860	
TOTAL CAPITAL COST OF SURVEY AND PLAT NOTIFICATION TO CITY				**$31,860**	

OPERATION AND MAINTENANCE COSTS (Years 1 - 30)

Description	Qty	Unit	Unit Cost	Total Cost	Notes
Long Term Monitoring					
Quarterly site inspection and report	4	UNIT	$4,700.00	$18,800	Engineer's Estimate
Quarterly Groundwater Monitoring	1	UNIT	$22,322.82	$22,323	BOA
SUBTOTAL				$41,123	
Landfill Operation and Maintenance	**Qty**	**Unit**	**Unit Cost**	**Total Cost**	**Notes**
Semi-annual mowing	2	EA	$ 250.00	$ 500.00	
Feature repairs (fence, gate, access road)	1	LS	$ 2,500.00	$ 2,500.00	Repairs may be dependent upon extreme weather or other factors and may vary considerably.
Soil cover maintenance (vegetation, soil cover, drainage)	1	LS	$ 5,000.00	$ 5,000.00	
SUBTOTAL				$ 8,000.00	
Contingency	20%			$ 9,825	
SUBTOTAL				$ 58,947	
Project Management	15%			$ 8,842	
TOTAL ANNUAL O&M COST if performed today (Years 1-4, 6-9, 11-14, 16-19, 21-24, 26-29)				$67,789	

OPERATION AND MAINTENANCE COSTS (Years 5, 10, 15, 20, 25, 30)

Site Inspection	**Qty**	**Unit**	**Unit Cost**	**Total Cost**	**Notes**
5-yr Review	1	UNIT	$45,000.00	45,000.00	Recent contract award
SUBTOTAL				45,000.00	
Contingency	20%			9,000.00	
SUBTOTAL				54,000.00	
Project Management	15%			8,100.00	
SUBTOTAL ANNUAL OPERATION AND MAINTENANCE COST (Years 5, 10, 15, 20, 25, 30)				62,100.00	
TOTAL ANNUAL O&M COST if performed today (Years 1-4, 6-9, 11-14, 16-19, 21-24, 26-29)				**67,789.50**	
TOTAL ANNUAL O&M COST if performed today (Years 5, 10, 15, 20, 25, 30)				**129,889.50**	
TOTAL PRESENT WORTH (30 Years)				**2,728,124.98**	

NOTE: ESTIMATES ARE BASED ON EXPERIENCE AT SIMILAR SITES. ACTUAL COSTS MAY VARY

It is not anticipated that a future release will occur. However, if groundwater LTM identifies a contaminant, and it is determined to be site related, the Navy will take appropriate action to protect human health and the environment and restrict exposure to the site groundwater until it meets regulatory levels which allow for unlimited use and unrestricted exposure.

In addition, to the ARARs identified in Appendix A, the Navy will comply with the following executive orders:

- Executive Order 11988, Floodplain Management, which requires federal agencies to evaluate the potential effects of actions they may take in a flood plain to avoid, to the extent possible, adverse effects associated with direct and indirect development of a floodplain. Federal agencies are required to avoid adverse impacts or minimize them if no practicable alternative exists.
- Executive Order 11990, Protection of Wetlands, which requires federal agencies conducting certain activities to avoid, to the extent practicable, the adverse impacts associated with destruction or loss of wetlands if a practicable alternative exists. Federal agencies are required to avoid adverse impacts or minimize them if no practicable alternative exists.

2.10.3 Expected Outcomes of the Selected Remedy

Currently, a helicopter-landing pad is situated on the landfill cover. Access to the landfill is generally restricted. A chain-linked fence surrounds the site and access is controlled through a locked gate on Helicopter Road. Current land use is expected to continue at Site 7. LUCs will be employed to prevent use of the site for residential, childcare, elementary or secondary school, or playground facilities; and restrict intrusive digging/excavation within the defined LUC boundary. Future land use such as industrial, recreational, and operational activities may be implemented provided the activities are consistent with the LUC objectives. Groundwater LTM will assess groundwater quality and verify that offsite migration of contaminants is not occurring.

2.10.4 Statutory Determinations

In accordance with the NCP, the Selected Remedy meets the following statutory requirements.

- **Protection of Human Health and the Environment**—The Selected Remedy will prevent potential human health and ecological risks posed by direct contact with landfill contents by means of a durable physical barrier provided by the soil cover. LUCs will ensure the soil cover is not altered or disturbed, and site use does not change. In addition, groundwater LTM will monitor for a potential future site release and migration of contaminants.
- **Compliance with ARARs**—The Selected Remedy will attain the federal and state ARARs presented herein (Attachment B Tables B-1 through B-6).
- **Cost-Effectiveness**—The Selected Remedy represents the most reasonable value for the money. The costs are proportional to overall effectiveness since the remedy achieves long-term effectiveness and permanence within a reasonable timeframe.
- **Utilization of Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable**—The Navy, in partnership with USEPA and VDEQ, determined the Selected Remedy for Site 7 represents the maximum extent to which solutions and treatment technologies can be used in a practicable manner.
- **Preference for Treatment as a Principal Element** – The Selected Remedy does not satisfy the statutory preference for treatment as a principal element. However, the large volume and heterogeneity of the landfill waste, and the relatively low concentrations of hazardous substances, make treatment impracticable.
- **Five-Year Review Requirements** – The remedy will result in pollutants or contaminants remaining onsite above levels that allow for unlimited use and unrestricted exposure, as required under CERCLA. Therefore, a statutory review will be conducted within 5 years of the initiation of the

remedial action (and every 5 years thereafter), to evaluate continuing remedy effectiveness and to determine if the remedy continues to be protective of human health and the environment.

2.11 Community Participation

The Navy and USEPA provide information regarding the cleanup of NAB Little Creek to the public through the community relations program, which consists of a Restoration Advisory Board (RAB) that was formed in 1994, public meetings, the Administrative Record for Site 7, the information repository, and announcements published in the local newspapers. During the course of investigations at Site 7, the RAB was informed of environmental activities associated with the site.

In accordance with Section 117(a) of CERCLA, the Navy provided a public comment period from February 1, 2009 through March 1, 2009 for the Site 7 Proposed Plan. A public meeting to present the Proposed Plan was held on February 9, 2009 at Shelton Park Elementary School. Public notice of the meeting and availability of documents was placed in *The Virginian-Pilot* newspaper on January 25, 2009.

The Proposed Plan was available during the public comment period at the Virginia Beach Central Library. The final Proposed Plan and previous investigation reports for Site 7 are available in the Administrative Record. The Administrative Record is accessible to the public via:

Public Affairs Office, NAVFAC Mid-Atlantic
9742 Maryland Ave, Bldg A-81
Norfolk, Virginia 23511-3095
Phone (757) 445-8732 ext. 3096
Evelyn.Odango@navy.mil

Or the index is available online at:

http://public.lantops-ir.org/sites/public/nablc/Site%20Files/AdminRecords.aspx

3 Responsiveness Summary

No written comments, concerns, or questions were received by the Navy, USEPA, or VDEQ during the public comment period. No one from the public attended the public meeting held on February 9, 2009. Navy, VDEQ, and USEPA representatives were available to present the Proposed Plan for Site 7 and answer questions regarding the Proposed Plan as well as any other documents in the information repository.

References

Item	Reference Phrase in ROD	Location in ROD	Identification of Referenced Document Available in the Administrative Record
1	**Non Time Critical Removal Action**	Section 2.1,	CH2M HILL. 2008. Final Construction Completion Report, Non-Time Critical Removal Action, Site 7, Naval Amphibious Base Little Creek, Virginia Beach, Virginia. January.
2	**Federal Facility Agreement**	Section 2.2	Department of Defense (DoD). 2003. Federal Facility Agreement for Naval Amphibious Base Little Creek. October.
3	**Initial Assessment Study**	Section 2.2	Rogers, Golden, and Halpern 1984. Initial Assessment Study of Naval Amphibious Base, Little Creek, Virginia Beach, Virginia. December. Section 2.3.1, page 2-3.
4	**Round 1 Verification Study**	Section 2.2	CH2M HILL. 1986. Final Progress Report Round 1 Verification Step. October. Page 3.
5	**Interim Remedial Investigation**	Section 2.2	Ebasco Environmental Consultants. 1991. Draft Final Interim Remedial Investigation. November. Section 2.1, page 2-1.
6	**RI/FS**	Section 2.2	Foster Wheeler Environmental Corporation. 1994. Final Remedial Investigation/Feasibility Study. November. Section 3.1, page 3-1.
7	**Proposed Remedial Action Plan**	Section 2.2	CH2M HILL. 1997. Proposed Remedial Action Plan, Site 7, Amphibious Base Landfill, Naval Amphibious Base Little Creek, Virginia Beach, Virginia. October.
8	**Decision Document**	Section 2.2	CH2M HILL. 1998. Decision Document Site 7, Amphibious Base Landfill, Naval Amphibious Base Little Creek, Virginia Beach, Virginia. January. Section 2.9, page 2-21.
9	**remedial action**	Section 2.2	OHM Remediation Services Corporation. 1999. Site 7 Remedial Action Closeout Report, Naval Amphibious Base Little Creek, Virginia Beach, Virginia. January.
10	**RI/Human Health Risk Assessment (HHRA)**	Section 2.2	CH2M HILL. 2004a. Remedial Investigation/Human Health Risk Assessment for Site 7, Naval Amphibious Base Little Creek, Virginia Beach, Virginia. November. Section 4.
11	**Ecological Risk Assessment (ERA)**	Section 2.2	CH2M HILL. 2004b. Ecological Risk Assessment for Site 7 Naval Amphibious Base Little Creek, Virginia Beach, Virginia. November.

Item	Reference Phrase in ROD	Location in ROD	Identification of Referenced Document Available in the Administrative Record
12	**HHRA**	Section 2.2, Table 1	CH2M HILL. 2004a. Remedial Investigation/Human Health Risk Assessment for Site 7, Naval Amphibious Base Little Creek, Virginia Beach, Virginia. November. Appendix E.
13	**Ecological risks**	Section 2.2, Table 1	CH2M HILL. 2004b. Ecological Risk Assessment for Site 7 Naval Amphibious Base Little Creek, Virginia Beach, Virginia. November. Table 4-22.
14	**Statistical evaluations**	Section 2.2, Table 1	CH2M HILL. 2005b. Final Long-Term Monitoring Report for Rounds 10 and 11 at Site 7, Naval Amphibious Base Little Creek, Virginia Beach, Virginia. August. Section 4.3, page 4-6.
15	**Removal alternatives**	Section 2.2, Table 1	CH2M HILL. 2005a. Final Engineering Evaluation/ Cost Analysis (EE/CA) for Amphibious Base Landfill Site 7, Naval Amphibious Base Little Creek, Virginia Beach, Virginia. March. Section 4, page 4-1.
16	**lateral extent of removal**	Section 2.2, Table 1	CH2M HILL. 2004. Final Technical Memorandum Canal Sediment Delineation Results and Recommended Path Forward for Site 7 - Naval Amphibious Base Little Creek, Virginia Beach, Virginia. March.
17	**extent of debris**	Section 2.2, Table 1	CH2M HILL. 2005c. Debris Delineation Results for Site 7 – The Amphibious Base Landfill, Naval Amphibious Base Little Creek, Virginia Beach, Virginia. November. Page 2.
18	**O&M**	Section 2.2, Table 1	CH2M HILL. 2009. Construction Completion Report, Site 7 Maintenance Actions, Naval Amphibious Base Little Creek, Virginia Beach, Virginia. February.
19	**Test pits**	Section 2.2, Table 1	CH2M HILL. 2008. Final Focused Feasibility Study for Site 7, Naval Amphibious Base Little Creek, Virginia Beach, Virginia. August. Sections 1.3 page 1-3.
20	**HHRA was revised**	Section 2.2, Table 1	CH2M HILL. 2008. Final Focused Feasibility Study for Site 7, Naval Amphibious Base Little Creek, Virginia Beach, Virginia. August. Sections 1.5 and 1.6, page 1-5.
21	**Preferred Alternative**	Section 2.2, Table 1	CH2M HILL. 2008. Final Focused Feasibility Study for Site 7, Naval Amphibious Base Little Creek, Virginia Beach, Virginia. August. Section 3.2, page 3-1.
22	**Construction Completion Report**	Section 2.5	CH2M HILL. 2008. Final Construction Completion Report, Non-Time Critical Removal Action, Site 7, Naval Amphibious Base Little Creek, Virginia Beach, Virginia. January.
23	**Cancer risks and non-cancer hazards**	Section 2.5.1	CH2M HILL. 2004a. Remedial Investigation/Human Health Risk Assessment for Site 7, Naval Amphibious Base Little Creek, Virginia Beach, Virginia. November. Appendix E, Table 7s and 8s.
24	**HHRA for groundwater was revised**	Section 2.5.1	CH2M HILL. 2008. Final Focused Feasibility Study for Site 7, Naval Amphibious Base Little Creek, Virginia Beach, Virginia. August. Appendix A.

Item	Reference Phrase in ROD	Location in ROD	Identification of Referenced Document Available in the Administrative Record
25	**no unacceptable risks**	Section 2.5.1	CH2M HILL. 2004a. Remedial Investigation/Human Health Risk Assessment for Site 7, Naval Amphibious Base Little Creek, Virginia Beach, Virginia. November. Appendix E, Table 7s and 8s.
26	**no unacceptable risks**	Section 2.5.1	CH2M HILL. 2004a. Remedial Investigation/Human Health Risk Assessment for Site 7, Naval Amphibious Base Little Creek, Virginia Beach, Virginia. November. Appendix E, Table 7s and 8s.
27	**potential risks**	Section 2.5.1	CH2M HILL. 2008. Final Focused Feasibility Study for Site 7, Naval Amphibious Base Little Creek, Virginia Beach, Virginia. August. Appendix A, Table 7s.
28	**exposure to soil, surface water, and sediment; and exposure via the food web**	Section 2.5.2	CH2M HILL. 2004b. Ecological Risk Assessment for Site 7 Naval Amphibious Base Little Creek, Virginia Beach, Virginia. November.
29	**presumptive remedy in the FFS process**	Section 2.8	USEPA. 1993. Presumptive Remedies: Policy and Procedures. USEPA 540/F-93/047. Washington D.C.
30	**remedial alternatives**	Section 2.8	CH2M HILL. 2008. Final Focused Feasibility Study for Site 7, Naval Amphibious Base Little Creek, Virginia Beach, Virginia. August. Section 3.2, page 3-1.
31	**Present-Worth Cost $0**	Section 2.8, Table 3	CH2M HILL. 2008. Final Focused Feasibility Study for Site 7, Naval Amphibious Base Little Creek, Virginia Beach, Virginia. August. Appendix D.
32	**Present-Worth Cost $2,728,125**	Section 2.8, Table 3	CH2M HILL. 2008. Final Focused Feasibility Study for Site 7, Naval Amphibious Base Little Creek, Virginia Beach, Virginia. August. Appendix D.
33	**nine evaluation criteria**	Section 2.8	CH2M HILL. 2008. Final Focused Feasibility Study for Site 7, Naval Amphibious Base Little Creek, Virginia Beach, Virginia. August. Section 4.1, page 4-1.
34	**Applicable or Relevant and Appropriate Requirements (ARARs)**	Section 2.8, Table 4	CH2M HILL. 2008. Final Focused Feasibility Study for Site 7, Naval Amphibious Base Little Creek, Virginia Beach, Virginia. August. Appendix C.

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

For access to information contained in the Administrative Record for NAB Little Creek please contact:

Public Affairs Office, NAVFAC Atlantic
6506 Hampton Blvd
Norfolk, Virginia 23508
Phone: (757) 322-8005

Attachment A – Risk Assessment Summary

TABLE A-1
Summary of RME Cancer Risks and Hazard Indices based on 2004 HHRA
Site 7, NAB Little Creek, Virginia Beach, Virginia

Receptor	Media	Exposure Route	Cancer Risk	COPCs with Cancer Risks >10^{-4}	Hazard Index	COPCs with HI > 1
Current Maintenance Worker	Surface Soil Weigh Station Area	Ingestion	8.9E-08		5.9E-03	
		Inhalation	NA		NA	
		Dermal Contact	1.0E-07		1.9E-02	
		Total	1.9E-07		2.5E-02	
	Surface Soil Area to West of Landfill, the "Ear"	Ingestion	1.2E-07		4.0E-03	
		Inhalation	NA		NA	
		Dermal Contact	5.9E-08		8.7E-03	
		Total	1.7E-07		1.3E-02	
	Surface Soil Site Perimeter	Ingestion	1.4E-07		1.1E-02	
		Inhalation	NA		NA	
		Dermal Contact	1.7E-07		6.2E-02	
		Total	3.1E-07		7.4E-02	
		Receptor Total	6.8E-07		1.1E-01	
Current/Future Trespasser/Visitor Adolescent	Surface Soil Weigh Station Area	Ingestion	3.8E-07		7.0E-02	
		Inhalation	NA		NA	
		Dermal Contact	1.3E-07		6.9E-02	
		Total	5.1E-07		1.4E-01	
	Surface Soil Area to West of Landfill, the "Ear"	Ingestion	5.0E-07		4.8E-02	
		Inhalation	NA		NA	
		Dermal Contact	7.5E-08		3.1E-02	
		Total	5.7E-07		7.8E-02	
	Surface Soil Site Perimeter	Ingestion	6.1E-07		1.3E-01	
		Inhalation	NA		NA	
		Dermal Contact	2.1E-07		2.2E-01	
		Total	8.3E-07		3.5E-01	
	Surface Water Little Creek Cove	Ingestion	3.7E-07		6.3E-03	
		Inhalation	NA		NA	
		Dermal Contact	6.9E-08		1.2E-03	
		Total	4.4E-07		7.5E-03	
	Surface Water Pond	Ingestion	2.8E-07		4.9E-03	
		Inhalation	NA		NA	
		Dermal Contact	1.6E-08		2.7E-04	
		Total	3.0E-07		5.1E-03	
	Sediment Pond	Ingestion	2.1E-07		1.8E-02	
		Inhalation	NA		NA	
		Dermal Contact	1.1E-07		3.4E-02	
		Total	3.2E-07		5.3E-02	
	Surface Water Canal on West Side of Site	Ingestion	7.2E-07		1.2E-02	
		Inhalation	NA		NA	
		Dermal Contact	5.7E-08		9.9E-04	
		Total	7.8E-07		1.3E-02	
	Sediment Canal on West Side of Site	Ingestion	1.7E-07		7.3E-03	
		Inhalation	NA		NA	
		Dermal Contact	9.0E-08		3.2E-02	
		Total	2.6E-07		3.9E-02	
Current/Future Trespasser/Visitor Adolescent (cont.)	Sediment Canal on East Side of Site	Ingestion	1.4E-07		2.4E-03	
		Inhalation	NA		NA	
		Dermal Contact	7.4E-08		1.3E-03	
		Total	2.1E-07		3.7E-03	
		Receptor Total	4.2E-06		6.9E-01	
Current/Future Trespasser/Visitor Adult	Surface Water Little Creek Cove	Ingestion	7.1E-07		4.6E-03	
		Inhalation	NA		NA	
		Dermal Contact	1.8E-07		1.2E-03	

TABLE A-1
Summary of RME Cancer Risks and Hazard Indices based on 2004 HHRA
Site 7, NAB Little Creek, Virginia Beach, Virginia

Receptor	Media	Exposure Route	Cancer Risk	COPCs with Cancer Risks >10^{-4}	Hazard Index	COPCs with HI > 1
		Total	8.9E-07		5.8E-03	
	Surface Water Pond	Ingestion	5.5E-07		3.5E-03	
		Inhalation	NA		NA	
		Dermal Contact	4.1E-08		2.7E-04	
		Total	5.9E-07		3.8E-03	
	Sediment Pond	Ingestion	4.0E-07		1.3E-02	
		Inhalation	NA		NA	
		Dermal Contact	2.5E-07		2.9E-02	
		Total	6.5E-07		4.2E-02	
	Surface Water Canal on West Side of Site	Ingestion	1.4E-06		9.1E-03	
		Inhalation	NA		NA	
		Dermal Contact	1.5E-07		9.6E-04	
		Total	1.5E-06		1.0E-02	
	Sediment Canal on West Side of Site	Ingestion	3.2E-07		5.3E-03	
		Inhalation	NA		NA	
		Dermal Contact	2.0E-07		2.7E-02	
		Total	5.2E-07		3.2E-02	
	Sediment Canal on East Side of Site	Ingestion	2.7E-07		1.7E-03	
		Inhalation	NA		NA	
		Dermal Contact	1.7E-07		1.1E-03	
		Total	4.3E-07		2.8E-03	
		Receptor Total	4.6E-06		9.7E-02	
Current/Future Site Worker	Surface Water Little Creek Cove	Ingestion	2.6E-07		1.6E-03	
		Inhalation	NA		NA	
		Dermal Contact	1.7E-08		1.1E-04	
		Total	2.8E-07		1.7E-03	
Future Resident Adult	Groundwater	Ingestion	NA		**2.9E+00**	
		Inhalation	NA		NA	
		Dermal Contact	NA		8.1E-02	
		Total	NA		**3.0E+00**	
	Soil Weigh Station Area	Ingestion	NA		1.9E-01	
		Inhalation	NA		NA	
		Dermal Contact	NA		4.4E-01	
		Total	NA		6.3E-01	
	Soil Area to West of Landfill, the "Ear"	Ingestion	NA		2.0E-01	
		Inhalation	NA		NA	
		Dermal Contact	NA		2.1E-01	
		Total	NA		4.1E-01	
Future Resident Adult (cont.)	Soil Site Perimeter	Ingestion	NA		3.9E-01	
		Inhalation	NA		NA	
		Dermal Contact	NA		**1.4E+00**	Vanadium (1.4)
		Total	NA		**1.8E+00**	
	Soil Covered Area	Ingestion	NA		1.2E-01	
		Inhalation	NA		NA	
		Dermal Contact	NA		3.3E-01	
		Total	NA		4.5E-01	
		Receptor Total	NA		**6.3E+00**	
Future Resident Child	Groundwater	Ingestion	NA		**6.8E+00**	Arsenic (1.5), Iron (2.1),
		Inhalation	NA		NA	
		Dermal Contact	NA		2.3E-01	
		Total	NA		**7.0E+00**	
	Soil Weigh Station Area	Ingestion	NA		**1.7E+00**	
		Inhalation	NA		NA	
		Dermal Contact	NA		5.8E-01	

TABLE A-1
Summary of RME Cancer Risks and Hazard Indices based on 2004 HHRA
Site 7, NAB Little Creek, Virginia Beach, Virginia

Receptor	Media	Exposure Route	Cancer Risk	COPCs with Cancer Risks >10^{-4}	Hazard Index	COPCs with HI > 1
		Total	NA		**2.3E+00**	
	Soil Area to West of Landfill, the "Ear"	Ingestion	NA		**1.9E+00**	
		Inhalation	NA		NA	
		Dermal Contact	NA		2.8E-01	
		Total	NA		**2.2E+00**	
	Soil Site Perimeter	Ingestion	NA		**3.7E+00**	Vanadium (2.6)
		Inhalation	NA		NA	
		Dermal Contact	NA		**1.9E+00**	Vanadium (1.9)
		Total	NA		**5.5E+00**	
	Soil Covered Area	Ingestion	NA		**1.1E+00**	
		Inhalation	NA		NA	
		Dermal Contact	NA		4.3E-01	
		Total	NA		**1.6E+00**	
		Receptor Total	NA		**1.9E+01**	
Future Resident Child/Adult	Groundwater	Ingestion	**1.5E-04**	Arsenic (1.5E-04)	NA	
		Inhalation	NA		NA	
		Dermal Contact	3.3E-07		NA	
		Total	**1.5E-04**		NA	
	Soil Weigh Station Area	Ingestion	8.3E-06		NA	
		Inhalation	NA		NA	
		Dermal Contact	3.0E-06		NA	
		Total	1.1E-05		NA	
	Soil Area to West of Landfill, the "Ear"	Ingestion	1.1E-05		NA	
		Inhalation	NA		NA	
		Dermal Contact	1.7E-06		NA	
		Total	1.3E-05		NA	
	Soil Site Perimeter	Ingestion	1.8E-05		NA	
		Inhalation	NA		NA	
		Dermal Contact	5.4E-06		NA	
		Total	2.3E-05		NA	
Future Industrial Worker	Soil Covered Area	Ingestion	1.6E-05		NA	
		Inhalation	NA		NA	
		Dermal Contact	8.9E-06		NA	
		Total	2.5E-05		NA	
		Receptor Total	**2.2E-04**		NA	
	Groundwater	Ingestion	3.6E-05		**1.0E+00**	
		Inhalation	NA		NA	
		Dermal Contact	NA		NA	
		Total	3.6E-05		**1.0E+00**	
	Soil Weigh Station Area	Ingestion	1.8E-06		1.3E-01	
		Inhalation	NA		NA	
		Dermal Contact	1.5E-06		4.0E-01	
		Total	3.4E-06		5.4E-01	
	Soil Area to West of Landfill, the "Ear"	Ingestion	2.4E-06		1.4E-01	
		Inhalation	NA		NA	
		Dermal Contact	1.2E-06		1.9E-01	
		Total	3.6E-06		3.3E-01	
	Soil Site Perimeter	Ingestion	3.9E-06		2.8E-01	
		Inhalation	NA		NA	
		Dermal Contact	2.4E-06		**1.3E+00**	Vanadium (1.3)
		Total	6.4E-06		**1.6E+00**	
	Soil Covered Area	Ingestion	3.6E-06		8.8E-02	
		Inhalation	NA		NA	
		Dermal Contact	5.8E-06		3.0E-01	
		Total	9.4E-06		3.9E-01	
		Receptor Total	5.8E-05		**3.9E+00**	

TABLE A-1
Summary of RME Cancer Risks and Hazard Indices based on 2004 HHRA
Site 7, NAB Little Creek, Virginia Beach, Virginia

Receptor	Media	Exposure Route	Cancer Risk	COPCs with Cancer Risks >10^{-4}	Hazard Index	COPCs with HI > 1
Future Construction Worker	Groundwater	Ingestion	NA		NA	
		Inhalation	NA		NA	
		Dermal Contact	3.0E-08		2.5E-01	
		Total	3.0E-08		2.5E-01	
	Soil Weigh Station Area	Ingestion	1.8E-07		3.0E-01	
		Inhalation	NA		NA	
		Dermal Contact	3.2E-08		1.3E-01	
		Total	2.1E-07		4.3E-01	
	Soil Area to West of Landfill, the "Ear"	Ingestion	2.3E-07		3.5E-01	
		Inhalation	NA		NA	
		Dermal Contact	1.8E-08		7.2E-02	
		Total	2.5E-07		4.2E-01	
	Soil Site Perimeter	Ingestion	3.8E-07		6.7E-01	
		Inhalation	NA		NA	
		Dermal Contact	5.8E-08		4.9E-01	
		Total	4.3E-07		**1.2E+00**	
	Soil Covered Area	Ingestion	3.4E-07		2.1E-01	
		Inhalation	NA		NA	
		Dermal Contact	9.6E-08		1.1E-01	
		Total	4.4E-07		3.2E-01	
		Receptor Total	1.4E-06		**2.6E+00**	

TABLE A-2
Summary of CTE Cancer Risks and Hazard Indices based on 2004 HHRA
Site 7, NAB Little Creek, Virginia Beach, Virginia

Receptor	Media	Exposure Route	Cancer Risk	COPCs with Cancer Risks >10^{-4}	Hazard Index	COPCs with HI > 1
Future Resident Adult	Groundwater	Ingestion	NA		6.4E-01	
		Inhalation	NA		NA	
		Dermal Contact	NA		1.8E-02	
		Total	NA		6.6E-01	
	Soil Site Perimeter	Ingestion	NA		3.0E-02	
		Inhalation	NA		NA	
		Dermal Contact	NA		9.2E-02	
		Total	NA		1.2E-01	
		Receptor Total	NA		7.8E-01	
Future Resident Child	Groundwater	Ingestion	NA		**2.1E+00**	
		Inhalation	NA		NA	
		Dermal Contact	NA		5.0E-02	
		Total	NA		**2.2E+00**	
	Soil Weigh Station Area	Ingestion	NA		3.9E-01	
		Inhalation	NA		NA	
		Dermal Contact	NA		2.1E-01	
		Total	NA		6.0E-01	
	Soil Area to West of Landfill, the "Ear"	Ingestion	NA		1.9E-01	
		Inhalation	NA		NA	
		Dermal Contact	NA		6.1E-02	
		Total	NA		2.5E-01	
	Soil Site Perimeter	Ingestion	NA		8.3E-01	
		Inhalation	NA		NA	
		Dermal Contact	NA		1.2E-01	
		Total	NA		9.5E-01	
	Soil Covered Area	Ingestion	NA		1.5E-01	
		Inhalation	NA		NA	
		Dermal Contact	NA		7.4E-02	
		Total	NA		2.3E-01	
		Receptor Total	NA		**4.2E+00**	
Future Resident Child/Adult	Groundwater	Ingestion	1.7E-05		NA	
		Inhalation	NA		NA	
		Dermal Contact	3.9E-08		NA	
		Total	1.7E-05		NA	
		Receptor Total	1.7E-05		NA	
Future Industrial Worker	Soil Site Perimeter	Ingestion	NA		2.8E-02	
		Inhalation	NA		NA	
		Dermal Contact	NA		4.8E-02	
		Total	NA		7.6E-02	
		Receptor Total	NA		7.6E-02	
Future Construction Worker	Soil Site Perimeter	Ingestion	NA		6.3E-02	
		Inhalation	NA		NA	
		Dermal Contact	NA		2.1E-02	
		Total	NA		8.4E-02	
		Receptor Total	NA		8.4E-02	

TABLE A-3
Summary of Ecological Constituents of Concern
Site 7, NAB Little Creek, Virginia Beach, Virginia

	Surface Water					Sediment							
Chemical	Cove	Wetland	Canal Downgradient	Canal Center	Canal Upgradient	Cove	Wetland	Canal Downgradient	Canal Center	Canal Upgradient	Groundwater	Food Web	Surface Soil
Inorganics													
Copper									X				
Cyanide		x		x	x				x				
Iron					x								
Lead									X				
Manganese					x								
Mercury						x							
Zinc							x		x				
Pesticides/PCBs													
Aroclor-1260							x		X	x			
4,4'-DDE									X	x			
4,4'-DDT									X	x			
Dieldrin									X				
Endrin						x			X				
Endrin ketone						x			X				

X - Potential risk drivers; x - Other potential COCs

TABLE A-4
Summary of Groundwater RME Cancer Risks and Hazard Indices based on the Revised 2008 HHRA for Groundwater
Site 7, NAB Little Creek, Virginia Beach, Virginia

Receptor	Media	Exposure Route	Cancer Risk	COPCs with Cancer Risks >10-4	Hazard Index	COPCs with HQ > 1
Future Resident Adult	Groundwater	Ingestion	NA		**4.9E+00**	Arsenic (2.6), Manganese (1.6)
		Inhalation	NA		N/A	
		Dermal Contact	NA		3.2E-01	
		Total	NA		**5.2E+00**	Arsenic (2.6), Manganese (1.8)
Future Resident Child	Groundwater	Ingestion	NA		**1.1E+01**	Arsenic (6.0), Iron (1.1), Manganese (3.6)
		Inhalation	NA		N/A	
		Dermal Contact	NA		9.5E-01	
		Total	NA		**1.2E+01**	Arsenic (6.0), Iron (1.1), Manganese (4.2)
Future Resident Child/Adult	Groundwater	Ingestion	**6.3E-04**	Arsenic (6.3E-04)	NA	
		Inhalation	NA		NA	
		Dermal Contact	3.6E-06		NA	
		Total	**6.3E-04**	Arsenic (6.3E-04)	NA	
Future Industrial Worker	Groundwater	Ingestion	**1.5E-04**	Arsenic (1.5E-04)	**1.7E+00**	
		Inhalation	N/A		NA	
		Dermal Contact	N/A		NA	
		Total	**1.5E-04**	Arsenic (1.5E-04)	**1.7E+00**	
Future Construction Worker	Groundwater	Ingestion	NA		NA	
		Inhalation	NA		NA	
		Dermal Contact	1.3E-07		3.6E-01	
		Total	1.3E-07		3.6E-01	

TABLE A-5
Summary of Groundwater CTE Cancer Risks and Hazard Indices based on the Revised 2008 HHRA for Groundwater
Site 7, NAB Little Creek, Virginia Beach, Virginia

Receptor	Media	Exposure Route	Cancer Risk	COPCs with Cancer Risks >10-4	Hazard Index	COPCs with HQ> 1
Future Resident Adult	Groundwater	Ingestion	NA		**1.1E+00**	
		Inhalation	NA		N/	
		Dermal Contact	NA		4.7E-02	
		Total	NA		**1.2E+00**	
Future Resident Child	Groundwater	Ingestion	NA		**3.7E+00**	Arsenic (1.4), Manganese (1.6)
		Inhalation	NA		NA	
		Dermal Contact	NA		1.1E-01	
		Total	NA		**3.8E+00**	Arsenic (1.4), Manganese (1.7)
Future Resident Child/Adult	Groundwater	Ingestion	8.0E-05		NA	
		Inhalation	NA		NA	
		Dermal Contact	2.0E-07		NA	
		Total	8.0E-05		NA	
Future Industrial Worker	Groundwater	Ingestion	9.2E-06		7.4E-01	
		Inhalation	N/A		NA	
		Dermal Contact	N/A		NA	
		Total	9.2E-06		7.4E-01	

FIGURE A-1
Conceptual Site Model for Potential Human Exposures
Site 7, NAB Little Creek, Virginia Beach, Virginia

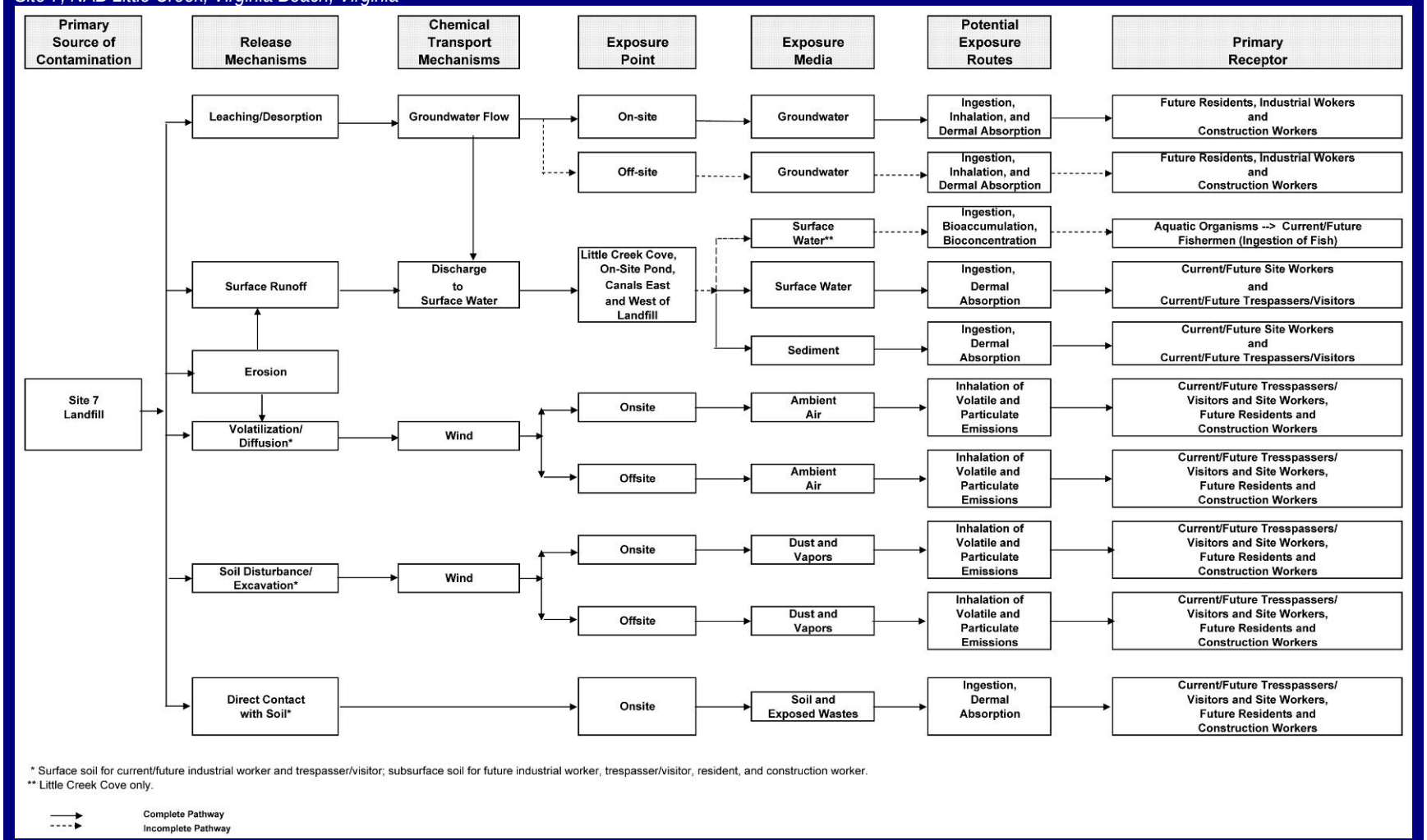
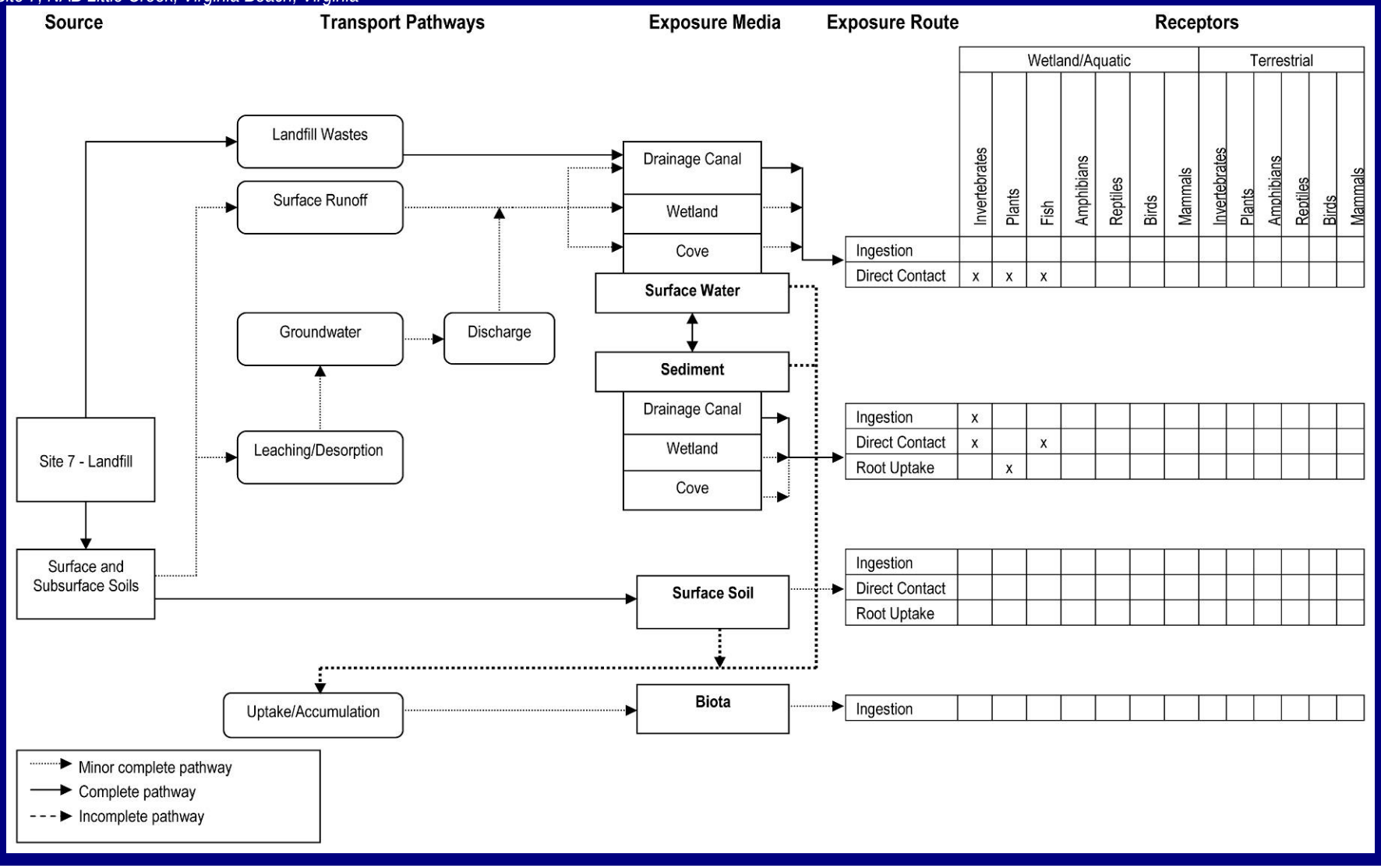


FIGURE A-2
Conceptual Site Model for Potential Ecological Exposure
Site 7, NAB Little Creek, Virginia Beach, Virginia



Attachment B – ARARs

Attachment B
Acronyms and Abbreviations
NAB Little Creek
Virginia Beach, Virginia

ARAR	Applicable or relevant and appropriate requirement
BTAG	Biological Technical Assistance Group
CERCLA	Comprehensive Environmental Response, Compensation and Li
CFC	Chlorofluorocarbon
CFR	Code of Federal Regulations
DCR	Virginia Department of Conservation and Recreation
DNH	Division of Natural Heritage
IDW	Investigation Derived Waste
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
NAAQS	National Ambient Air Quality Standards
NESHAPs	National Emission Standards for Hazardous Air Pollutants
NPDES	National Pollutant Discharge Elimination System
NSDWRs	National Secondary Drinking Water Regulations
NSPS	New Source Performance Standards
OSWER	Office of Solid Waste and Emergency Response
PCB	Polychlorinated biphenyls
PMCL	Primary Maximum Contaminant Level
POTW	Publicly Owned Treatment Works
ppm	Parts per Million
RBC	Risk-Based Concentrations
RCRA	Resource Conservation and Recovery Act
SDWA	Safe Drinking Water Act
SMCL	Secondary Maximum Contaminant Level
TCLP	Toxicity Characteristic Leaching Procedure
TSCA	Toxic Substance Control Act
UIC	Underground Injection Control
USACE	US Army Corps of Engineers
USC	United States Code
USEPA	United States Environmental Protection Agency
VAC	Virginia Administrative Code
VMRC	Virginia Marine Resource Commission
VPA	Virginia Pollutant Abatement
VPDES	Virginia Pollutant Discharge Elimination System

Notes:

Listing the statutes, policies, and citations for the ARARs does not indicate that the Navy accepts the entire statutes or policies as potential ARARs; only substantive requirements of the specific citations are considered potential ARARs .

References

Commonwealth of Virginia, 2004. Preliminary Identification, Applicable or Relevant and Appropriate Requirements.

USEPA, 1998. *CERCLA Compliance with Other Laws Manual: Interim Final* . Office of Emergency and Remedial Response. EPA/540/G-89/006.

USEPA, 1998. *CERCLA Compliance with Other Laws Manual: Part II. Clean Air Act and Other Environmental Statutes.* Office of Emergency and Remedial Response.

USEPA, 1998. RCRA, Superfund & EPCRA Hotline Training Manual. Introduction to Applicable or Relevant and Appropriate

Table B-1
Federal Chemical-Specific ARARs
Site 7 Amphibious Base Landfill
NAB Little Creek
Virginia Beach, Virginia

Location	Requirement	Prerequisite	Citation	ARAR Determination	Comment
There are no Federal Chemical-Specific ARARs for the Selected Remedy					

Table B-2
Virginia Chemical-Specific ARARs
Site 7 Amphibious Base Landfill
NAB Little Creek
Virginia Beach, Virginia

Location	Requirement	Prerequisite	Citation	ARAR Determination	Comment
There are no Virginia Chemical-Specific ARARs for the Selected Remedy					

Table B-3
Federal Location-Specific ARARs
Site 7 Amphibious Base Landfill
NAB Little Creek
Virginia Beach, Virginia

Location	Requirement	Prerequisite	Citation	ARAR Determination	Comment
Clean Water Act [33 USC §§ 1251-1387] [a]					
Wetlands	Avoid adverse effects, minimize potential harm, and preserve and enhance wetlands, to the extent possible.	Existing Wetland is filled in or permanently destroyed	40 CFR 230.2, .10-.12, .20-.32, .41-.42, .53, .60-.77, .93, .94(a), .94(c), .95-.98 33 CFR 320.4, 328.2, 330.1(c), 330.4, 332.3, 332.4(a), 332.4(c), 332.5-8	Relevant and Appropriate	A wetland exists on Site 7 and if any portion permanently filled or removed as part of an O&M maintenance activity mitigation will meet these requirements.
Coastal Zone Management Act [16 USC §§1451-1464] [a]					
Coastal zone or area that will affect the coastal zone	Federal activities must be consistent with, to the maximum extent practicable, State coastal zone management programs.	Action causes an effect in State's coastal zone.	*Coastal Zone Management Act* , 16 USC 1456(c), 15 CFR 930.30 to .33, .36(a), .39(b-d)	Relevant and Appropriate	If activities at site 7 affect the State's coastal zone, the activities will be consistent to the maximum extent practicable with the state's enforceable policies.
Migratory Bird Treaty Act [16 USC § 703] [a]					
Migratory bird area	Forbids the unregulated taking of native birds, their nests, or their eggs in the United States.	Presence of migratory birds.	*Migratory Bird Treaty Act,* 16 USC 703	Applicable	If migratory birds, or their nests or eggs, are identified at Site 7, O&M operations will not destroy the birds, nests or eggs.

Note:
a: statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader; listing the statutes and policies does not indicate that the DON accepts the entire statutes or policies as potential ARARs; specific potential ARARs are addressed in the table below each general heading; only pertinent substantive requirements of the specific citations are considered potential ARARs

Table B-4
Virginia Location-Specific ARARs
Site 7 Amphibious Base Landfill
NAB Little Creek
Virginia Beach, Virginia

Location	Requirement	Prerequisite	Citation	ARAR Determination	Comment
General Provisions Relating to Marine Resources Commission **[VA Code Ann. §§ 28.2-1300 to 1320 (1998)][a]**					
Wetlands	Compensation or mitigation for permanent loss of wetlands will be determined on a case-by-case basis.	Permanent loss of wetlands	*Wetlands Mitigation Compensation Policy* , 4 VAC 20-390-10 to 50	Relevant and Appropriate	Wetlands are present at Site 7. Any O&M activities conducted in wetlands will involve restoration to natural conditions. If permanent loss of wetland occurs, compensation or mitigation will be determined based on this regulation.
State Water Control Law **[VA Code Ann. §§ 62.1-44.2 to 62.1-44.34:28 (2003)][a]**					
Wetlands	Wetland delineations must be conducted in accordance with "Wetland Delineation Manual, Technical Report Y-87-1, January 1987, Final Report" (Federal Manual)	A wetland delineation is required.	*Virginia Water Protection Permit Program* 9 VAC 25-210-45	Relevant and Appropriate	Any wetland delineation will be conducted in accordance with this regulation.
Wetlands	Activities performed in a wetland will comply with these requirements.	Activities will be performed in a wetland.	*Virginia Water Protection Permit Program* 9 VAC 25-210-50	Relevant and Appropriate	Any wetland activities will be conducted in accordance with this regulation.

Note:
a: statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader; listing the statutes and policies does not indicate that the DON accepts the entire statutes or policies as potential ARARs; specific potential ARARs are addressed in the table below each general heading; only pertinent substantive requirements of the specific citations are considered potential ARARs

Table B-5
Federal Action-Specific ARARs
Site 7 Amphibious Base Landfill
NAB Little Creek
Virginia Beach, Virginia

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comment
Clean Water Act [33 USC §§ 1251-1387] [a]					
Discharge of dredge-and-fill	No discharge of dredged or fill material will be allowed unless appropriate and practicable steps are taken that minimize potential adverse impacts of the discharge on the aquatic ecosystem.	Discharges of dredged or fill material to surface waters, including wetlands.	40 CFR 230.2(b), .10-.12, .20-.32, .41-.42, .53, .60-.77 33 CFR 320.4, 328.2, 330.1(c), 330.4	Relevant and Appropriate	O&M operations that result in filling of adjacent wetlands will be conducted in accordance with these regulations.

Note:
a: statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader; listing the statutes and policies does not indicate that the DON accepts the entire statutes or policies as potential ARARs; specific potential ARARs are addressed in the table below each general heading; only pertinent substantive requirements of the specific citations are considered potential ARARs

Table B-6
Virginia Action-Specific ARARs
Site 7 Amphibious Base Landfill
NAB Little Creek
Virginia Beach, Virginia

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comment
Erosion and Sediment Control Law **[VA Code Ann. §§ 10.1-562 - 573 (2005)][a]**					
O&M activities that that disturb at least 10,000 sq ft of land.	Regulations for the effective control of soil erosion and sediment deposition to prevent the unreasonable degradation of properties, stream channels, waters and other natural resources.	O&M or construction activities that disturb at least 10,000 sq ft of land.	*Erosion and Sediment Control Regulations* , 4 VAC 50-30-40, 60.A	Relevant and Appropriate	Construction of the soil cover is complete. If construction activities necessary for O&M disturb at least 10,000 sq ft, an erosion and sediment control plan will be established to monitor and prevent erosion of the soil cover to adjacent water bodies.
Air Pollution Control Board **[VA Code Ann. §§ 10.1-1300 to 1326 (1998)][a]**					
Fugitive Dust caused by O&M or construction activities	Reasonable precautions will be taken to prevent particulate matter from becoming airborne.	Fugitive Dust emission from disturbance of soil, treatment of soil or water, or other pollutant management activities.	*Standards for Fugitive Dust/Emissions* 9 VAC 5-50-90	Applicable	If fugitive dust occurs during maintenance activities it will be managed according to this requirement.
Stormwater Management Act **[VA Code Ann. §§ 10.1-603.1 to 603.2:1 (2005)][a]**					
O&M and construction activities that disturb one acre or more of land.	Procedures, and requirements, and BMPs to be followed in connection with O&M and construction activities. establishment of surface water management areas, the issuance of surface water withdrawal permits and the issuance of surface water withdrawal certificates to provide for the protection of beneficial uses during periods of low streamflow.	O&M or construction activities that disturb one acre or more of land.	*Stormwater Management Regulations* , 4 VAC 50-60-30 to 80, 300, 310, 380.A&B., 420, 430, 1100 to 1140, 1160, 1170	Relevant and Appropriate	Construction of the soil cover is complete. If construction activities are necessary for O&M, and disturb one acre or greater of land, a site specific stormwater management plan will be developed for these activities. The Navy will follow the substantive, but not procedural, requirements of the law.

Table B-6
Virginia Action-Specific ARARs
Site 7 Amphibious Base Landfill
NAB Little Creek
Virginia Beach, Virginia

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comment
Virginia Waste Management Act **[VA Code Ann. §§ 10.1-1400 to 1457 (2004)][a]**					
Waste/Soil/ Water And Handling, Storage, treatment, and disposal of IDW	Wastes to be managed must be sampled for the appropriate waste characterization, storage and disposal requirements.	Management of wastes.	*Solid and Hazardous Waste Regulations* 9 VAC 20-60-261 (hazardous waste identification), 9 VAC 20-60-262 (incorporating 40 CFR Parts 262.11 and 262.34) (generator requirements) 9 VAC 20-80-140, 150, 240.C	Applicable	This remedy will generate water and potentially soil IDW which will be characterized for disposal. Based on site history, it is not anticipated that IDW will be characterized as hazardous waste.

Note:
a: statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader; listing the statutes and policies does not indicate that the DON accepts the entire statutes or policies as potential ARARs; specific potential ARARs are addressed in the table below each general heading; only pertinent substantive requirements of the specific citations are considered potential ARARs

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