DEPARTMENT OF THE ARMY
US ARMY CORPS OF ENGINEERS
NORFOLK DISTRICT
FORT NORFOLK
803 FRONT STREET
NORFOLK VA 23510-1011

September 27, 2017

Operations Branch

SUBJECT: Back River Navigation Channel Maintenance Dredging Project Draft Environmental Assessment

DISTRIBUTION LIST:

This letter is being transmitted by the U. S. Army Corps of Engineers (USACE) as the agent for Joint Base Langley-Eustis (JBLE). Enclosed with this letter is a compact disc of the draft Environmental Assessment and Federal Consistency Determination for the Back River Navigation Channel Maintenance Dredging Project, located in Hampton, VA. An electronic copy has been uploaded to the Norfolk District U.S. Army Corps of Engineers website (http://www.nao.usace.army.mil/).

The Proposed Action includes maintenance and new work dredging of the Back River Navigation Channel and the transport and placement of dredged material at the Norfolk Ocean Disposal Site (NODS).

To assist in the evaluation of the project, please submit any comments you may have by November 1, 2017. Please address all comments to Mrs. Shannon Reinheimer, Norfolk District, U.S. Army Corps of Engineers, 803 Front Street, Norfolk, VA 23510 or email to Shannon.J.Reinheimer@usace.army.mil.

Should you have any questions or require further information on this submittal, please contact Shannon Reinheimer of my staff via email or 757-201-7074. Thank you for your assistance.

Sincerely,

Jason R. Flowers, P.E. For Keith Lockwood

Keith B. Lockwood
Chief, Operations Branch

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Draft Environmental Assessment
Back River Navigation Channel Maintenance Dredging

Joint Base Langley-Eustis-Langley
Hampton, Virginia

Prepared By:

U.S. Army Corps of Engineers

Operations Branch

803 Front Street

Norfolk, Virginia 23510

Sept 28, 2017

I. EXECUTIVE SUMMARY

This draft Environmental Assessment (EA) has been prepared to assess the potential impacts of the Back River Navigation Channel, a Federally-maintained project supporting Joint Base Langley-Eustis-Langley (JBLE-Langley) in Hampton, Virginia. The Proposed Action includes maintenance and new work dredging of the Back River Navigation Channel and the transport and placement of dredged material at the Norfolk Ocean Disposal Site (NODS). The following sites were evaluated for the placement of dredged material:

- No Action Alternative
- Ocean disposal at Norfolk Ocean Disposal Site (NODS)
- Upland confined placement of dredged material at the Mears Site
- Upland placement of dredged material at Shirley Plantation (WEANAC)
- Placement at Craney Island Dredged Material Management Area (CIDMMA)

The direct and indirect impacts of the Proposed Action and No-Action Alternative were evaluated for temporary and permanent impacts.

Short-term impacts associated with the Proposed Action include destruction of the non-motile benthic community[1] and temporary changes in water quality, air and noise emissions. Short-term impacts would cease with the completion of dredging and placement activities.

Long-term impacts to soils and bathymetry[2], typical for a dredging project, would be expected as a result of the Proposed Action. Long-term positive impacts to human health and safety could also be anticipated as the dredged channel will improve safe navigation for vessels transiting the Back River Navigation Channel.

This EA was prepared in compliance with the National Environmental Policy Act (NEPA) of 1969 (40 CFR 1500-1508) and all applicable implementing regulations. This EA will be available for review and comment for 30 days from the date of posting.

[1] A group of immobile organisms that live on, or in, the seabed.
[2] The depth and shape of underwater terrain.

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APPENDICES

LIST OF ACRONYMS

AQCR	Air Quality Control Region
ATG	Automatic Tank Gauging
CAA	Clean Air Act
CCD	Coastal Consistency Determination
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CIDMMA	Craney Island Dredged Material Management Area
CY	Cubic yards
CZMA	Coastal Zone Management Act
DDT	Dichlorodiphenyltrichloroethane
DLA	Defense Logistics Agency
EA	Environmental assessment
EFH	Essential Fish Habitat
EPA	U.S. Environmental Protection Agency
ERA	Ecological risk assessment
ERP	Environmental restoration program
FDA	U.S. Food and Drug Administration
FEIS	Final Environmental Impact Statement
FEMA	Federal Emergency Management Agency
FIRM	Flood insurance rate map
FMP	Fisheries management plan
FONPA	Finding of No Practicable Alternative
FONSI	Finding of No Significant Impact
JBLE	Joint Base Langley-Eustis
JBLE-Langley	Joint Base Langley-Eustis-Langley
LAFB	Langley Air Force Base
LPC	Limiting Permissible Concentration
MLLW	Mean lower low water
MPRSA	Marine Protection, Research and Sanctuaries Act
NAAQS	National Ambient Air Quality Standard
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NODS	Norfolk Ocean Disposal Site
NRCS	Natural Resources Conservation Service
NWI	National Wetlands Inventory
OCDD	Octachlorodibenzo-p-dioxin
PAH	Polycyclic aromatic hydrocarbon

PCB	Polycholorinated byphenyl
PCC	Portland cement concrete
PCT	Polycholorinated terphenyls
PP	Proposed plan
RA	Remedial Action
RAC	Risk Assessment Code
RD/RAWP	Remedial Design/Remedial Action Work Plan
RI	Remedial investigation
RONA	Record of Non-Applicability
SAV	Submerged aquatic vegetation
SIP	State implementation plan
SMMP	Site Management and Monitoring Plan
STFate	Short-Term Fate of Dredged Material Disposal
SVOC	Semi-volatile organic compounds
SWPPP	Storm Water Pollution Prevention Plan
TEQ	Toxicity equivalent
UFC	Unified Facilities Criteria
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Agency
VDCR	Virginia Department of Conservation and Recreation
VDEQ	Virginia Department of Environmental Quality
VDGIF	Virginia Department of Game and Inland Fisheries
VDHR	Virginia Department of Historic Resources
VIMS	Virginia Institute of Marine Sciences
VMRC	Virginia Marine Resources Commission
VNHR	Virginia Natural Heritage Resources
VOC	Volatile organic compounds
WQC	Water quality criteria

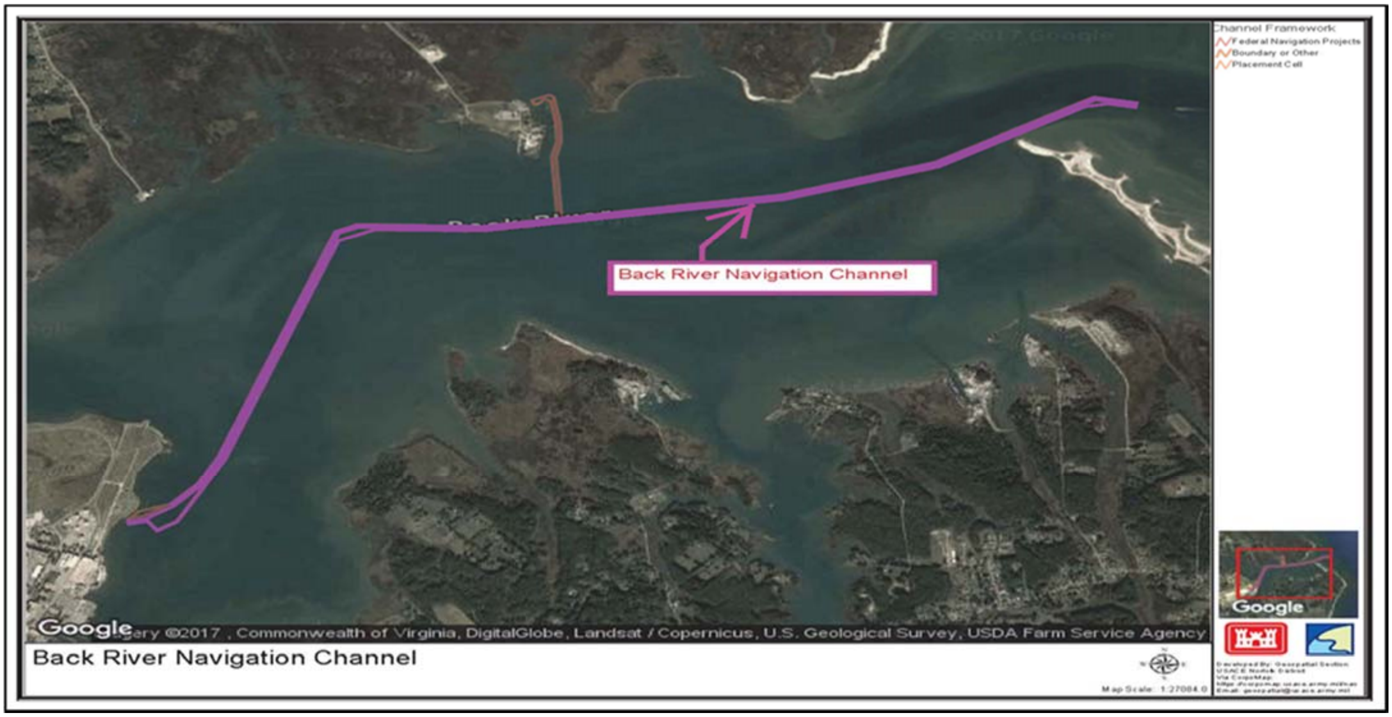
INTRODUCTION

Established in 1917, Langley Air Force base (LAFB) is the oldest continuously active air force base in the United States. In 2010, LAFB aligned with Fort Eustis in Newport News to become Joint Base Langley-Eustis (JBLE-Langley). JBLE-Langley covers approximately 2,883 acres and contains an airfield and support facilities, research and development facilities, testing facilities, fuel docking and storage facilities, ordnance, housing, golf courses, and various recreational areas. JBLE-Langley is home to the 633d Air Base Wing, 1st Fighter Wing, 480th and 363d Intelligence, Surveillance, and Reconnaissance Wings, and the 192d Fighter Wing. The base also hosts the Global Cyberspace Integration Center field operating agency and Headquarters Air Combat Command. The base serves a large population made up of over 125,000 active duty, guard and reserve, family members, civilians, contractors, and retirees.

1.1 PROJECT LOCATION

Back River, an estuarine inlet of the Chesapeake Bay, is located between the cities of Hampton and Poquoson, Virginia. The Back River Navigation Channel is a 19,500 feet channel that connects JBLE-Langley with the Chesapeake Bay. This channel provides access and safe navigation in support of national defense to JBLE-Langley located in Hampton, Virginia, from the Chesapeake Bay. Maintenance dredging of the Back River Navigation Channel, a Federally-maintained project, was last performed in 2003. The project location is identified in Figure 1.

Figure 1 Back River Navigation Channel Project Vicinity Map



1.2 PURPOSE AND NEED

JBLE-Langley proposes to conduct dredging of the Back River Navigation Channel through appropriated Military Operations and Maintenance funds in a manner that is consistent with previous operations at this location. The purpose of the Proposed Action is to provide and maintain a safe operational channel for vessel transit to JBLE-Langley. Dredging of the Back River Navigation Channel needs to be performed to maintain an operational channel for watercraft access to JBLE-Langley in support of national defense. Access to the channel is needed to efficiently provide fuel to the 1st Fighter Wing. Reduced or discontinued dredging would eventually result in the continued reduction in operational depth and channel restrictions which would adversely impact the JBLE-Langley 1st Fighter Wing operations and missions. The current depth of the Back River Navigation Channel indicates there is shoaling (defined as the building up of sediment on the bottom of the channel that poses a hazard to navigation). Because of the shoaling, larger vessels entering the channel have limited access at high tide. Maintenance dredging of the Back River Navigation Channel occurs approximately every 15 years. In addition, the new work dredging will occur within the approach to the newly constructed JBLE fuel pier. For this cycle estimated at 180 days, approximately 200,000-250,000 cubic yards of material will be dredged.

1.3 SCOPE OF THE ENVIRONMENTAL ASSESSMENT

Under the requirements of Section 102 of the National Environmental Policy Act (NEPA), this proposed project constitutes a major Federal action, and an Environmental Assessment (EA) is therefore required. This EA has been prepared pursuant to NEPA and its implementing regulations.

The purpose of this EA is to evaluate the direct and indirect impacts associated with maintenance and new work dredging operations within the Back River Navigation Channel and placement at the NODS. This document identifies and evaluates the potential environmental, cultural resources, and socioeconomic effects associated with the Proposed Action as accomplished by implementing the Preferred Alternative discussed in Section 2.0. Section 3.0 of this EA describes the alternatives considered. Section 4.0 describes the existing conditions that fall within the scope of this EA. Section 5.0 describes the environmental consequences envisioned as a result of implementing the Proposed Action.

The EA focuses on impacts likely to occur from dredged material placement and transport from maintenance and new work dredging of the Back River Navigation Channel. The document analyzes direct effects (those resulting from the alternatives and occurring at the same time and place) and indirect effects (those distant or occurring at a future date).

1.4 PUBLIC AND AGENCY INVOLVEMENT

The draft EA was coordinated with the following:

- JBLE-Langley
- City of Hampton
- City of Poquoson
- U.S. Army Corps of Engineers (USACE)
- U.S. Coast Guard (USCG)
- U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS)
- U.S. Environmental Protection Agency (EPA)
- U.S. Fish and Wildlife Agency (USFWS)
- National Oceanic and Atmospheric Administration (NOAA)

- NOAA - National Marine Fisheries Service (NMFS)
- Virginia Department of Conservation and Recreation (VDCR)
- Virginia Department of Environmental Quality (VDEQ)
- Virginia Department of Game and Inland Fisheries (VDGIF)
- Virginia Department of Historic Resources (VDHR)
- Virginia Institute of Marine Science (VIMS)
- Virginia Marine Resources Commission (VMRC)
- Owners of Oyster Lease Numbers: 19755, 20403, 19763, 20333, & 21140

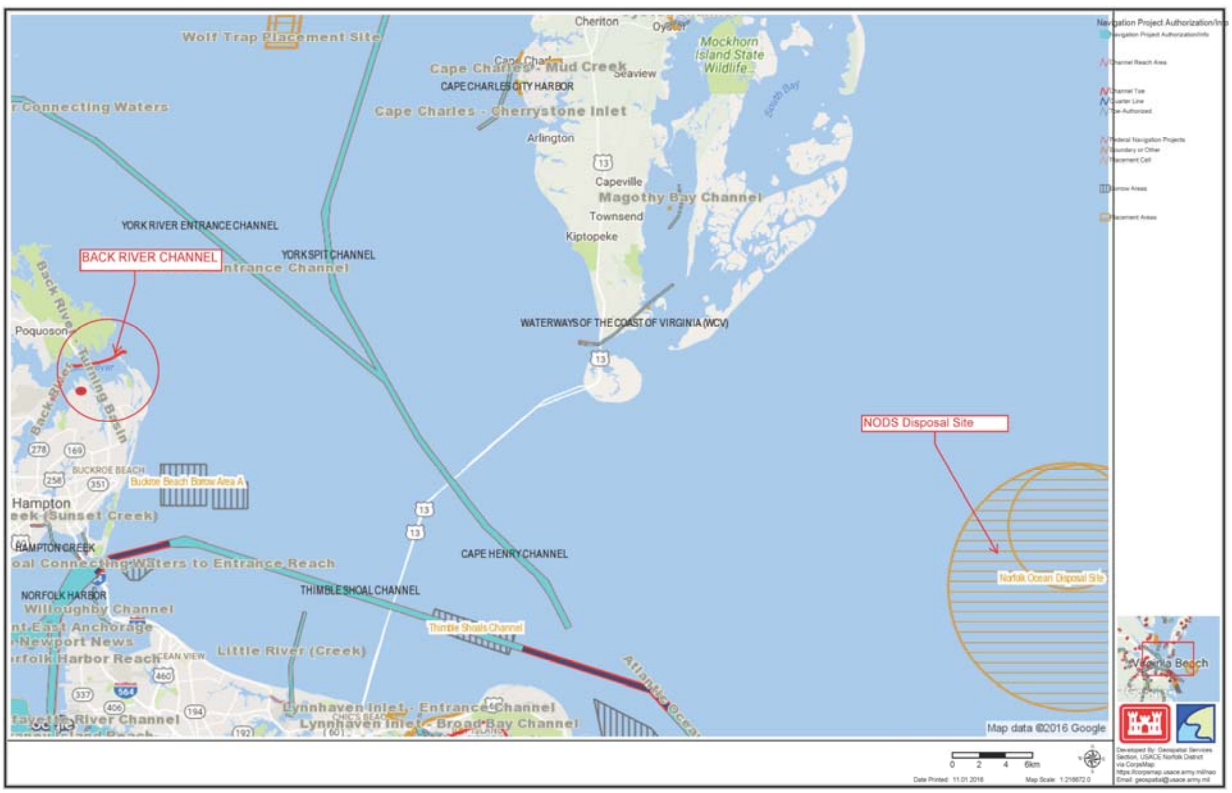
This EA will be provided electronically to interested parties for a 30-day comment period. There will also be a link to it on the Norfolk District USACE (http://www.nao.usace.army.mil/) website.

2 PROPOSED ACTION

The Proposed Action is to conduct maintenance and new work dredging operations in the Back River Navigation Channel. The project includes the dredging of approximately 200,000-250,000 cubic yards of material from the 19,500 feet channel. Dredged material will be placed at the NODS. See Figure 2 for the project site and placement site location.

JBLE-Langley is responsible for maintenance dredging of the Back River Navigation Channel to its authorized depth, width, and length through appropriated Military Operations and Maintenance funds. In support of national defense, maintenance dredging is necessary to maintain a safe operational channel for vessels. The effects of maintenance dredging and material placement at an upland confined placement facility (Mears Site) were considered in previous environmental assessments.

Figure 2 Proposed Action Project Site and Dredged Material Placement Location



2.1 MECHANICAL DREDGING WITH BARGE AND/OR SCOW PLACEMENT

Mechanical dredging is the method that will be used at the Back River Navigation Channel Project. This method allows for sediment resuspension at vertical points in the water column from the bottom to above the water surface. Resuspension of the material into the water column can happen as the bucket impacts the bottom, closes, and is pulled off the bottom through the water column and breaks the water surface. Generally, resuspension of sediment is higher using mechanical clamshell dredges than hydraulic dredges but can be minimized through operational controls. Clamshell (bucket) dredges can be used in smaller navigation channels due to increased maneuverability. Dredged material will be removed from the channel and placed onto a scow/barge. The scow/barge will transport and place the dredged material at the NODS.

2.2 PLACEMENT OF DREDGED MATERIAL AT THE NORFOLK OCEAN DISPOSAL SITE

Each maintenance dredging cycle for the Back River Navigation Channel will remove approximately 205,000 cubic yards (CY) of dredged material within the footprint of the 19,500 feet navigation channel to a depth of -15 MLLW[3]. The dredged material would be transported by scow/barge for the purpose of ocean placement at the NODS. The material within the channel has been tested in accordance with the Marine Protection, Research, and Sanctuaries Act (MPRSA) and meets the requirements for ocean placement. The U.S. Environmental Protection Agency (USEPA) formally concurred that the dredged material meets the ocean disposal criteria on 30 August 2016. The approximate number of trips to the NODS depends on the capacity of the scow and may range from 50 to 100 round trips. Subsequent maintenance dredging cycles for ocean placement would require appropriate testing once the E.P.A. concurrence expires.

2.2.1 NODS History

Approximately 205,000 CY of sediment from the dredging activities associated with the maintenance dredging of the Back River Navigation Channel dredging project are proposed for placement at the NODS. The NODS was officially designated as an ocean placement site in 1993 pursuant to Section 102c of the Marine Protection, Research, and Sanctuaries Act (MPRSA) of

[3] -15 feet MLLW maintained depth includes a required depth of -12 feet MLLW plus -2 feet paid overdepth and -1 foot non-paid overdepth.

1972 (as amended, 33 U.S.C. 1401 et seq). The site has a history of ocean disposal, as a portion of the NODS overlaps an area historically used for dredged material disposal prior to the 1960s.

To determine the site's suitability for ocean disposal, the Norfolk District USACE submitted a Final Environmental Impact Statement (FEIS) for the NODS on July 23, 1982. The results of the evaluation determined that the site was an acceptable location for ocean dumping. A test dump program conducted in October 1981 demonstrated that there was no evidence of widespread dispersal of dredged material during operations. In late 1981, an archaeological investigation concluded that no sites of archaeological interest would be endangered by disposal operations. As a result of the FEIS, the NODS was designated by the EPA as an approved ocean disposal location in December of 1986. A FEIS, entitled "Final Environmental Impact Statement for the Designation of an Ocean Dredged Material Disposal Site Located Offshore Norfolk Virginia," was finalized in March of 1993. In August 1993, the site was utilized in conjunction with the construction of the Cheatham Annex Naval Supply Center and the Naval Weapons Station. These projects required the disposal of 51,000 CY and 475,000 CY dredged material respectively. The sediments from this dredging were primarily silt and clay. During the period of October 2013 to October 2014 the VDOT-Midtown Tunnel Project placed 1,121,642 CY of silt and clay dredged material at the NODS. Additionally, during the period of November 2014 through December 2014 approximately 128,266 cy of silt and clay dredged material was placed at the NODS from Skiffes Creek Channel which provides navigable access to the Third Port Facility located at Fort Eustis. Since 2009, additional projects have received authorization to place dredged material at the NODS including the Craney Island Eastward Expansion (CIEE) (24.5 million CY), Norfolk Inner Harbor Channel 50-feet element (1 million CY), Baltimore Harbor Upper Bay Approach Channels, Joint Base Langley Eustis – Fuel Pier Replacement Project, Cheatham Annex Naval Supply Center (48,000 CY), the Yorktown Naval Weapons Station (65,000 CY), and Chesapeake Bay Bridge Tunnel – Parallel Thimble Shoals Tunnel Project (1.7 million CY) .

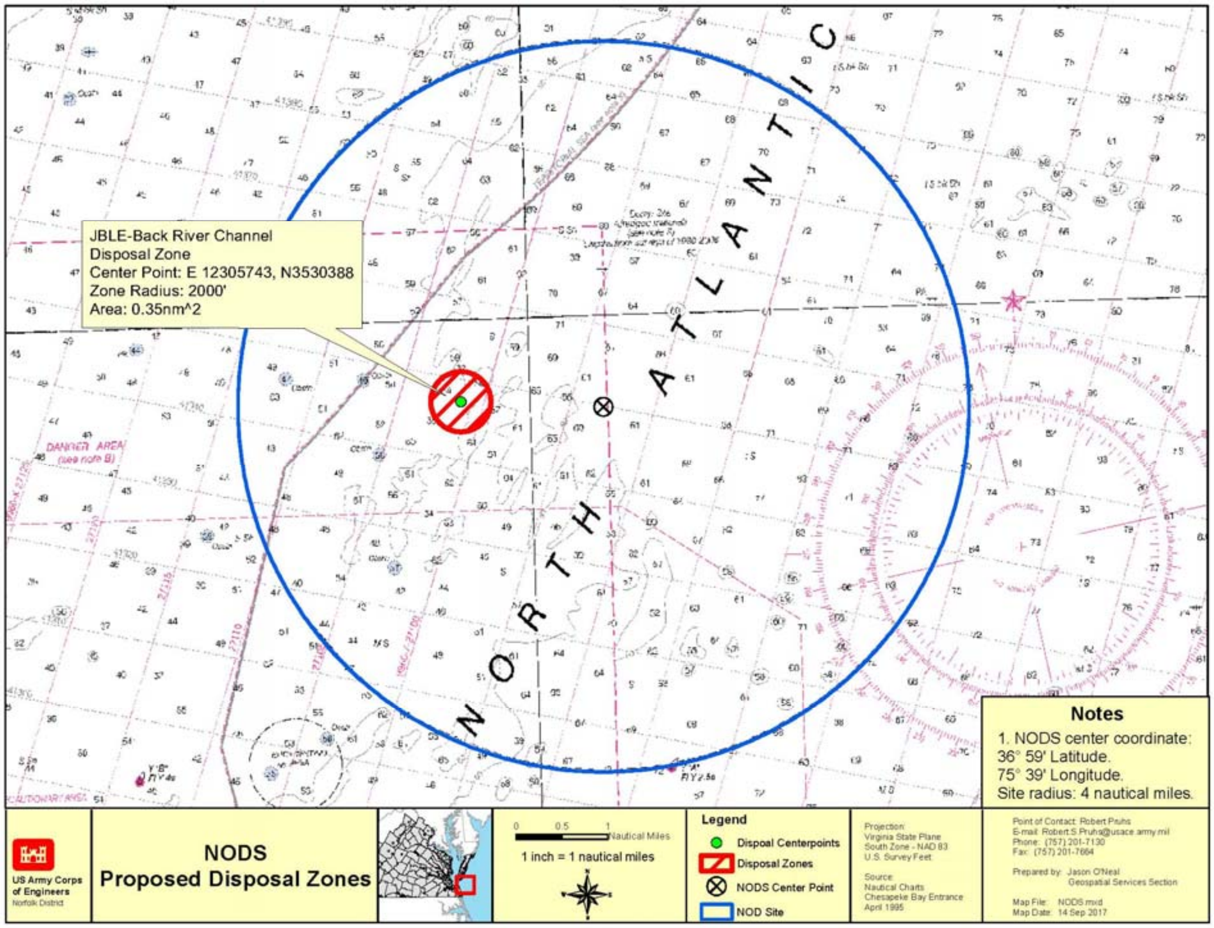
2.2.2 NODS Location and Management

The center of the NODS is located 17 nautical miles east of the mouth of the Chesapeake Bay. The NODS is circular with a radius of 4 nautical miles and an area of approximately 50 square nautical miles. The center of the NODS site is located at 36° 59' north latitude and 75° 39' west longitude (Figure 3). Water depths near the center of the site vary between 43 to 85 feet. Bottom topography is generally flat with depth contours running parallel to the coastline.

Currently, the site has been designated to receive suitable new work and maintenance dredge material from Norfolk Harbor and the lower Chesapeake Bay. This site is authorized to receive appropriate dredge material from the Thimble Shoals, Cape Henry, Atlantic, Hampton Roads, and York Spit Federal navigation channels. An EIS, titled: “Final Environmental Impact Statement for the Designation of an Ocean Dredged Material Disposal Site Located Offshore Norfolk Virginia” was finalized in March of 1993.

Management of the NODS and dredged material placement operations at NODS are conducted in accordance with the Site Management and Monitoring Plan (SMMP). The SMMP for the NODS site establishes specific requirements for use of the site. The SMMP provides that only dredged material that has been evaluated in accordance with the MPRSA Section 103 regulations may be placed at the site. The SMMP does not specify specific methods of placement but does require that dredged material be evenly distributed to prevent unacceptable mounding and becoming a hazard to navigation. The management objective for the NODS area is to limit disposal quantities so as not to exceed 1.3 billion CY. The USACE has estimated that up to 250 million CY of dredged material from dredging projects (public and private) may be disposed at the site over the next 50 years. The quantity of material to be placed at the site depends on the quality of the dredged material. Only material that meets ocean dumping criteria will be placed at the NODS. Acceptable material includes unconsolidated fine to medium grain sands, silts, and clays. No seasonal restrictions to the placement of dredged material have been implemented for the site. The management plan requires that each ocean disposal event must be verified and documented through a computer database system. Scow or hopper dredge transits and actual placement activities at the NODS are currently required to be tracked using the USACE Dredge Quality Management program (DQM) (formerly “Silent Inspector”) for tracking vessel transit locations and dredged material placement locations and activities.

Figure 3 NODS Proposed Disposal Zone



2.2.3 Need for Ocean Disposal (Compliance With 40 CFR Part 227 Subpart C)

Placement of the dredged material at the NODS is one of the most viable options. Upland placement at privately-owned upland facilities, such as Port Tobacco at Weanack-Shirley Plantation and the previously used Mears Site, were both considered as alternate placement options for the dredged material from the Back River Navigation Channel. The dredged material meets the Proposed Virginia Exclusionary Criteria requirements for upland placement at Port Tobacco at Weanack, the Mears Site, and the requirements for ocean placement at the NODS. Upland dredged material placement capacity is limited in the southern Virginia region and is preferential for projects with contaminated sediments that cannot meet the requirements for ocean or open-water placement.

In addition to the NODS, another alternative identified to be feasible for dredged material placement of sediments from the Back River Navigation Channel was Craney Island Dredged Material Management Area (CIDMMA). Dredged material from the Back River Navigation Channel is precluded from placement at CIDMMA because CIDMMA is restricted to placement of material from dredging to support navigation in Norfolk Harbor and adjacent waters [(USACE)-Norfolk District Policy Memorandum WRD-01]. Material from non-navigation transportation projects is specifically precluded from placement at CIDMMA unless the material is clean and needed for dike construction. Physical and chemical testing of the dredged material from the Back River Navigation Channel indicated that the sediments would not be suitable for dike construction.

Because the previously used Mears Site is not available for the current maintenance dredging cycle, and the material meets the ocean placement requirements, the most viable alternate option for the dredged material from Back River Navigation Channel is ocean placement at the NODS.

2.3 IMPACT TOPICS ELIMINATED FROM FURTHER ANALYSIS AND CONSIDERATION

The following impact topics were eliminated from further analysis in this EA and a brief rationale for dismissal is provided for each topic. Potential impacts to these resources would be negligible, localized, and most likely immeasurable.

2.3.1 Land Use

The project is sub-tidal and would not impact occupancy, property values, or ownership; therefore this impact topic was dismissed from further analysis in this EA.

2.3.2 Prime Farmland

Prime farmland is defined as land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is also available for these uses. The soil qualities, growing season, and moisture supply are those needed for a well-managed soil to produce a sustained high yield of crops in an economic manner. The land can be cropland, pasture, rangeland, or other land, but not urban built-up land or water. Prime farmland is protected under the Farmland Protection Policy Act of 1981 to minimize the extent to which

Federal programs contribute to the unnecessary or irreversible conversion of farmland to nonagricultural uses. The Back River Navigation Channel Project is sub-tidal and is not considered prime farmland. This impact topic was dismissed from further analysis in this EA.

2.3.3 Geohazards

There are no known geohazards within the project area; therefore, this impact topic was dismissed from further analysis in this EA.

2.3.4 Groundwater

The project is sub-tidal; therefore this impact topic was dismissed from further analysis in this EA.

2.3.5 Cultural Resources

Section 106 consultation regarding cultural resources within the area of the Back River Navigation Channel project was submitted in March 2017 with the recommendation of no adverse effect to archaeological properties and historic landscapes. VDHR concurred that no historic properties will be affected in a Record of Coordination letter dated 18 April 2017 (see Appendix A); therefore, this impact topic was dismissed from further analysis in this EA.

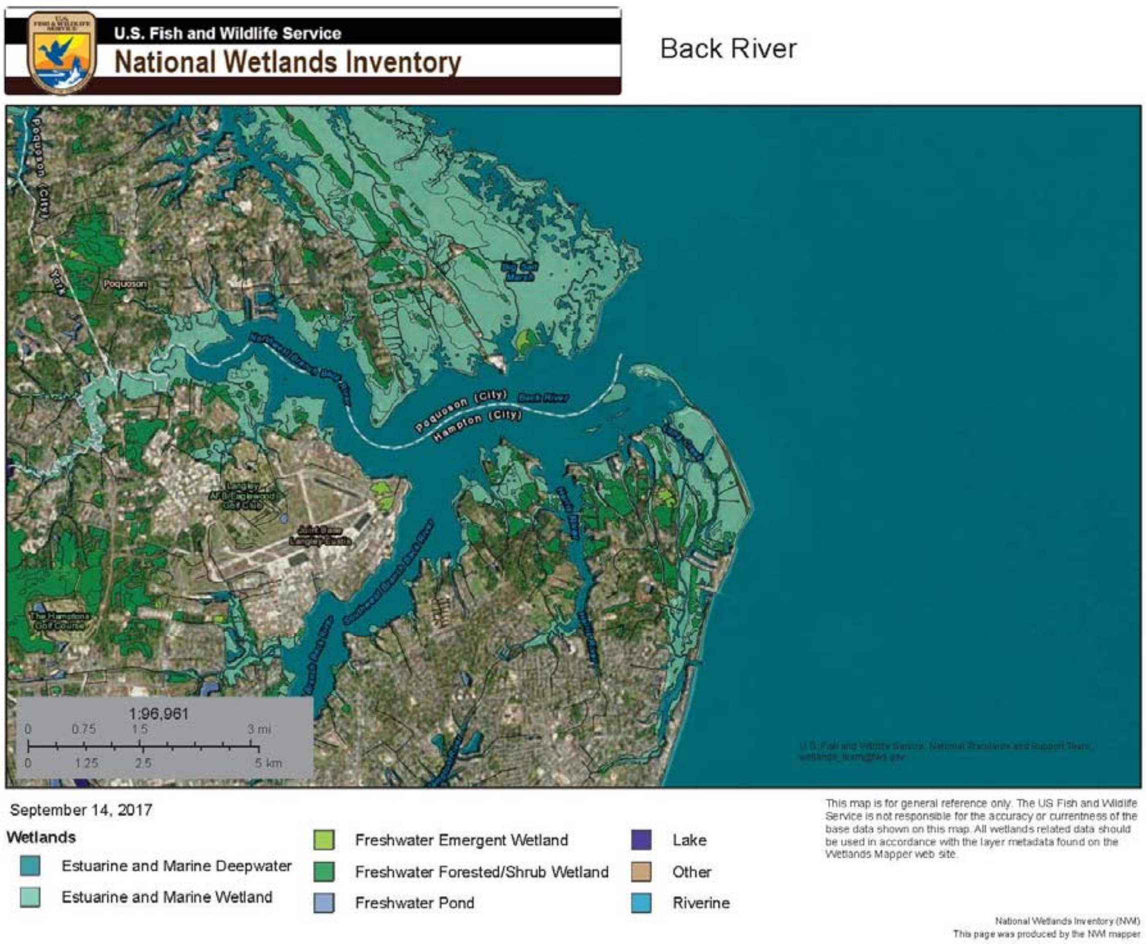
2.3.6 Floodplain

The project is subtidal; therefore, no floodplain impacts associated with the Proposed Action are anticipated. This impact topic was dismissed from further analysis in this EA.

2.3.7 Wetlands

Tidal estuarine emergent, non-tidal emergent, and palustrine forested wetlands can be found within 1 mile of the project area adjacent to Back River Navigation Channel and its tributaries. The USFWS National Wetlands Inventory (NWI) has not identified any wetlands in the project area (Figure 4). The Plum Tree National Wildlife Refuge (NWR) is located just north of the project area and consists of tidal and non-tidal wetlands. The Grandview Nature Preserve is located south of the project area and also consists of tidal and non-tidal wetlands. At the entrance of the channel (located north of the Grandview Nature Preserve) there is a series of segmented breakwater and tombolo structures and associated intertidal habitat within approximately 120 to 150 feet of the channel toe. The existing channel depth in this reach of the channel is greater than -15 feet MLLW. No other emergent wetland habitat is located in proximity to the project boundaries. Based on current information, no impacts to wetlands are anticipated.

Figure 4 NWI Map Showing Wetlands Adjacent to, but Not Within, the Project Site



2.3.8 Unique Ecosystems, Biosphere Reserves, and World Heritage Sites

There are no known unique ecosystems, biosphere reserves, or World Heritage Sites listed within or adjacent to the project area; therefore, this impact topic was dismissed from further analysis in this EA.

2.3.9 Wild and Scenic Rivers

The project is not located in or adjacent to a National Wild and Scenic River; therefore, this impact topic was dismissed from further analysis in this EA.

2.3.10 Indian Trust Resources

Secretarial Order 3175 requires that any anticipated impacts to Indian trust resources from a proposed project or action by Department of Interior agencies is explicitly addressed in environmental documents. The Federal Indian Trust responsibility is an obligation on the part of the U.S. Government, in carrying out the mandates of Federal law, to protect the tribal lands, assets, resources, and treaty rights of Federally-recognized American Indian tribes and Alaska Native entities. The project does not occur within tribal lands nor are any Native American resources known to exist within the project area; therefore, this impact topic was dismissed from further analysis in this EA.

2.3.11 Environmental Justice and Protection of Children from Environmental Health and Safety Risks

On February 11, 1994, President Clinton issued Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations." This order directs agencies to address environmental and human health conditions in minority and low-income communities so as to avoid the disproportionate placement from any adverse effects by Federal policies and actions on these populations. Additionally, Executive Order 13045, "Protection of Children from Environmental Health Risks and Safety Risks" directs Federal agencies to identify and assess environmental health and safety risks that may disproportionately affect children. Local residents near the project area may include low-income populations and children; however, these populations would not be particularly or disproportionately affected by activities associated with the project. These impact topics were dismissed from further analysis in this EA.

2.3.12 Socioeconomic Resources

NEPA requires an analysis of impacts to the human environment, which includes economic, social, and demographic elements in the affected area. The current conditions in the project area, as represented by the No-Action Alternative, would not have any impacts to the socioeconomic resources of the surrounding area. The Proposed Action would neither change local and regional land use, nor appreciably impact local businesses or other agencies. Implementation of the Proposed Action could provide a negligible beneficial impact to the nearby surrounding economies from short-term minimal increases in employment opportunities for the construction workforce and revenues for local businesses and government generated from construction activities. Since the impacts to the socioeconomic resources associated with the project would be negligible, this impact topic was dismissed from further analysis in this EA.

2.3.13 Aesthetics

The project does not contain features that are aesthetically prominent or architecturally distinguished; therefore, this impact topic was dismissed from further analysis in this EA.

2.3.14 Stormwater Systems

The project is sub-tidal; therefore this impact topic was dismissed from further analysis in this EA.

2.3.15 Utilities

There are no known active or abandoned utilities located within the project area. This impact topic has been dismissed from further analysis in this EA.

3 ALTERNATIVES TO THE PROPOSED ACTION

Under NEPA, an EA must evaluate reasonable alternatives for a project. Five (5) alternatives have been identified for the project:

- No Action Alternative
- Upland confined placement of dredged material at the Mears Site
- Upland placement of dredged material at Shirley Plantation (WEANAC)
- Placement at Craney Island Dredged Material Management Area (CIDMMA)
- Beneficial Uses of Dredged Material

The maintenance dredging of the Back River Navigation Channel and the placement of dredged material at the Norfolk Ocean Disposal Site (NODS) was carried forward as part of the Proposed

Action. This plan has been determined to be the best and most appropriate action to meet the Federal Standard[4] and allow for the efficient completion of the project.

3.1 NO ACTION ALTERNATIVE

NEPA regulations refer to the No-Action Alternative as the continuation of existing conditions of the affected environment without implementation of, or in the absence of, the Proposed Action. Inclusion of the No-Action Alternative is prescribed by the Council on Environmental Quality (CEQ) regulations as the benchmark against which Federal actions are evaluated. Under this alternative, dredging of accumulated sediment within the Back River Navigation Channel would not be performed. This alternative would eliminate the environmental impacts to the benthic community in the channel. Discontinued maintenance of the channel would result in the continued reduction in operational depth of the navigation channel. Eventually the channel would reach hydrodynamic equilibrium as determined by the sediment transport, tidal and fluvial currents. Adversely, it would allow the navigation channel to naturally shoal thereby eliminating the benefits of the waterway by closing it off to safe navigation. Eventually, vessels would not be able to access JBLE-Langley in support of national defense.

3.2 UPLAND CONFINED PLACEMENT OF DREDGED MATERIAL AT THE MEARS SITE

Placement of dredged material from the Back River Federal Navigation project at the Upland Confined Placement area known as the Mears Site was considered as an alternative. A geotechnical evaluation of the existing Mears Site was conducted by the Norfolk District. The geotechnical evaluation determined the existing containment dikes will not satisfy USACE factor of safety requirements for dike slope stability without improvements to the containment dikes. The containment dike improvements will result in a larger footprint of the dike and will impact exterior areas adjacent to the placement site. Portions of the exterior areas appear to reside in jurisdictional wetland areas that may require mitigation for permanent and temporary impacts. This alternative

[4] The Federal Standard is defined in USACE regulations as the least costly dredged material disposal or placement alternative (or alternatives) identified by USACE that is consistent with sound engineering practices and meets all federal environmental requirements, including those established under the Clean Water Act (CWA) and the Marine Protection, Research, and Sanctuaries Act (MPRSA) (see 33 CFR 335.7, 53 FR 14902).

was discarded because it did not meet the Federal Standard and would not meet the project objectives within a reasonable timeframe.

3.3 UPLAND PLACEMENT OF DREDGED MATERIAL AT SHIRLEY PLANTATION (WEANAC)

Placement of dredged material from the Back River Federal Navigation project at Shirley Plantation/WEANAC was considered as an alternative. This site is located 65 miles one way and placement at this site would include double handling of material to maintain dredge production efficiencies. This alternative is cost prohibitive and, therefore, does not meet the Federal Standard.

3.4 DREDGED MATERIAL PLACEMENT AT CRANEY ISLAND DREDGED MATERIAL MANAGEMENT AREA (CIDMMA)

The U.S. Army Corps of Engineers, Craney Island Dredged Material Management Area (CIDMMA) located in the City of Portsmouth, Virginia, was a considered alternative for dredged material placement. The CIDMMA is a Congressionally authorized dredged material placement site. The site is a confined disposal facility located in Norfolk Harbor. CIDMMA was determined not to be a viable alternative since Back River Navigation Channel is not located within the geographic service area defined in the law authorizing CIDMMA as a dredged material placement facility.

3.5 BENEFICIAL USES OF DREDGED MATERIAL

Beneficial uses of dredged material from Back River Navigation project that may benefit habitat development, erosion control or restoration were considered. However, the material is predominantly fine grained silts and clays not suitable for these types of projects which typically require heavier and less dispersible material. The submerged aquatic vegetation, oyster grounds, current, and wave energy may constrain the use of the fine-grained dredged material for these beneficial uses. In addition, beneficial uses of dredged material may require a local sponsor to cover the additional costs associated beyond the Federal Standard. Based on the constraints, beneficial use projects were considered not to be viable at this time.

4 AFFECTED ENVIRONMENT

This section describes the affected environment and the existing conditions for the resource categories that may be impacted by maintenance and new work dredging of the Back River Navigation Channel. Each resource category was reviewed for its potential to be impacted. Through this analysis, resource categories clearly not applicable to the alternatives were screened from further evaluation (and were briefly described in Section 2.4). Those resources eliminated from further discussion as inapplicable to the Proposed Action included: land use, prime farmland, geohazards, groundwater, cultural resources, floodplains, wetlands, unique ecosystems, biosphere reserves, World Heritage Sites, Wild and Scenic Rivers, Indian trust resources, environmental justice, socioeconomic resources, aesthetics, stormwater systems, and utilities. Only those affected resources applicable to the Proposed Action are discussed further in this section and in Section 5.0, Environmental Consequences.

The Back River Navigation Channel footprint is approximately 46 acres. Impacts from the Proposed Action would primarily be found within the project boundaries. Each dredging cycle, dredging would remove approximately 200,000 – 250,000 CY of material to provide for safe navigation to and from the fuel pier at JBLE-Langley. The area will be mechanically dredged to a maintained depth of -15 feet MLLW[5]. The maximum dredging depth of -15 feet MLLW is necessary to provide safe navigation and access. Dredged material would be transported and placed at the NODS.

4.1 SOILS

Sediment in the Back River Navigation Channel project is considered previously disturbed maintenance material and new work material. To ensure that dredged material is suitable for placement at the NODS, sediment and site water samples within the project footprint were tested (see Sections 4.4 and 5.4). Soils are predominantly fine grained material, silts, and clays.

[5] -15 feet MLLW maintained depth includes a minimum depth of -12 feet MLLW plus -2 feet paid overdepth and -1 foot non-paid overdepth.

4.2 BATHYMETRY

The Back River Navigation Channel project site is located within the Atlantic Coastal Plain Physiographic Province. The site itself is sub-tidal and mostly flat with water depth varying from -4 feet to -25 feet MLLW. Roads, buildings, bridges, and other common urban features are found in the surrounding area.

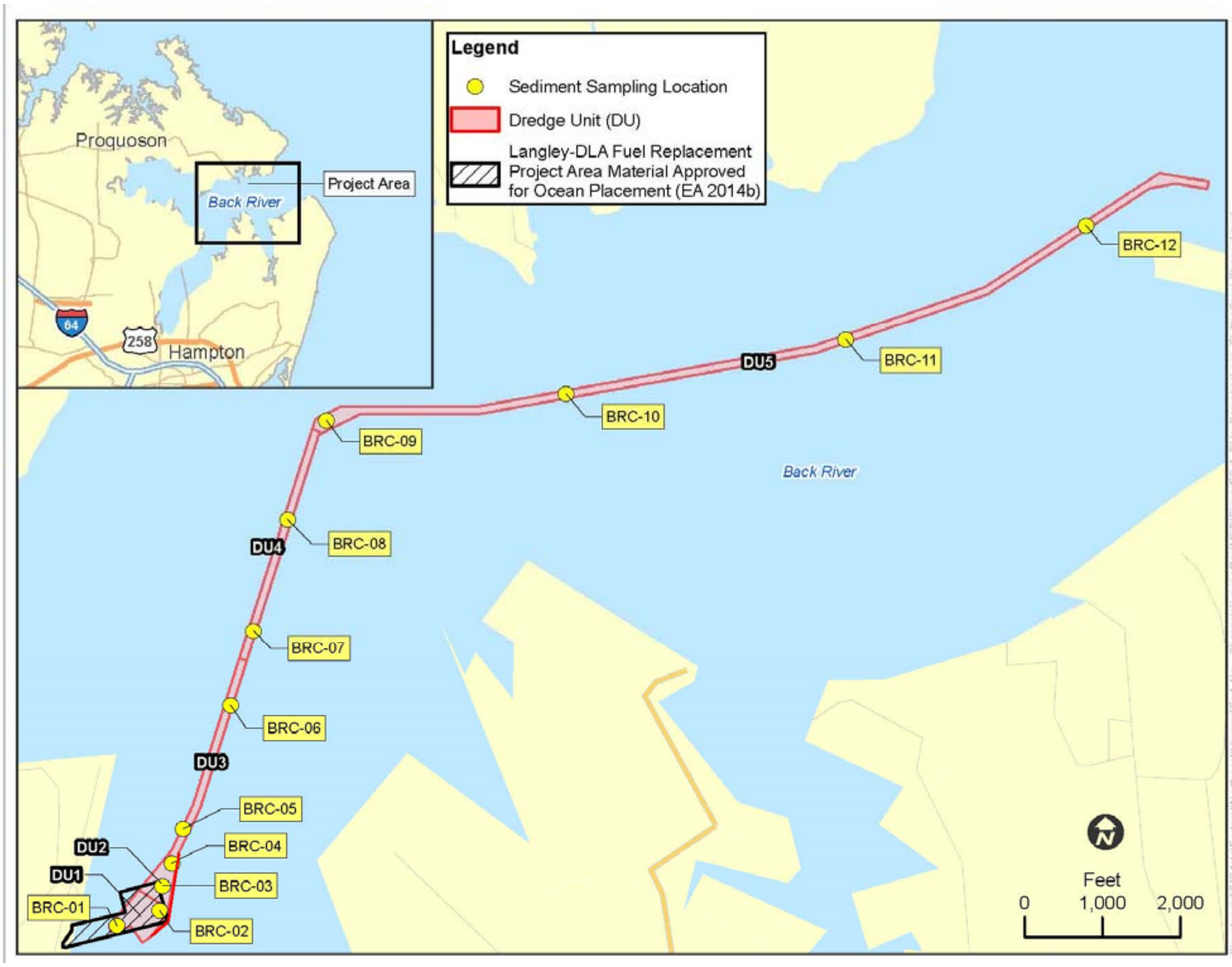
4.3 WATER QUALITY

The Back River Navigation Channel project site ranges in salinity from 14.81 – 23.54 parts per thousand, water temperature ranges from 33° to 85° Fahrenheit, and the turbidity ranges from 0.8 - 1100 NTU based on data collected by the USGS from two monitoring stations in Back River (USGS Water Data, 2017). The NODS ocean reference site general water quality parameters observed during sample collection in December 2015 were: 33.12 parts per thousand for salinity, 58.4° Fahrenheit, and 0.5 NTU for turbidity (see field notes from Section 103 Evaluation in Appendix D). Dredged material ocean placement requires a Section 103 concurrence from the EPA.

4.4 DREDGED MATERIAL CHARACTERIZATION

To ensure the Proposed Action's dredged material is suitable for placement at the NODS, sediment and site water samples from twelve separate locations within the project's dredging footprint were collected (see Figure 5).

Figure 5 Target Sample Locations in the Dredging Footprint



Samples from the dredging footprint were collected in December 2015 via vibracore or Van Veen surface sampler and were evaluated in accordance with Section 103 of the MPRSA. Reference sediments were also collected, evaluated, and used for comparison to the Proposed Action's sediment. Reference samples were evaluated simultaneously with the project's dredged material. Reference and control sediments were collected at an EPA approved location at Willoughby Bank reference site, the Atlantic Ocean reference site, and the Chesapeake Bay control site. The Willoughby Bank and Atlantic Ocean reference sites were selected to accommodate changes in grain size throughout the channel.

4.4.1 Applicable Regulations and Testing

The transport of dredged material for the purpose of ocean disposal is regulated under Section 103 of the MPRSA of 1972 (Public Law 92-532). The law states that any proposed placement of dredged material into ocean waters must be evaluated through the use of criteria published by the EPA in Title 40 of the Code of Federal Regulations, Parts 220-228 (40 CFR 220-228). The primary purpose of Section 103 of the MPRSA is to limit and regulate adverse environmental impacts of ocean placement of dredged material. Dredged material proposed for ocean placement must comply with 40 CFR 220-228 (Ocean Dumping Regulations) and 33 CFR 320-330 and 335-338 (USACE Regulations for discharge of dredged materials into waters of the U.S.) prior to being issued an ocean placement permit. The technical evaluation of potential contaminant-related impacts that may be associated with ocean placement of dredged material is conducted in accordance with 40 CFR 220-228 and the *Ocean Testing Manual* (EPA/USACE 1991). The criteria in 40 CFR Part 227 are used to determine compliance.

In accordance with 33 CFR, Part 324, the USACE has authority to issue or deny MPRSA Section 103 permits for activities subject to a Department of the Army permit that involve ocean disposal of dredged material. The USACE must seek and obtain concurrence from the EPA for the proposed ocean disposal.

The Proposed Action's dredged material was evaluated for water column impacts and benthic impacts in four specific cases to comply with the Limiting Permissible Concentration (LPC) (as defined in 40 CFR 227.27):

Water quality criteria compliance (liquid phase)
Water column toxicity compliance (liquid and suspended particulate phase)
Benthic toxicity (solid phase)
Benthic bioaccumulation (solid phase)

4.4.1.1. Evaluation of the Liquid Phase – Water Quality Criteria (WQC)

Six standard elutriates were prepared from composite samples locations. Standard elutriates were tested for each chemical constituent to determine compliance with applicable Federal water quality criteria and the LPC for the liquid phase dredged material in 40 CFR 227.6 and 227.27.

4.4.1.2. Evaluation of the Liquid and Suspended Particulate Phases – Water Column Bioassay

Water column bioassays were conducted using the following three benchmark water column species: *Mytilus galloprovincialis* (blue mussel), *Americamysis bahia* (opossum shrimp), and *Menidia beryllina* (inland silverside). The water column species were exposed to a series of standard dilution of elutriates (100, 50, 10, and 1 percent) created from composite sediment samples and one site water sample collected from within the dredging footprint. The opossum shrimp and inland silverside tests were measured for effects to organism survival and blue mussel tests measured development effects to embryos. Test survival or effects results from each dilution series were used to calculate LC50/EC50. Dredged material must meet the toxicity threshold of 0.01 of the EC50/LC50 within 4-hours inside the boundary of the placement site.

4.4.1.3. Evaluation of the Solid Phase – Whole Sediment Bioassay

Ten day whole sediment bioassays were conducted to determine benthic toxicity using two benthic species: *Leptocheirus plumulosus* and *Ampelisca abdita* (estuarine amphipods). The tests were static, non-renewal tests with ten days of exposure to the composite sediments and overlying water. Tests measured survival of tests organisms in project materials compared to survival in the reference sediments. To meet the LPC for the solid phase, the bioassay organisms in the dredged material must not exhibit mortality that is statistically greater than in the reference sediment and exceeds mortality in the reference sediment by at least 20%.

4.4.1.4. Evaluation of Solid Phase – Bioaccumulation Evaluation

Twenty-eight day bioaccumulation tests were conducted on six composite sediment samples collected from within the Back River Navigation Channel dredging footprint using two sensitive benthic marine organisms: *Nereis virens* (polychaete) and *Macoma nasuta* (blunt nose clam). The bioaccumulation tests measured the potential for bioaccumulation of contaminants in organism tissue as a result of exposure to the Back River Navigation Channel dredged material. Test organisms were also exposed to reference sediments from the Willoughby Bank and Atlantic Ocean reference sites. Dredged material bioaccumulation tests are compared to reference sediment bioaccumulation tests and are compared to U.S. Food and Drug Administration (FDA) Action Levels. When bioaccumulation of contaminants in dredged material tests exceeds that in the reference sediments, general risk based factors must be assessed to determine compliance with 40 CFR 227.13.

The EPA required a subset of the organism tissue exposed to the composite samples to be analyzed for lipids and moisture content and the following constituents of concern: metals, polycyclic aromatic hydrocarbon (PAHs), polychlorinated biphenyl congeners (PCB's), dioxin and furan congeners, and select pesticides. The constituents selected for analyses in organism tissues samples were determined on constituent detections in the dredged material bulk sediment analyses. Pre-test and reference sediment organism tissue were also analyzed.

4.5. PROTECTED SPECIES AND CRITICAL HABITAT

Wildlife found in this area is typical for a subaqueous environment. Species generally include a variety of fish, small reptiles and amphibians. In addition, a variety of song birds and bats inhabit the area including the bald eagle (*Haliaeetus leucocephalus*). Two federally threatened species are listed on the IPaC resource report (Appendix C): the piping plover (Charadrius melodus) and northeastern beach tiger beetle (Cicindela dorsalis dorsalis). Piping plovers nest on sandy substrates above the high tide line and forage in intertidal areas. The tiger beetles are most commonly found in sandy intertidal areas. However, there is no critical habitat for these species since the project is subtidal. Refer to Appendix C "Threatened and Endangered Species Lists and U.S. Fish and Wildlife Service Project Review Package" for the VDGIF, USFWS, and Virginia Natural Heritage Resources (VNHR) species tables for the project area.

Species Conclusions Table

Project Name: Back River Navigation Channel

Date: March 28, 2017

Species / Resource Name	Conclusion	ESA Section 7 / Eagle Act Determination	Notes / Documentation
Piping plover	Species not present within the project area	No effect	The project is outside the designated critical habitat area for piping plover

Northeastern Beach Tiger Beetle	Species not present within the project area	No effect	No suitable habitat
Critical habitat	No critical habitat present	No effect	There are no critical habitats within the project area

4.5.1 Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act, or MSA), as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), established procedures designed to identify, conserve, and enhance Essential Fish Habitat (EFH) for those species regulated under a Federal fisheries management plan (FMP). Section 305(b)(2) of the MSA requires Federal action agencies to consult with National Marine Fisheries Service (NMFS) on all actions, or Proposed Actions, authorized, funded, or undertaken by the agency, that may adversely affect EFH. As part of the EFH consultation process, the guidelines require Federal action agencies to prepare a written EFH Assessment describing the effects of that action on EFH (50 CFR 600.920(e)(1)). An EFH assessment was coordinated with NMFS NOAA Fisheries with a determination of "adverse effect on EFH is not substantial". Concurrence was received on September 14, 2017 (see Appendix A "Agency Coordination").

4.5.2 Informal Endangered Species Act Section 7 Consultation

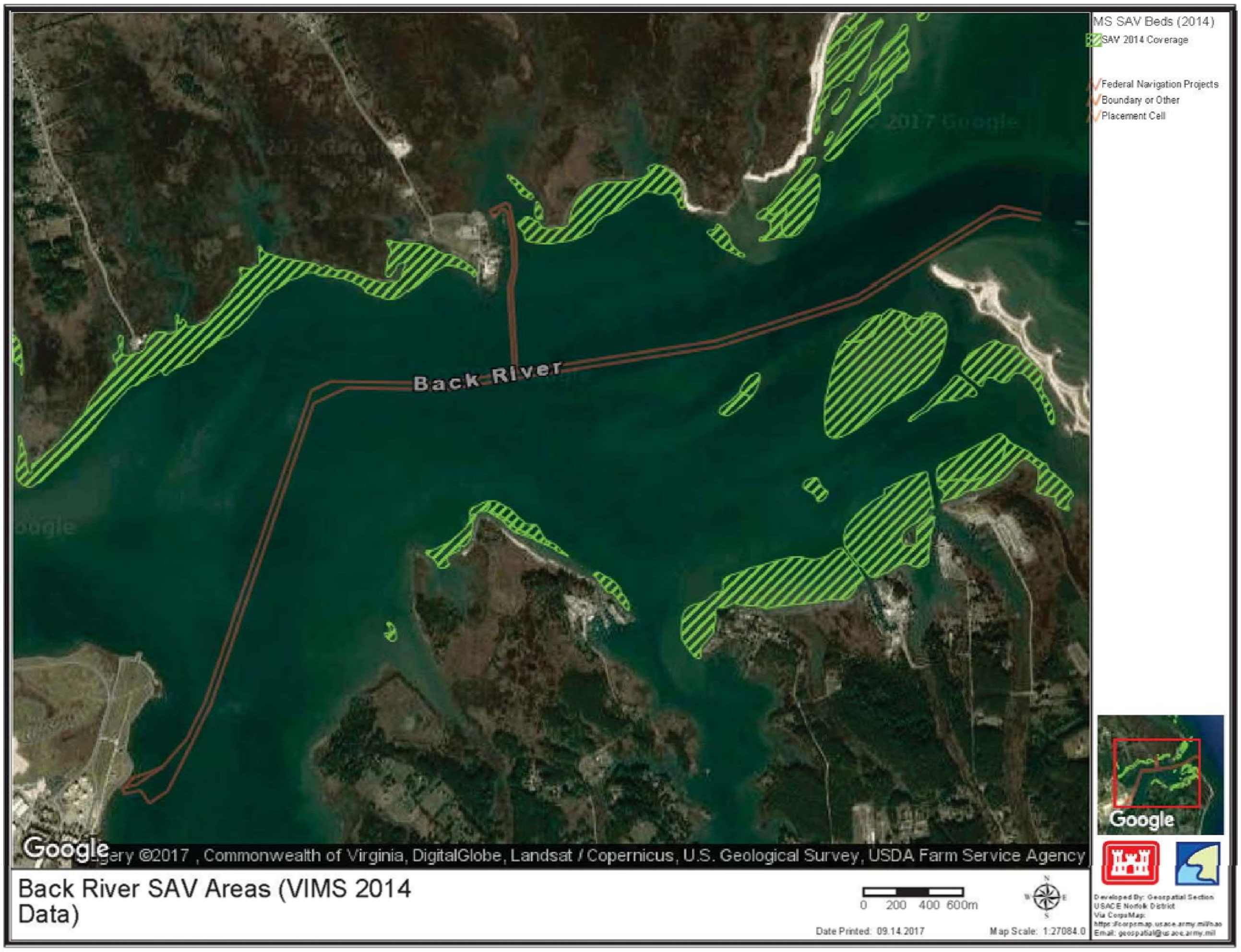
"Under section 7 Federal agencies must consult with NOAA Fisheries when any action the agency carries out, funds, or authorizes may affect either a species listed as threatened or endangered under the Endangered Species Act (ESA), or any critical habitat designated for it. If the agency taking the action (referred to as the "action agency" under section 7) concludes that the project is not likely to adversely affect (NLAA) listed species and/or critical habitat, they submit an informal consultation request to NOAA Fisheries (referred to as the "Consulting Agency under section 7) for concurrence. An NLAA determination is the appropriate conclusion to be made when effects on ESA listed species and/or critical habitat are expected to be discountable (extremely unlikely to occur), insignificant (so small they cannot be meaningfully measured, detected or evaluated), or wholly beneficial (ALL effects benefit the species and/or critical habitat). If consultation cannot be concluded informally because adverse effects to listed species are expected, the action agency must request formal consultation" (NOAA 2017).

An informal section 7 consultation was submitted to NMFS NOAA Fisheries Protected Resources Division (PRD) on March 13, 2017 for coordination and concurrence, with a determination of "not likely to adversely affect" (NLAA) species listed as threatened or endangered within NMFS jurisdiction under the ESA of 1973 (see Appendix A). NMFS NOAA Fisheries concurred with the determination of NLAA listed species or critical habitat on 25 May 2017.

4.6. VEGETATION

The Virginia Institute of Marine Science (VIMS) submerged aquatic vegetation (SAV) data mapper has not identified SAV in the channel. However, SAV is located adjacent to the project area (Figure 6). This figure shows the approximate location of SAV resources in 2014. SAVs such as eelgrass (Zostera marina) represent a distinct biotic component in shallow water habitat. Fish communities tend to be more abundant in SAV beds than in adjacent unvegetated areas. Many species of fish and shellfish use SAV for shelter and as a place to find food. The project is located in deepwater habitat. SAV resources are located within 300 feet of the channel toe in shallow water habitat. This area of the Back River Channel will require minimal dredging (approximately 7,000 cy of pay material, station 120+00 to 172+00 and 3,400 cy of pay material, station 80+00 to 120+00) and will likely only require approximately 5-days to complete. The sediments in these station ranges are predominantly sands that will not result in significant sediment re-suspension and we do not foresee impacts to SAV resources in that area. The majority of the dredging work will be required from the dog-leg in the channel (approximate station 80+00) to the fuel pier. There are no SAV resources in close proximity to this reach of the channel. The closest SAV are greater than 1,000-feet from these upstream portions of the channel.

Figure 6 VIMS SAV Data Showing SAV within 300 feet of the Project Site



4.7. GREENHOUSE GASES AND CLIMATE CHANGE

The Back River Navigation Channel is located between the cities of Hampton and Poquoson, Virginia, and characterized by a humid, subtropical climate with hot summers and mild to cool winters (Weatherbase 2017). The average annual temperature in Hampton is 61.9° Fahrenheit and ranges from an average high of 89° Fahrenheit in July to an average low temperature of 50° Fahrenheit in January (U.S. Climate Data 2017). Mean average annual rainfall for the area is approximately 45 inches and ranges from an average high of 5.35 inches in August to an average low of 2.99 inches in February (U.S. Climate Data 2017). Precipitation peaks during the summer in July and August but is relatively evenly distributed throughout the year (U.S. Climate Data 2017).

The NODS is located 17 nautical miles east of the mouth of the Chesapeake Bay. The NODS is circular with a radius of 4 nautical miles and an area of approximately 50 square nautical miles. The area is characterized by a humid, subtropical climate with hot summers and mild to cool winters (Weatherbase 2017).

4.8. AIR QUALITY

The Clean Air Act (CAA) as amended requires Federal actions to conform to an approved state implementation plan (SIP) designed to achieve or maintain an attainment designation for air pollutants as defined by the National Ambient Air Quality Standard (NAAQS). The NAAQS were designed to protect public health and welfare. The criteria pollutants include carbon monoxide (CO), ozone (O_3), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter ($PM_{2.5}$ and PM_{10}), VOC, and lead (Pb). The General Conformity Rule (40 CFR Parts 51 and 93) implements these requirements for actions occurring in air quality nonattainment areas.

The Back River Federal Navigation Channel project site is located in the Air Quality Control Region (AQCR) known as Hampton Roads Intrastate ACQR in Virginia (40 CFR 81.93). This region is in attainment for all the NAAQSs.

4.9. NOISE

The main source of noise within the Back River Navigation Channel and the surrounding area is airplane, jet, and vehicular traffic as well as commercial and recreational boats passing near or through the area. Noise also originates from common sources found in an urban environment, such as lawn mowers.

4.10. TRANSPORTATION

The Back River Federal Navigation Channel is accessible by boat via the Southwest Branch of the Back River. The NODS, the proposed placement site, is accessible by boat.

4.11. RECREATIONAL AND COMMERCIAL USE OF WATERS

Small, recreational boats may utilize the project area in the Back River and the Southwest Branch of Back River. Since the last dredging cycle in 2003, updated VMRC mapping indicates private oyster leases, pending private oyster leases, and public clamming grounds are located within the Back River Channel (Figure 3). To resolve a potential issue for a pending private oyster lease within the channel, the Corps sent an email to protest the pending oyster lease. VMRC's response to USACE for the pending private oyster lease within the channel stated, "It is our policy to not lease Federal Project Channels. Any survey of this area will exclude the channel footprint."

According to the Constitution of Virginia, Article XI Subaqueous Guidelines, Section I (B) Authority Required for Use of Subaqueous Beds, "Statutory Authority (approved by law) is, however, conferred on: 3. Construction and maintenance of Congressionally approved navigation or flood control projects undertaken by an authorized federal agency." Therefore, no further coordination is required for subaqueous beds located within the Back River Channel. Coordination with adjacent private oyster leaseholders and other agencies will be performed through Public Notice and agency reviews for NEPA, FCD, and the Joint Permit Application review process. The new work dredging area has been previously coordinated with the private oyster leaseholder.

The adjacent Back River-Messick Point spur channel connects Messick Point with the Back River Federal Navigation Channel. Messick Point is the homeport for vessels engaged in the commercial seafood industry. In addition to commercial traffic, recreational boaters also utilize the navigation channels in the Back River.

4.12. HUMAN HEALTH AND SAFETY

Shoaling, defined as the building up of sand on the bottom of the channel that poses a hazard to navigation, has reduced the operating depth of the project and could impact operations at the fuel pier. Reduced operating depths restrict JBLE-Langley's ability to receive fuel for training activities and missions. Reduced depths may also inhibit or be a hazard to recreational boaters navigating the area; because the designated channel depth has shoaled in, or become more shallow than needed for safe passage through the channel.

5. ENVIRONMENTAL CONSEQUENCES

This section of the EA identifies and evaluates the anticipated environmental consequences or impacts associated with the Proposed Action and the No-Action Alternative. Table 5.1 summarizes the environmental impacts associated with the Proposed Action.

The terms "impact" and "effect" are used interchangeably in this section. Impacts may be discussed as positive or negative, significant or minor, as appropriate to the resource area. Positive impacts occur when an action results in a beneficial change to the resource, whereas negative impacts occur when an action results in a detrimental change to the resource. Significant impacts occur when an action substantially changes or affects the resource. A minor impact occurs when an action causes impact, but the resource is not substantially changed. Impacts are also discussed as temporary as well as short and long-term impacts and are associated with relative time frames as the direct result of the action. In this case, temporary refers to an impact only during the period of construction. Short-term describes the impact for 1-3 years post construction, whereas long-term describes the permanent impacts that would be expected to remain for many years. This section is organized by resource area following the same sequence as in the preceding Section 4.0. Some resource topics were excluded from further evaluation. A brief discussion of those topics can be found in Section 2.3.

In addition to the following, a Coastal Consistency Determination (CCD) was submitted to comply with the requirements of the Coastal Zone Management Act (CZMA) passed in 1972. The Act provides for management of the nation's coastal resources and balances economic development with environmental conservation. It requires that Federal agencies be consistent in enforcing the policies of state coastal zone management programs when conducting or supporting activities that affect a coastal zone. The CZMA is intended to ensure that Federal activities are consistent with state programs for the protection and, where possible, enhancement of the nation's coastal zones. The CCD is included in Appendix B "Coastal Consistency Determination and Clean Air Act General Conformity Rule Record of Non-Applicability" with the recommendation that the Proposed Action is consistent to the maximum extent practicable with the enforceable policies of the Virginia Coastal Resources Management Program.

Table 5.1 Environmental Consequences Summary

Impact Topic	Proposed Action	No Action Alternative
Soils	• Long-term impact due to removing soil from the project site	• No impact to existing conditions
Bathymetry	• Long-term impact due to deepening the project site to a the maintained depth	• No impact to existing conditions
Water Quality: Dredging Site	• Temporary, localized adverse impacts due to resuspension of sediments at dredging site	• No impact to existing conditions
Water Quality: Dredged Material Placement Site (NODS)	• Temporary, localized adverse impacts due to resuspension of sediments at placement site	• No impact to existing conditions
Dredged Material Characterization	•No anticipated contamination issues.	• No impact to existing conditions
Protected Species and Critical Habitat	• Localized, short-term adverse impacts to benthos at dredging and placement site(s)	• No impact to existing conditions
Submerged Aquatic Vegetation	• No impacts are anticipated	• No impact to existing conditions
Greenhouse Gases and Climate Change	• Minor and temporary, localized impacts due to operation of the dredging equipment	• No impact to existing conditions
Air Quality	• Minor and temporary, localized impacts due to dredging and dredged material placement activities	• No impact to existing conditions
Noise	• Temporary, localized adverse impacts due to dredging and dredged material discharge activities and construction at shoreline placement site	• No impact to existing conditions
Transportation	• No anticipated impacts to the dredging and placement sites as both are sub-tidal.	• No impact to existing conditions

Recreational and Commercial Use of Waters	• Long term impacts to 5 oyster leases that overlap the dredging project channel • Long term impacts to the Back River Shellfish Management Area which overlaps the project area • Temporary interruptions to access during dredging activities • Long term positive impacts as the Proposed Action would improve conditions for safe navigation and access to Back River for commercial and recreational traffic	• Continued shoaling could result in a reduction in operational depth that would eventually eliminate the benefits of the waterway and allow shoaling to become a hazard to safe navigation
Human Health and Safety	• Long term positive impacts as the Proposed Action would eliminate the potential hazards to safe navigation	• Continued shoaling and reduced depths could allow for the potential increase of safety hazards and negative impacts to human health

5.1. SOILS

5.1.1 Proposed Action

Long-term impacts, typical of dredging projects, would be expected from the Proposed Action. Each cycle, approximately 200,000 – 250,000 CY of material would be dredged from the project's dredging footprint to achieve a maximum depth of -15 feet MLLW. Suitable dredged material would be transported to the NODS for ocean disposal.

5.1.2 No-Action Alternative

Under the No-Action Alternative, the Proposed Action would not occur; therefore, there would be no impacts to soils.

5.2. BATHYMETRY

5.2.1 Proposed Action

The Proposed Action's intent is to remove sediment in the project footprint to restore the authorized depths of the Back River Navigation Channel to a maximum depth of -15 feet MLLW. The result of this action would create long term impacts to the current bathymetry which ranges from -4 feet MLLW to -25 feet MLLW.

5.2.2 No-Action Alternative

Under the No-Action Alternative, the Proposed Action would not occur. There would be no impacts to the site's bathymetry; therefore, the ongoing shoaling would continue to occur and result in an increased potential for negative impacts to human health and safety.

5.3. WATER QUALITY

5.3.1 Proposed Action

The Proposed Action would result in temporary impacts to water quality at the dredging and placement sites. Placement at the NODS received MPRSA Section 103 concurrence from the EPA on August 30, 2016.

5.3.1.1. Impacts to Water Quality at the Dredging Site

Resuspension of sediment is expected with dredging however, this impact can be minimized through operational controls. Impacts to water quality from mechanical dredging would be minor, temporary and localized to the area around the dredge. Localized turbidity would dissipate once dredging has ceased. Based on data collected from the Virginia Department of Environmental Quality, the ambient total suspended solids at a monitoring station in Back River ranged from 11 – 20 mg/L in 2002 (My Waters Mapper). Total suspended solids concentrations associated with mechanical clamshell bucket dredging operations have been shown to range from 105 mg/L in the middle of the water column to 445 mg/L near the bottom (210 mg/L, depth-averaged) (USACE, 2001). The Proposed Action will cause a temporary increase in the amount of turbidity and total suspended solids in the action area; however, suspended sediment is expected to settle out of the water column within a few hours and any increase in turbidity and total suspended solids will be short term. Due to the area of impact and relatively short duration of the dredging activity, the Proposed Action would not significantly impact water quality.

5.3.1.2. Impacts to Water Quality at the Proposed Placement Site

Dredged material removed from the proposed project site would be transported to the NODS for ocean disposal. Temporary turbidity impacts to water quality during dredged material disposal would occur at the proposed placement site. Increased sediment loads in the water column can result in a reduction of dissolved oxygen through biochemical oxygen demand. These impacts may be more pronounced during late summer months when water temperatures are warmer and less capable of holding dissolved oxygen. Due to the area of impact and relatively short duration of the discharge activity, the Proposed Action is not likely to significantly impact water quality.

5.3.2 No-Action Alternative

Under the No-Action Alternative, the Proposed Action would not occur; therefore, there would be no impacts to water quality.

5.4. DREDGED MATERIAL CHARACTERIZATION

5.4.1 Proposed Action

Samples from the project site were collected and analyzed as described in section 4.5. No petroleum or other obvious pollution was observed during sample collection. The evaluation process for ocean disposal emphasizes the potential biological effects, rather than chemical presence of contaminants (EPA/USACE, 1991). Tier II and Tier III evaluations were conducted on the Proposed Action's dredged material. The sediments consisted predominantly of alluvial silts and clays with embedded sands and do not meet exclusion criteria. The MPRSA provides for exclusions to testing if the dredged material consists of the following:

1. Predominantly sand, gravel, or rock and is found in areas of high current or wave energy.
2. Dredged material is for beach nourishment.
3. When the dredged material is substantially the same as the substrate at the proposed disposal site and the material is far removed from known existing and historical sources of pollution.

Tier II investigations typically consist of sediment, water, and elutriate chemistry evaluations. Tier III investigations typically consist of appropriate water column and whole sediment bioassays on appropriate sensitive organisms to determine the potential for significant effects due to acute toxicity or bioaccumulation of constituents in the dredged material over a sufficient period of time.

Dredged material proposed for ocean disposal is required to comply with the LPC (as defined in 40 CFR 227.27) for water column impacts and benthic impacts in four specific cases:

1. Water quality criteria compliance (liquid phase).

2. Water column toxicity compliance (liquid and suspended particulate phase).
3. Benthic toxicity (solid phase).
4. Benthic bioaccumulation (solid phase).

Summary tables of the evaluation results can be found in Appendix D "Back River Project Dredged Material Evaluation Section 103 Report."

5.4.1.1. Evaluation of the Liquid Phase – Water Quality Criteria (WQC)

Compliance with the LPC was determined using the USACE Short-Term Fate of Dredged Material Disposal in Open Water (STFate) model to determine whether the liquid phase dredged material would achieve WQC within the site boundary and/or within 4-hours following dredged material discharge. Comparison of chemical concentrations detected in the standard elutriates created from site sediments and site water indicated that ammonia was detected in the full strength elutriates from four of the six DUs at concentrations that exceeded the USEPA saltwater acute WQC for the protection of aquatic life. For the organic constituents, (PAHs, PCB congeners, dioxin and furan congeners, chlorinated pesticides, organophosphorus pesticides, SVOCs, and butyltins) few constituents were detected, and most of the concentrations were low and estimated below the laboratory reporting limit. For each standard elutriate the lowest achievable cyanide reporting limit (10 microgram per liter µg/L exceeded the acute water quality criterion (1.0 µg/L) and required a 9-fold dilution to achieve the LPC compliance. This was the most conservative dilution requirement of all the analytes with concentrations that exceeded respective acute WQC. The STFATE model indicated that 99 to101-fold dilutions would occur within the four hours following each discrete placement event and would remain within the boundary of the NODS site.

Based on the information above, the liquid phase of the dredged material meets the LPC and is in compliance with 40 CFR 227.6(c)(1) and 227.27(a)(1).

5.4.1.2. Evaluation of the Liquid and Suspended Particulate Phases – Water Column Bioassay

Three water column bioassays were conducted on dredged material representative of each dredging unit. The water column bioassays for M. galloprovincialis had EC50 values of >100 percent elutriate, and the LC50 for the M. beryllina and A. bahia bioassays were also each greater than 100 percent elutriate. Based on the EC50 for M. galloprovincialis, a 99-fold dilution is required to meet the LPC compliance for water column toxicity for each project sample. The STFATE model indicated that 99-101-fold dilutions would occur for each sample within the four hours following a discrete placement events ranging from 32,000-62,000 cy of dredged material and remain within the boundaries of the NODS site. It should be noted that this range of discharge volume represents the maximum discharge volume that would result in compliance with the liquid and suspended particulate phase LPC. Actual operational discharges will be based on the scow size of the government contractor. Typical ocean-going scows typically range from 3,000 cy to 6,000 cy in size.

Based on the results of the Tier III STFATE modeling, the Back River Federal Navigation Channel elutriates meet the LPC for water column toxicity for discrete placement volumes ranging up to 32,000 to 62,000cy.

5.4.1.3. Evaluation of the Solid Phase – Whole Sediment Bioassay

Ten day whole sediment bioassays were conducted on dredged material representative of each composite sample location. Mortality in the Back River Federal Navigation Channel dredged material whole sediment bioassays is not statistically greater than in the reference sediment and does not exceed the mortality in the reference sediment by 20%.

Based on the above information, the dredged material meets the LPC for benthic toxicity in 40 CFR 227.13(c)(3).

5.4.1.4. Evaluation of Solid Phase – Bioaccumulation Evaluation

None of the tissues samples analyzed in Proposed Action's dredged material exceeded FDA action levels. Only two constituents, 1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin, from DU3, and octachlorodibenzo-p-dioxin (OCDD), from DU4, statistically exceeded the reference sites concentrations in the clam tissue, but not the mean pre-test tissue concentrations. Therefore, the mean concentration of these analytes was likely elevated prior to, not caused by, exposure to the Back River Navigation Channel samples. Mean OCDD concentrations in the worm tissue exposed to the Back River Federal Navigation Channel samples from DU2 and DU4 statistically exceeded mean reference and mean pre-test tissue concentrations. There are no USEPA Region 4 background concentrations for OCDD, however, this dioxin congener is the least toxic with a toxicity equivalency factor value of 0.0003. In addition, none of the dioxin toxicity equivalency quotients (TEQs) statistically exceeded the reference site TEQs. For DU6, none of the mean concentrations of metals, PAHs, dioxins, or PCBs statistically exceeded mean Atlantic Ocean reference site concentrations. Although mean concentrations of cadmium and OCDD for DU5 statistically exceeded the mean concentrations detected in tissues exposed to the sediment from the Atlantic Ocean reference site, they did not exceed the mean pretest tissue concentrations. Mean concentrations of lead and nickel in clam tissue from DU5 statistically exceeded the mean concentration of tissue for both mean reference and pre-test tissue. The UCLM values for these metals were compared to the Region 4 background concentrations for South Atlantic Bight, and the UCLMs did not exceed the background ranges.

Determining compliance with the LPC for benthic bioaccumulation considers at least one of the following factors; number of constituents that statistically exceed reference sediment results, magnitude by which the constituent exceeds reference sample, propensity of the constituent for significant bioaccumulation, toxicological importance of the constituent, and comparison to EPA Region 4 background concentrations for clam tissues. After consideration of various factors, USACE has determined that dredged material placement at the NODS will not result in ecologically significant bioaccumulation for the individual contaminants.

Based on the above information, the solid phase of the dredged material complies with 40 CFR 227.6(c)(3) and 227.27(b).

5.4.2 No-Action Alternative

Under the No-Action Alternative the Proposed Action would not occur; therefore, there would be no changes to the existing conditions.

5.5. PROTECTED SPECIES AND CRITICAL HABITAT

5.5.1 Proposed Action

The Back River Navigation Channel project would result in localized, temporary impacts to existing resources in the dredging area and placement sites. The dredging activity and placement at the NODS would result in the destruction of the existing non-motile benthic community; however, repopulation of benthic organisms within the impacted areas would begin quickly. The benthic community should repopulate within one to two years. In addition, motile marine organisms would be able to relocate during the dredging operations to avoid any direct physical impacts.

The probability of sea turtles being found within the project site is very low (Appendix C). Satellite tracking studies of sea turtles have found that foraging turtles mainly occurred in areas where the water depth was between approximately 16 and 49 feet. This depth was interpreted not to be as much an upper physiological depth limit for turtles, as a natural limiting depth where light and food are most suitable for foraging turtles. Sea turtles may move into shallower or deeper waters during migration, resting, and other activities. Sea turtles have not been shown to exhibit sensitivity to increased suspended sediments; however, if prey items are affected, adverse effects to sea turtles may occur as well (NOAA 2017). Sea turtles may be present within the action area. Any sea turtles within the project would be able to leave the project area.

The probability of Atlantic Sturgeon being found within the project site is low (Appendix C). The distribution of Atlantic sturgeon, from any distinct population segment (DPS), is strongly associated with prey availability, and as a result, Atlantic sturgeon may occur where suitable forage such as mollusks and crustaceans, and appropriate habitat conditions are present. Based on the best available information, sub adult and adult Atlantic sturgeon originating from any of five DPSs could occur in marine and estuarine habitat along the coast of Virginia and in Chesapeake Bay (NOAA 2017). Juvenile and early life stages (ELS) of Atlantic sturgeon would not be present based on the tidal marine nature of the habitat in the action area. Juveniles and ELS are not able to withstand the salinity of marine and coastal waters. Atlantic sturgeon also tends to be at least as tolerant of turbid estuarine and river conditions as other anadromous fish, such as striped bass.

Sediment removal may also cause effects on sturgeon and sea turtles by reducing prey species through the alteration of the existing biotic assemblages and habitat. Atlantic sturgeon or sea turtles are not likely to use any portions of the action area as foraging grounds (high vessel transit), and therefore, the alteration of the habitat as a result of sediment removal is not likely to remove critical amounts of prey resources for sturgeon or sea turtles. Therefore, there would not be any disruption of essential behaviors such as foraging.

Listed bird species may pass through and use areas adjacent to the dredging site; however, no adverse impacts are anticipated because they are highly mobile. Other species not mentioned but are listed would likely not be present as they are upland species and the Proposed Action's project sites are sub-tidal.

5.5.2 No-Action Alternative

Under the No-Action Alternative the Proposed Action would not occur; therefore, there would be no impacts to existing wildlife and aquatic biota.

5.6. SUBMERGED AQUATIC VEGETATION

5.6.1 Proposed Action

The Back River Navigation Channel project would result in localized, temporary impacts to existing resources in the dredging area and placement sites. The Virginia Institute of Marine Science (VIMS) submerged aquatic vegetation (SAV) data mapper has not identified SAV in the channel. The project is located in deepwater habitat. SAV resources are located within 300 feet of the channel toe in shallow water habitat. The quantity of required dredging from the channel that is adjacent to SAV is less than 10% of the total cubic yards that will be dredged from the entire channel. The dredged material from the channel that is in proximity to the SAV beds predominantly consists of sand, which settles faster than other fine grain material. Dredging of the channel would temporarily increase turbidity in the waters adjacent to dredging operations. As SAV is constrained by light attenuation, this project may have a limited but temporary effect on SAV beds in proximity to the channel due to suspended sediment. The effects of this suspension are expected to be temporary in nature and not likely to adversely affect SAV resources.

5.6.2 No Action Alternative

Under the No-Action Alternative the Proposed Action would not occur and therefore, submerged aquatic vegetation would not change as compared to current conditions.

5.7. GREENHOUSE GASES AND CLIMATE CHANGE

5.7.1 Proposed Action

With implementation of the Proposed Action, dredging and placement of the material at the NODS would result in short-term, temporary Greenhouse Gas Emissions (GHG) (i.e. carbon dioxide) emissions from operation of dredging equipment. However, this would not result in any measurable increase in regional GHG emissions. Consequently, implementation of the proposed action would result in a less than significant, short-term increase in GHG emissions.

In addition, the final CEQ guidance requires that NEPA-compliant analyses also consider the impacts of climate change effects on the Proposed Action (e.g. increasing sea level, drought, high intensity precipitation events, increased fire risk, or ecological change). Implementation of the Proposed Action would not increase risks to structures in that may be at risk of loss from sea level rise. Consequently, impacts to climate change with implementation of the Proposed Action would be less than significant.

5.7.2 No Action Alternative

Under the No-Action Alternative the Proposed Action would not occur and therefore, greenhouse gases and climate change would not change as compared to current conditions.

5.8. AIR QUALITY

5.8.1 Proposed Action

Air emissions due to the dredging and placement activities for this project will be minor and temporary. This project has been analyzed for conformity applicability pursuant to regulations implementing Section 176(c) of the Clean Air Act. The EPA has ruled that certain Federal actions, such as maintenance dredging and debris disposal are presumed to conform, have *de minimus* effects and therefore are exempt from the conformity requirement 40 CFR 93.153(c)(2)(ix). A Record of Non-Applicability (RONA) was prepared in April 2017 and is included with the FCD.

(Refer to Appendix B "Coastal Consistency Determination and Clean Air Act General Conformity Rule Record of Non-Applicability" for the RONA letter).

5.8.2 No-Action Alternative

Under the No-Action Alternative the Proposed Action would not occur and therefore, air emissions would not change as compared to current conditions. Long-term minor adverse effects would be expected if Back River is not able to accommodate fuel barges to support operations on JBLE-Langley. If shoaling occurred to the point that fuel barges can no longer access the fuel pier at JBLE-Langley, fuel would be transported by truck, thereby increasing mobile source emissions.

5.9. NOISE

5.9.1 Proposed Action

The Proposed Action would result in minor, short term, local increases in noise production during dredging and dredge material placement. The noise would result from the use of dredging equipment within the channel and at the NODS. The dredging contract will require the use of properly installed and maintained mufflers, silencers, and the manufacturer-recommended sound suppressors on all plant, machinery, and equipment. Any impacts associated with the Proposed Action would cease with the completion of the project.

5.9.2 No-Action Alternative

Under the No-Action Alternative, the Proposed Action would not occur; therefore, there would be no noise impacts beyond those associated with the existing daily activities related to the channel and in the surrounding area.

5.10. TRANSPORTATION

5.10.1 Proposed Action

The Proposed Action would have negligible adverse impacts on traffic conditions in the area. The channel dredging and ocean placement sites are sub-tidal and accessible by boat. During dredging, movement of vessels may be restricted in the channel, but this impact will be temporary and cease when operations are complete. Increased depths and an improved turning basin area would have long-term positive impacts on transportation for vessels utilizing the channel and basin.

5.10.2 No-Action Alternative

Under the No-Action Alternative, the Proposed Action would not occur; therefore there would be no impact to the existing conditions. The ongoing shoaling would result in a continued reduction in operational depth of the channel and basin. If shoaling occurs to the extent that vessels are no longer able to utilize the channel and basin to access the fuel pier at JBLE-Langley, ground traffic would be adversely impacted. Fuel would be transported by truck, thereby significantly increasing ground traffic to deliver fuel to maintain operations.

5.11. RECREATIONAL AND COMMERCIAL USE OF WATERS

5.11.1 Proposed Action

During dredging and dredged material placement activities, movement of vessels may be restricted; however, the impact would be temporary, lasting only as long as the construction activities occur. The proposed dredging footprint transects five oyster leases and public clamming grounds and therefore will permanently impact these resources. According to the Virginia Administrative code "Regulation: Pertaining to Shellfish Management Areas Virginia Marine Resources Commission "Pertaining to Shellfish Management Areas" Regulation 4 VAC 20-560-10 ET. SEQ. Statutory Authority (approved by law) is, however, conferred on: 3. Construction and maintenance of Congressionally approved navigation or flood control projects undertaken by an authorized Federal agency." Therefore, no coordination is required for subaqueous beds that are depicted in the Back River Navigation channel.

5.11.2 No-Action Alternative

Under the No-Action Alternative, the Proposed Action would not occur; therefore, there would be no impacts to the existing recreational and commercial use of waters. The ongoing shoaling would result in a continued reduction in operational depth of the channel and basin. Eventually, the shoaled conditions would eliminate the benefits of the waterway as the channel and basin reach hydrodynamic equilibrium and the shoaling would become a hazard to safe navigation and human health and safety.

5.12. HUMAN HEALTH AND SAFETY

5.12.1 Proposed Action

No human health or safety hazards would be introduced into the project sites as a result of the Proposed Action. Dredging the Back River Navigation Channel project to operational depths would maintain safe navigation and reduce risks to human health and safety that could occur if the current shoaling continues.

5.12.2 No-Action Alternative

Under the No-Action Alternative, the Proposed Action would not occur; therefore, there would be no impacts to the existing conditions. The ongoing shoaling would result in a continued reduction in operational depth of the channel and basin. Eventually, the channel and basin would reach hydrodynamic equilibrium and the shoaling would become a hazard to safe navigation and human health and safety.

6. CUMULATIVE IMPACTS

Cumulative impacts on environmental resources result from incremental impacts of Proposed Actions when combined with other past, present, and reasonably foreseeable projects in an affected area. Cumulative impacts can result from minor, but collectively substantial, actions undertaken over a period of time by various agencies (e.g., federal, state, or local) or persons. In accordance with the various agencies (e.g. federal, state, or local) or persons. In accordance with the NEPA, a discussion of cumulative impacts resulting from projects proposed, under construction, recently completed, or anticipated to be implemented in the near future is required.

6.1 APPROACH TO CUMULATIVE IMPACTS ANALYSIS

Per CEQ guidelines for considering cumulative effects under NEPA, this cumulative impact analysis includes three primary considerations to:

1. Determine the scope of the cumulative analysis, including relevant resources, geographic extent, and timeframe;
2. Conduct the cumulative effects analysis; and
3. Determine the cumulative impacts to relevant resources.

6.1.2 Scope of Cumulative Impacts Analysis

Implementation of the Proposed Action would include the maintenance and new work dredging of the Back River Navigation Channel and the placement of dredged material at the NODS.

6.1.3 Cumulative Projects

CEQ guidelines require that potential cumulative impacts be considered over a specified time period (i.e., from past through future). The appropriate time for considering past, present, and reasonably foreseeable future projects can be the design life of a project, or future timeframes used in local master plans and other available predictive data. Determining the timeframe for cumulative impacts analysis requires estimating the length of time the impacts of a Proposed Action would last and considering the length of time the impacts of a Proposed Action would last and considering the specific resource in terms of its history of degradation. The cumulative impacts analysis presented herein is not bound by a specific future timeframe. Per CEQ guidelines, in order to assess the influence of a given action, a cumulative impact analyses should be conducted using existing, readily available data and the scope of the cumulative impact analysis should be defined, in part, by data availability. Consequently, only past projects or reasonably foreseeable future projects with the potential to contribute to cumulative impacts of the Proposed Action or its alternatives have been evaluated in this section. While the cumulative impacts analysis is not limited by a specific timeframe, it should be recognized that available information, uncertainties, and other practical constraints limit the ability to analyze cumulative impacts for the indefinite future. Consequently, future actions that are speculative are not considered in this EA.

The Proposed Action would involve maintenance and new work dredging of the Back River Federal Navigation Channel and placement of the material at the NODS. Dredging and placement activities would be consistent with USACE regulations and standards, and would obtain all appropriate permits and concurrences prior starting any dredging activities. The Back River Navigation Channel dredged material will be transported to the NODS site for the purpose of ocean disposal in accordance with Section 103 of the Marine Protection, Research, and Sanctuaries Act (MPRSA). The USACE has MPRSA Section 103 permitting authority for the transport of dredged material for ocean disposal. MPRSA requires USEPA concurrence that the dredged material is suitable and complies with the limiting permissible concentration criteria. The Back River Federal

Navigation Channel project received USEPA Section 103 MPRSA concurrence on 30 August 2016. The USEPA concurrence is valid through 30 August 2019. Currently the site is designated to receive new work and maintenance dredge material from Norfolk Harbor and the lower Chesapeake Bay. This site is authorized to receive appropriate dredge material from the Thimble Shoals, Cape Henry, Atlantic, Hampton Roads, and York Spit Federal navigation channels. An EIS, titled: "Final Environmental Impact Statement for the Designation of an Ocean Dredged Material Disposal Site Located Offshore Norfolk Virginia" was finalized in March of 1993.

Management of the NODS and dredged material placement operations at NODS are conducted in accordance with the Site Management and Monitoring Plan (SMMP). The SMMP for the NODS site establishes specific requirements for use of the site. The SMMP provides that only dredged material that has been evaluated in accordance the Marine Protection, Research, and Sanctuaries Act (MPRSA) Section 103 regulations may be placed at the site. The SMMP does not specify specific methods of placement, but does require that dredged material be evenly distributed to prevent unacceptable mounding and becoming a hazard to navigation. While several Federal actions have been designated to place material at the NODS, none of these Federal actions will happen concurrently with the Proposed Action. Therefore, none of these Federal Actions would be anticipated to affect or otherwise interact with the Proposed Action. Further, no proposed shoreline projects that would interfere with or directly affect the Proposed Action area are anticipated within the foreseeable future. Environmental effects identified in the analysis do not support a conclusion that there would be significant cumulative impacts as a result of dredging the Back River Federal Navigation Channel or placement at the NODS. Cumulative impacts would therefore be less than significant.

7. CONCLUSIONS

The Norfolk District USACE has prepared this NEPA documentation for the Proposed Action of dredging operations in the Back River Navigation Channel located between Poquoson and Hampton, Virginia. The purpose of this project is to allow for safe navigation between the JBLE-Langley fuel pier and the Chesapeake Bay. The Back River Navigation Channel would be dredged to a maximum depth of -15 feet MLLW, which is necessary to be able to support the vessels that barge in the fuel. The -15 feet MLLW is also the authorized depth for the fuel pier's berthing area and turning basin. Dredging would be performed mechanically to remove the material in the dredging footprint. Dredged material would be transported to the NODS for ocean disposal.

The Proposed Action needs to be completed to efficiently provide fuel to the 1st Fighter Wing. Reduced or discontinued maintenance dredging would eventually result in the continued reduction in operational depth which would adversely impact the JBLE-Langley 1st Fighter Wing operations and missions.

Short-term adverse impacts associated with the Proposed Action include localized impacts to the benthic environment at the dredging and placement sites. Temporary, localized adverse impacts to water quality, utilities, air emissions, noise, and benthos would occur at the dredging and placement sites. Long-term impacts to soils and bathymetry, typical for a dredging project, would be expected as a result of the Proposed Action. Additionally, long-term impacts will occur to five oyster leases in the proposed channel's dredging footprint.

Long-term positive impacts to human health and safety and recreational and commercial use of the water could also be anticipated as the dredging operations will allow for safe navigation of the Back River Federal Navigation Channel.

The Proposed Action requires coordination with Federal, state, and local agencies for the discharge of dredged material. Any required authorizations would be obtained prior to the start of construction.

This Environmental Assessment was prepared by the Norfolk District USACE in compliance with the NEPA and all applicable implementing regulations. Based on the evaluation of environmental impacts described in Section 5 and summarized in Table 5.1, no significant impacts would be expected from the Proposed Action; therefore, an Environmental Impact Statement will not be prepared and a Finding of No Significant Impact (FONSI) and FONPA will be prepared and signed.

8. CONTACT INFORMATION

If you have any questions or wish to provide comments, please contact Shannon Reinheimer of the U.S. Army Corps of Engineers, Norfolk District, at shannon.j.reinheimer@usace.army.mil or 757-201-7074.

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U.S. Army Corps of Engineers (USACE). 2001. *Monitoring of Boston Harbor confined aquatic disposal cells.* Compiled by L.Z. Hales, ACOE Coastal and Hydraulics Laboratory. ERDC/CHL TR-01-27.

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U.S. Fish and Wildlife Service Information, Planning, and Conservation System (IPaC) search March 28, 2017 http://ecos.fws.gov/ipac/wizard/chooseLocation!prepare.action

U.S. Fish and Wildlife Service National Wetlands Inventory search September 14, 2017 http://www.fws.gov/wetlands/Data/Mapper.html

U.S.G.S. Water Resources Water Data search September, 27 2017 https://nwis.waterdata.usgs.gov/va/nwis/uv?cb_00010=on&cb_63680=on&format=gif_stats&site_no=0167891721&period=&begin_date=2017-06-01&end_date=2017-06-30

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Virginia Department of Historic Resources Virginia Cultural Resource Information System (V-CRIS) search March 16, 2017 https://vcris.dhr.virginia.gov/vcris/

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William and Mary Virginia Institute of Marine Science SAV in Chesapeake Bay and Coastal Bays search January 31, 2017 http://web.vims.edu/bio/sav/maps.html

11. COMMENTS RECEIVED ON DRAFT ENVIRONMENTAL ASSESSMENT

This section will be updated after the 30-day comment period has closed.

10. REFERENCES

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>
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William and Mary Virginia Institute of Marine Science SAV in Chesapeake Bay and Coastal Bays search January 31, 2017 http://web.vims.edu/bio/sav/maps.html

11. COMMENTS RECEIVED ON DRAFT ENVIRONMENTAL ASSESSMENT

This section will be updated after the 30-day comment period has closed.

APPENDIX A

Agency Coordination

From:	LaBudde, Gregory (DHR)
To:	Reinheimer, Shannon J CIV USARMY CENAO (US)
Subject:	[Non-DoD Source] Back River Navigation Channel (DHR File No. 2017-3320) | e-Mail #02996
Date:	Tuesday, April 18, 2017 11:55:50 AM

Dear Ms. Reinheimer:

The Department of Historic Resources (DHR) has received through our ePIX system the Back River Navigation Channel project (DHR File No. 2017-3320) for our review and comment. Our comments are provided to the U.S. Army Corps of Engineers (Corps) as assistance in meeting its responsibilities under Section 106 of the National Historic Preservation Act. Based on the information provided, it is DHR's opinion that no historic properties will be affected by the undertaking.

Implementation of the undertaking in accordance with the finding of no historic properties affected as documented fulfills the federal agency's responsibilities under Section 106 of the National Historic Preservation Act. If for any reason the undertaking is not or cannot be conducted as proposed in the finding, consultation under Section 106 must be reopened.

Please note that all ePIX applications should include a completed copy of the Corps' VDHR Coordination Form and the Joint Permit Application. The Norfolk District Standard Operating Procedures

for Section 106 Coordination with the Virginia Department of Historic Resources, revised in March 2017, provides additional information about Section 106 coordination with DHR.

Thank you for your consideration of historic resources. Please contact me if you have any questions or if we may provide any further assistance.

Sincerely,

Greg LaBudde, Archaeologist

Review and Compliance Division

Department of Historic Resources

2801 Kensington Avenue

Richmond, VA 23221

phone: 804-482-6103

fax: 804-367-2391

gregory.labudde@dhr.virginia.gov <mailto:roger.kirchen@dhr.virginia.gov>

Nadal, Teresita I CIV USARMY CENAO (US)

From:	MCDAID, CHRISTOPHER L GS-12 USAF 733 MSG 733 MISSION SUPPORT GP/JB L-E <christopher.mcdaid@us.af.mil>
Sent:	Friday, July 07, 2017 1:13 PM
To:	JENNINGS, DAVID M GS-12 USAF ACC 633 CES/CEIE
Subject:	FW: [Non-DoD Source] Back River Dredging
Attachments:	Back River Dredging.pdf

Dave,
The response from the Delaware Tribe.
The also asked " Can the dredging material from the back River Dredging be used to help with the erosion at the burial site?"

The site referred to is one here at Eustis with human remains that is subject to erosion. As the EA process goes forward could that issue be addressed?
Thanks
McD

Dr. Christopher L. McDaid
Archaeologist
Cultural Resources Manager
Environmental Element
Civil Engineer Division
733d Mission Support Group
Joint Base Langley-Eustis (Eustis)
(757) 878-7365
EMAIL ADDRESS: christopher.l.mcdaid.civ@mail.mil

Our Facebook page:
http://www.facebook.com/pages/Fort-Eustis-Cultural-Resources-Management/514907211887936?ref=hl

-----Original Message-----
From: Eastern Historic Preservation [mailto:temple@delawaretribe.org]
Sent: Monday, July 03, 2017 11:11 AM
To: McDaid, Christopher L CIV USAF 733 MSG (US) <christopher.l.mcdaid.civ@mail.mil>
Subject: [Non-DoD Source] Back River Dredging

Chris,
Please see the attached document.
Susan Bachor
Delaware Tribe Historic Preservation Representative P.O. Box 64 Pocono Lake, PA 18347 sbachor@delawaretribe.org

Delaware Tribe Historic Preservation Representatives
P.O. Box 64
Pocono Lake, PA 18347
sbachor@delawaretribe.org

July 3, 2017

Department of the Air Force
Joint Base Langley-Eustis
Headquarters, 633d Air Base Wing
Ft. Eustis, VA 23604

Re: **Maintenance Dredging Back River Navigational Channel**

Dr. McDaid:

Thank you for informing the Delaware Tribe of this proposed project. We are committed to protecting historic sites important to our tribal heritage, culture, and religion. We have no objection to the maintenance dredging as it should only be removing recent sedimentation. If the project changes and dredging occurs in an area that has not already been disturbed we would like to be notified.

If you have any questions, feel free to contact me by phone at (610) 761-7452 or by e-mail at sbachor@delawaretribe.org.

Sincerely,

Susan Bachor
Delaware Tribe Historic Preservation Representative

Nadal, Teresita I CIV USARMY CENAO (US)

From:	MCDAID, CHRISTOPHER L GS-12 USAF 733 MSG 733 MISSION SUPPORT GP/JB L-E <christopher.mcdaid@us.af.mil>
Sent:	Friday, July 07, 2017 1:10 PM
To:	JENNINGS, DAVID M GS-12 USAF ACC 633 CES/CEIE
Subject:	FW: [Non-DoD Source] RE: Back River Navigation Channel/ Langley Air Base/ Joint Base Langley-Eustis/ Virginia

Dave,
Response from the Delaware Nation

Dr. Christopher L. McDaid
Archaeologist
Cultural Resources Manager
Environmental Element
Civil Engineer Division
733d Mission Support Group
Joint Base Langley-Eustis (Eustis)
(757) 878-7365
EMAIL ADDRESS: christopher.l.mcdaid.civ@mail.mil

Our Facebook page:
http://www.facebook.com/pages/Fort-Eustis-Cultural-Resources-Management/514907211887936?ref=hl

-----Original Message-----
From: Kimberly Penrod [mailto:kpenrod@delawarenation.com]
Sent: Thursday, June 29, 2017 10:25 AM
To: McDaid, Christopher L CIV USAF 733 MSG (US) <christopher.l.mcdaid.civ@mail.mil>
Cc: Kimberly Penrod <kpenrod@delawarenation.com>
Subject: [Non-DoD Source] RE: Back River Navigation Channel/ Langley Air Base/ Joint Base Langley-Eustis/ Virginia

____

Dr. McDaid,

Yes, please keep us informed of the progress on this project.

The protection of our tribal cultural resources and tribal trust resources will take all of us working together.

We look forward to working with you and your agency.

With the information you have submittedwe can concur at present with this proposed plan.

As with any new project, we never know what may come to light until work begins.

The Delaware Nation asks that you keep us up to date on the progress of this project and

if any discoveries arise please contact us immediately.

If you need anything additional from me please do not hesitate to contact me.

Respectfully,

Kim Penrod

Delaware Nation

Director, Cultural Resources/106

Archives, Library and Museum

31064 State Highway 281

PO Box 825

Anadarko, OK 73005

(405)-247-2448 Ext. 1403 Office

(405)-924-9485 Cell

kpenrod@delawarenation.com < Caution-mailto:kpenrod@delawarenation.com >

Nadal, Teresita I CIV USARMY CENAO (US)

From: Reinheimer, Shannon J CIV USARMY CENAO (US)
Sent: Wednesday, September 27, 2017 2:56 PM
To: Nadal, Teresita I CIV USARMY CENAO (US)
Subject: FW: Langley Tribal Responses

-----Original Message-----
From: Reinheimer, Shannon J CIV USARMY CENAO (US)
Sent: Wednesday, July 12, 2017 2:50 PM
To: 'JENNINGS, DAVID M GS-12 USAF ACC 633 CES/CEIE' <david.jennings.4@us.af.mil>
Cc: Nadal, Teresita I CIV USARMY CENAO (US) <Teresita.I.Nadal@usace.army.mil>
Subject: RE: Langley Tribal Responses

Dave,

Teri and I checked on this suggestion from the Delaware Tribe. After looking through the sediment characterization, the material we will be dredging from Back River Channel is predominantly fine-grained material, silts, and clays that are not suitable for erosion control. That type of project would require coarse and heavy material.

Please let me know if you need additional information.

Thanks!
Shannon

-----Original Message-----
From: Reinheimer, Shannon J CIV USARMY CENAO (US)
Sent: Friday, July 07, 2017 3:59 PM
To: 'JENNINGS, DAVID M GS-12 USAF ACC 633 CES/CEIE' <david.jennings.4@us.af.mil>
Cc: Nadal, Teresita I CIV USARMY CENAO (US) <Teresita.I.Nadal@usace.army.mil>
Subject: RE: Langley Tribal Responses

Dave,

That is an interesting suggestion. I will look into this, Teri likely knows more. I believe, but could be wrong, their suggestion would be considered a beneficial use. In order to be used as beneficial use, it must meet additional qualifications for material type. Depending on whether or not it would be considered beneficial use, would determine if the material from Back River could potentially be used. If it is and doesn't qualify, it might be worth considering for other projects that have the specific material type.

Thanks!
Shannon

-----Original Message-----
From: JENNINGS, DAVID M GS-12 USAF ACC 633 CES/CEIE [mailto:david.jennings.4@us.af.mil]
Sent: Friday, July 07, 2017 2:42 PM
To: Reinheimer, Shannon J CIV USARMY CENAO (US) <Shannon.J.Reinheimer@usace.army.mil>
Subject: Langley Tribal Responses

Shannon,
Hey, we've got a couple tribal responses, one from the Delaware Tribe and the other from the Delaware Nation. Still some others to go, but it's a start.

Interesting suggestion from the Delaware Tribe. Ft Eustis has an issue with erosion at a burial site - believe on Mulberry Island. The Tribe asks if dredge material from this project can be used to protect the burial site. I don't believe it would be practical for this project, given the lead time for studies and permitting that would be needed, along with the fact that distance by barge from Langley to Eustis looks to be close to that from Langley to the NODS.

It begs the question, though, would the Corps be interested in using Eustis as a site for dredge disposal? I don't know that it's practical, and if it is I don't know that the Air Force and the Army would go along with it. I'm certainly not in a position to offer it up, but it's a question worth asking. It could be good for the Corps and get us some points with the tribes. A two-fer!

Dave

David Jennings
Environmental Engineer
633 CES / CEIE
37 Sweeney Blvd
Langley AFB, VA 23665
Phone Number: 757-225-4223
DSN: 575-4223
Cell Phone: 757-846-3698

Elizabeth G. Waring
Chief, Operations Branch
Norfolk District, US Army Corps of Engineers
803 Front Street
Norfolk VA 23510

January , 2015

Dear Ms. Waring:

I lease oyster grounds designated as lease number 19755 / plat number 20452 as shown by and in the records of the Virginia Marine Resources Commission (VMRC) in the vicinity of the Defense Logistics Agency's (DLA) existing fuel pier on Joint Base Langley-Eustis-Langley, Hampton, Virginia. I understand that the U.S. Army Corps of Engineers plans to conduct new work dredging and construction for the replacement of the existing fuel pier, and will conduct future maintenance dredging in Back River in connection with the DLA fuel pier's construction and maintenance.

As long as no construction activities or avoidable adverse impacts occur in the area on the enclosed map specifically highlighted in orange (labeled Oyster Rock Location), I have no objections to the construction activities associated with the DLA Fuel Pier Replacement Project occurring within the yellow highlighted area (labeled Project Area). Therefore, I for myself, my heirs, successors and assigns do hereby release my rights to the Project Area that falls within my lease number 19755 / plat number 20452 and discharge the United States of America, its agents, employees and contractors from any and all claims for damages, of whatever nature, which may result from the DLA Fuel Pier Project, including all associated future maintenance dredging.

Please contact me if there are any changes to the project and associated drawings that may affect my leased grounds.

Thank you,

Anthony Martin

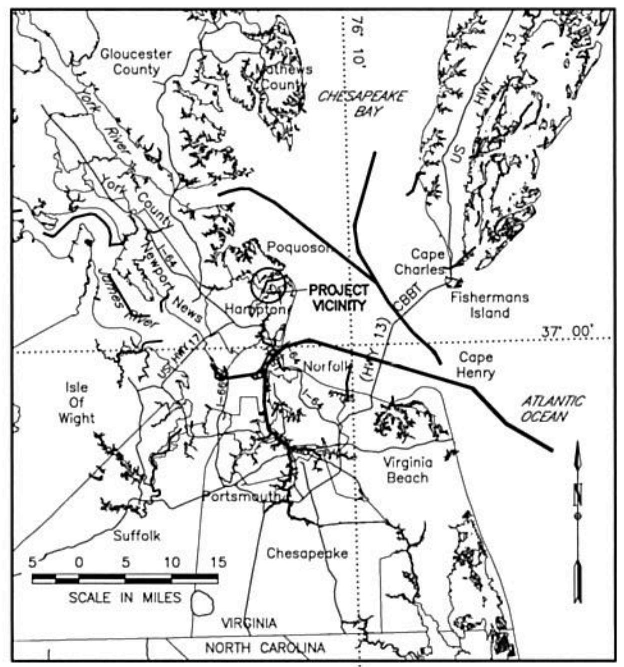
Anthony Martin
VMRC Lease Holder
19755 / Plat Number 20452

Received
2-9-2015

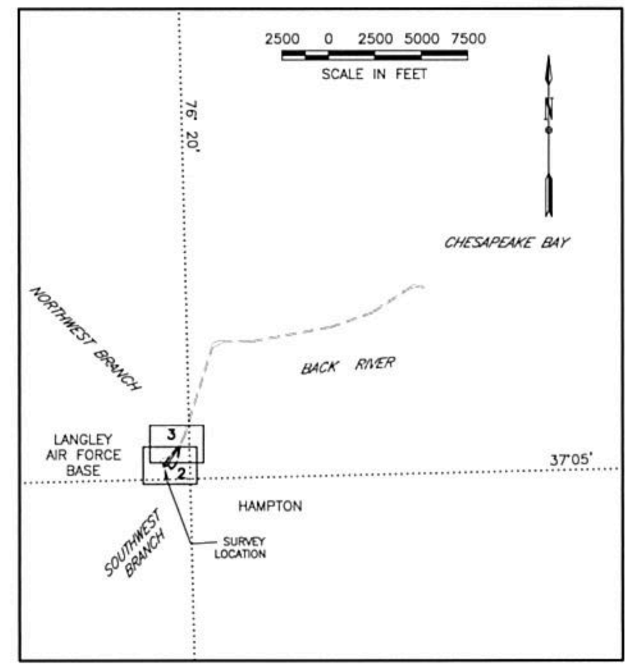
LANGLEY AIR FORCE BASE
FUEL PIER CHANNEL
PLANS FOR DREDGING
SURVEY OF OCTOBER 2014
HAMPTON, VIRGINIA

DRAFT COPY
SUBJECT TO REVISION

COORDINATES OF CENTERLINE STATIONS		
STATION	EAST(X)	NORTH(Y)
0+00.0	12,113,238.54	3,562,036.16
2+34.2	12,113,465.06	3,562,095.68
7+37.3	12,113,874.50	3,562,388.07
13+50.1	12,114,268.31	3,562,857.52
19+92.6	12,114,545.05	3,563,437.33
71+84.3	12,116,116.07	3,568,385.64
74+98.2	12,116,397.53	3,568,524.71
92+88.3	12,118,187.56	3,568,534.69
136+56.6	12,122,485.64	3,569,314.65
159+86.0	12,124,687.68	3,570,074.62
186+59.9	12,126,927.71	3,571,534.59
192+77.5	12,127,536.28	3,571,429.29



VICINITY MAP



LOCATION MAP

MEAN LOWER LOW WATER (MLLW), National Tidal Datum Epoch (NTDE) 1960–1978, was determined by the National Ocean Service (NOS) at Messick Point, Back River.

SOUNDINGS are in feet referred to NOS MLLW and were taken on 30 April, and 1 and 6 May 2013 and 8 October 2014.

MEAN RANGE OF TIDE is 2.30 feet at Messick Point, Back River, based on NOS observations, NTDE 1960–1978.

PLANIMETRIC FEATURES were provided by Langley Air Force Base and GIS data sources.

COORDINATES are referred to the Virginia State Plane Coordinate System, South Zone in U.S. survey feet, and are based on the North American Datum of 1983.

LAST DREDGED by Cottrell Contracting Corporation during the period 9 April through 25 May 2002 under Contract No. DACW65-01-C-0068 dated 15 October 2001.

– QUANTITY ESTIMATE –

LOCATION	TO 7 FEET (Required)	1 FOOT OVERDEPTH (Allowable)	TOTAL
STATION TO STATION	CUBIC YARDS, PLACE MEASUREMENT		
0+00 to 22+04 (60' Width)	16,400	6,100	22,500
22+04 to 37+93 (Width Varies)	23,400	7,300	30,700
Estimated Accretion to March 2015	1,800	200	2,000
• TOTAL •	41,600	13,600	55,200

VICINITY MAP

– LEGEND –

Dashed lines	INDICATES LIMITS OF CHANNEL TOE
Dashed line	OYSTER BAYLOR GROUNDS
Solid line with long dashes	OYSTER LEASE GROUNDS
Hatched area	DREDGING AREA

INDEX TO DRAWINGS

SHEET NO.	TITLE	FILE NUMBER
1	TITLE SHEET	LFP.SP(1)
2	MAPPING SHEET	LFP.SP(2)

The information depicted on this map represents the results of surveys made on the date(s) indicated and can only be considered as indicating the general conditions existing at that time.

SIGNATURES AFFIXED BELOW INDICATE OFFICIAL RECOMMENDATION AND APPROVAL OF ALL DRAWINGS IN THIS SET AS INDICATED ON INDEX TO DRAWINGS.

DEPARTMENT OF THE ARMY
NORFOLK DISTRICT, CORPS OF ENGINEERS
NORFOLK, VIRGINIA

REVIEWED: CHIEF, NAVIGATION SUPPORT AND SURVEY SECTION
APPROVED: CHIEF, OPERATIONS BRANCH
SUBMITTED: CHIEF, DESIGN SECTION
APPROVED: CHIEF, WATER RESOURCES DIVISION

US Army Corps of Engineers
Norfolk District

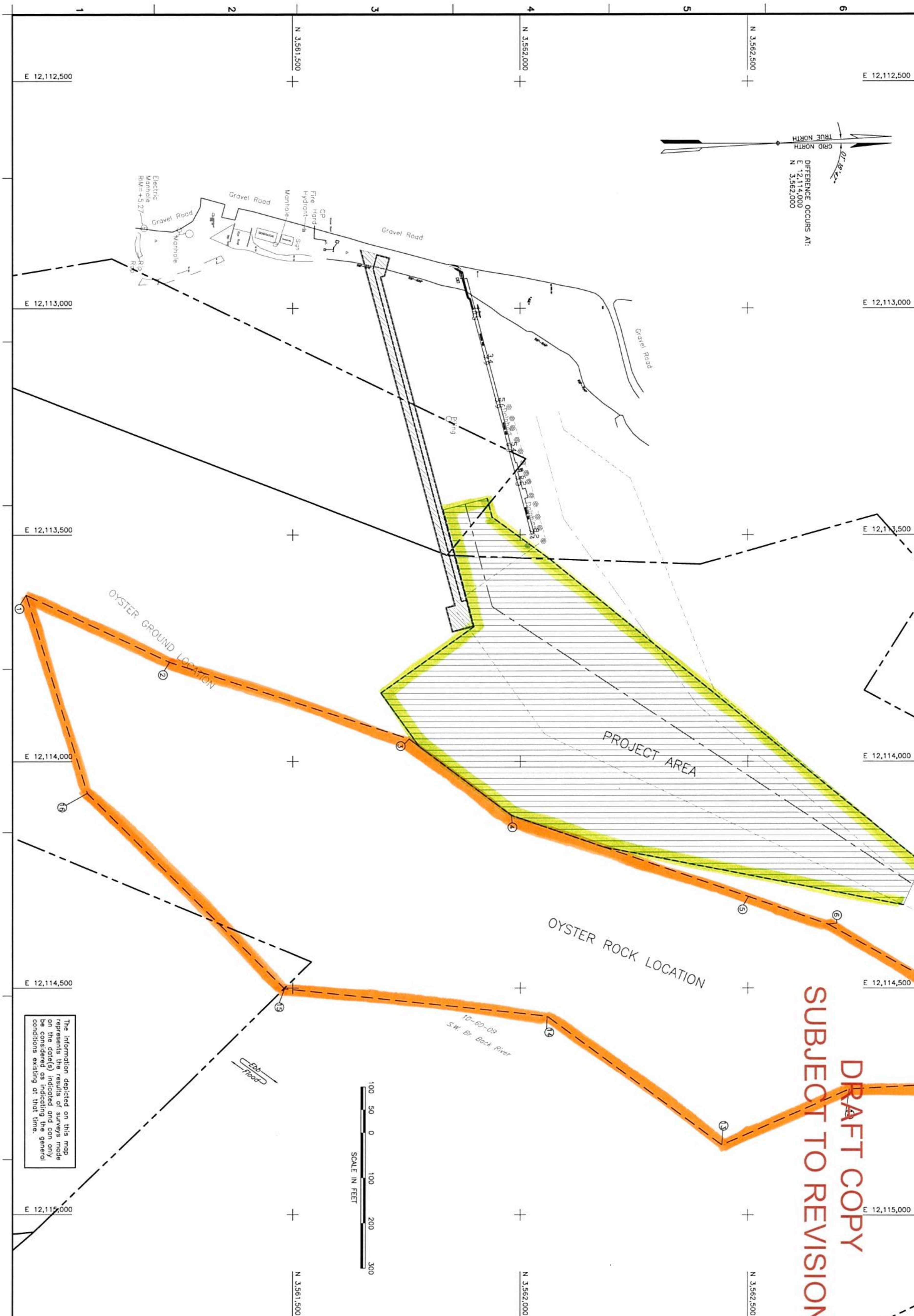
REV.	DATE	DESCRIPTION	BY	APP.

NORFOLK DISTRICT
CORPS OF ENGINEERS
NORFOLK, VIRGINIA

DESIGNED: P.J. CHECKED: R.W.S. DATE: 15 JAN 15
DRAWN: P.J. SUBMITTED: M.L.A. SCALE: AS SHOWN
NORFOLK DISTRICT FILE NO.: LBR.2014-10-08.PS (1)
DRAWING NO.:
SURVEYED BY: M.A.W.

LANGLEY AIR FORCE BASE
FUEL PIER CHANNEL
PLANS FOR DREDGING
SURVEY OF OCTOBER 2014
HAMPTON, VIRGINIA

SHEET 1 OF 3



SHEET 2 OF 3

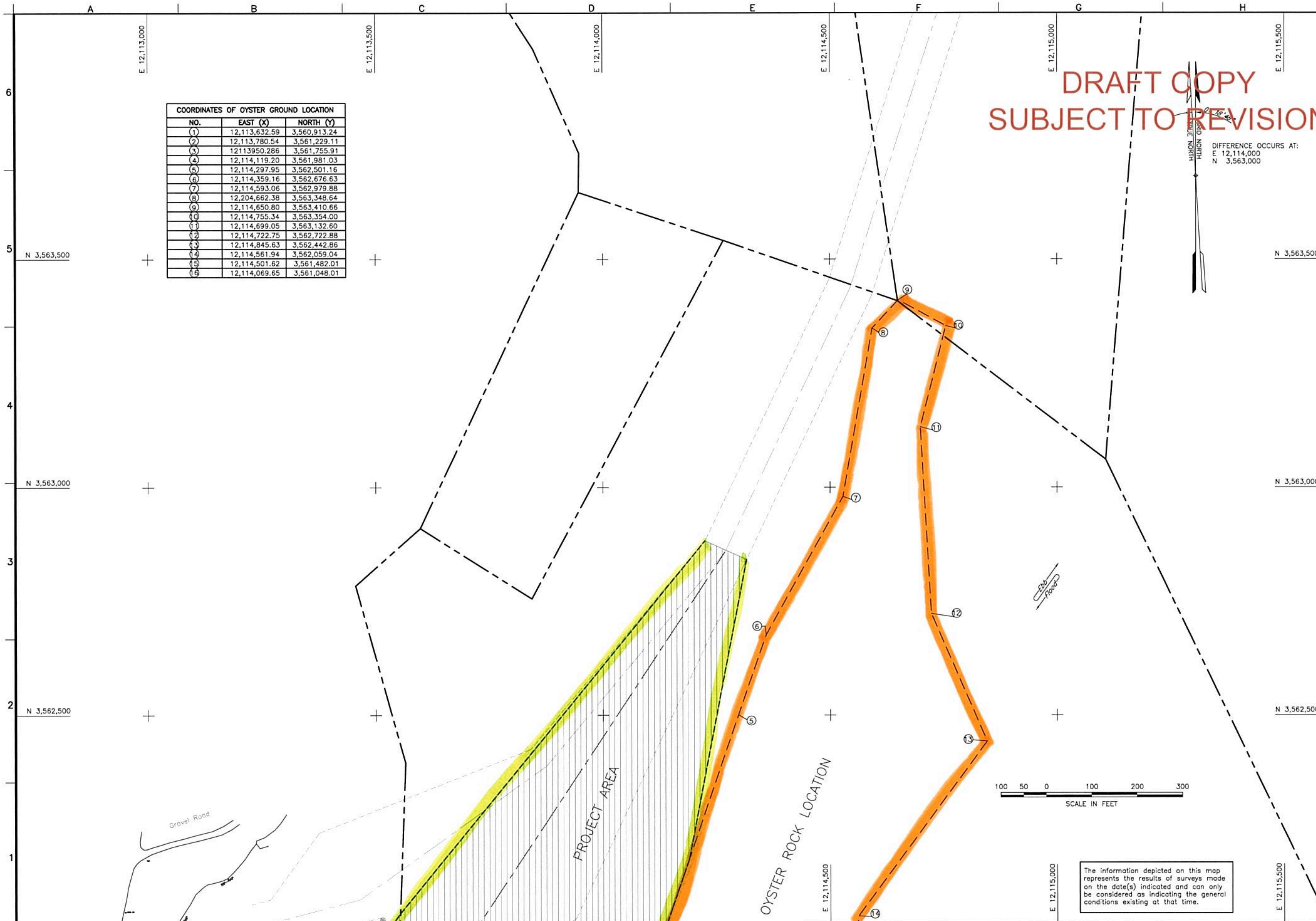
LANGLEY AIR FORCE BASE
FUEL PIER CHANNEL
PLANS FOR DREDGING
SURVEY OF OCTOBER 2014
HAMPTON, VIRGINIA

NORFOLK DISTRICT
CORPS OF ENGINEERS
NORFOLK, VIRGINIA

DESIGNED:	CHECKED: R.W.S.	DATE: 15 JAN 15
DRAWN: P.J.	SUBMITTED: M.L.A.	SCALE: AS SHOWN
NORFOLK DISTRICT FILE NO.: LBR.2014-10-08.PS (2)		
DRAWING NO.:		
SURVEYED BY: M.A.W.		

REV.	DATE	DESCRIPTION	BY	APP.

US Army Corps of Engineers
Norfolk District



COORDINATES OF OYSTER GROUND LOCATION		
NO.	EAST (X)	NORTH (Y)
1	12,113,632.59	3,560,913.24
2	12,113,780.54	3,561,229.11
3	12113950.286	3,561,755.91
4	12,114,119.20	3,561,981.03
5	12,114,297.95	3,562,501.16
6	12,114,359.16	3,562,676.63
7	12,114,593.06	3,562,979.88
8	12,204,662.38	3,563,348.64
9	12,114,650.80	3,563,410.66
10	12,114,755.34	3,563,354.00
11	12,114,699.05	3,563,132.60
12	12,114,722.75	3,562,722.88
13	12,114,845.63	3,562,442.86
14	12,114,561.94	3,562,059.04
15	12,114,501.62	3,561,482.01
16	12,114,069.65	3,561,048.01

The information depicted on this map represents the results of surveys made on the date(s) indicated and can only be considered as indicating the general conditions existing at that time.

US Army Corps of Engineers Norfolk District

REV.	DATE	DESCRIPTION	BY	APP.

NORFOLK DISTRICT CORPS OF ENGINEERS NORFOLK, VIRGINIA

DESIGNED: P.J. | CHECKED: R.W.S. | DATE: 15 JAN 15
DRAWN: P.J. | SUBMITTED: M.L.A. | SCALE: AS SHOWN
NORFOLK DISTRICT FILE NO.: LBR.2014-10-08.PS (3)
DRAWING NO.:
SURVEYED BY: M.A.W.

LANGLEY AIR FORCE BASE
FUEL PIER CHANNEL
PLANS FOR DREDGING
SURVEY OF OCTOBER 2014
HAMPTON, VIRGINIA

SHEET 3 OF 3

Nadal, Teresita I CIV USARMY CENAO (US)

From: Stagg, Ben (MRC) <Ben.Stagg@mrc.virginia.gov>
Sent: Thursday, January 26, 2017 9:48 AM
To: Nadal, Teresita I CIV USARMY CENAO (US)
Cc: Lockwood, Keith B CIV USARMY CENAO (US)
Subject: [EXTERNAL] RE: Protest to Pending Oyster Lease Application (UNCLASSIFIED)

To all:

It is our policy to not lease Federal Project Channels. Any survey of this area will exclude the channel footprint.

Ben Stagg, LS
Chief Engineer, Western Area
Engineering/Surveying Department
VMRC
757-247-2225

-----Original Message-----
From: Nadal, Teresita I CIV USARMY CENAO (US) [mailto:Teresita.I.Nadal@usace.army.mil]
Sent: Thursday, January 26, 2017 9:45 AM
To: Stagg, Ben (MRC)
Cc: Lockwood, Keith B CIV USARMY CENAO (US)
Subject: Protest to Pending Oyster Lease Application (UNCLASSIFIED)
Importance: High

CLASSIFICATION: UNCLASSIFIED

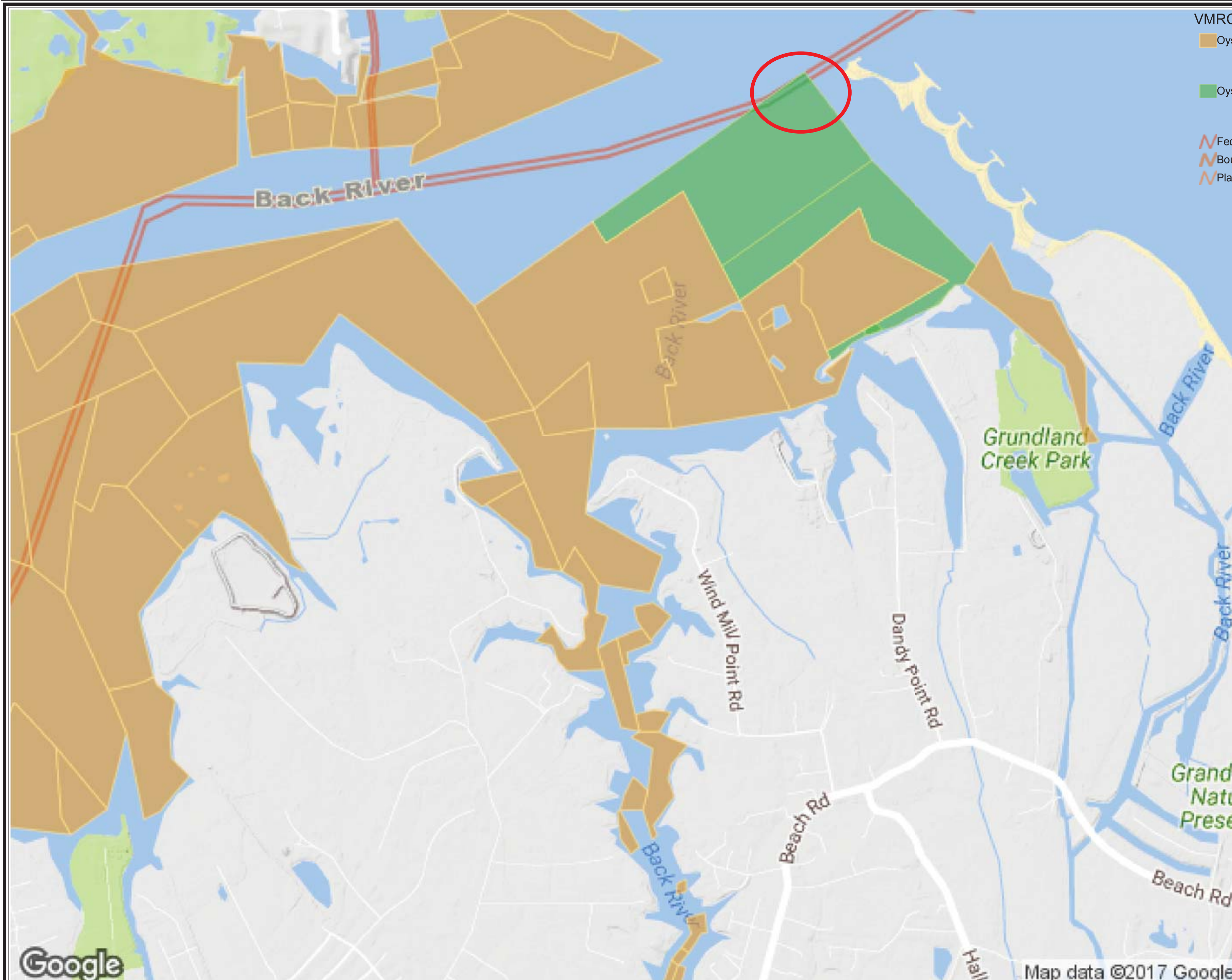
Ben,
The Norfolk District objects to the oyster lease application (pdf attached with proposed lease area circled in red) due to the conflicts with the Back River Federal Navigation Channel Project. It appears that the oyster lease application overlaps with the Back River Federal Navigation Channel.
The private oyster lease application must be at a distance of 100 feet from the Toe of the Channel.

Please let me know if you need further information from me, and if there will be a hearing for this application.

Thank you.

Teri

Teri Nadal
Ops Branch, Technical Support Section
U.S. Army Corps of Engineers
Norfolk District
(757) 201-7299
CLASSIFICATION: UNCLASSIFIED



VMRC Oyster Ground Leases

- Oyster Ground Leases
- Oyster Ground Applications
- Federal Navigation Projects
- Boundary or Other
- Placement Cell

0 200 400 600m

Date Printed: 01.26.2017

Map Scale: 1:27084.0

Developed By: Geospatial Section
USACE Norfolk District
Via CorpsMap:
https://corpsmap.usace.army.mil/nao
Email: geospatial@usace.army.mil

APPENDIX B

Coastal Consistency Determination (CCD) and

Clean Air Act (CAA) General Conformity Rule

DEPARTMENT OF THE ARMY
US ARMY CORPS OF ENGINEERS
NORFOLK DISTRICT
FORT NORFOLK
803 FRONT STREET
NORFOLK VA 23510-1011

September 27, 2017

Operations Branch

Ms. Bettina Sullivan
EIR Program Manager
Office of Environmental Impact Review
Virginia Department of Environmental Quality
629 East Main Street, 6th Floor
Richmond, VA 23219

Dear Ms. Sullivan:

I have enclosed the U.S. Army Corps of Engineers, Norfolk District's Federal Consistency Determination (FCD) for the Back River Navigation Channel, a Federally-maintained project supporting Joint Base Langley-Eustis-Langley (JBLE-Langley). The project includes maintenance and new work dredging of the Back River Navigation Channel with the transport and placement of the dredged material at the Norfolk Ocean Disposal Site (NODS). Approximately 205,000 cubic yards (CY) of material will be removed from the Back River Navigation Channel. Dredged material will be transported and placed overboard for ocean disposal at NODS.

The Norfolk District has determined that the proposed Federal agency action has minor anticipated effects on Virginia's coastal uses and resources and is consistent to the maximum extent practicable with the enforceable policies of Virginia's Coastal Resource Management Program.

Should you have any questions or require further information on this submittal, please contact Mrs. Teri Nadal of my staff at (757) 201-7299 or via email at teresita.i.nadal@usace.army.mil or. Thank you for your cooperation and assistance.

Sincerely,

Jason R. Flowers, P.E. for
Keith Lockwood

Keith B. Lockwood
Chief, Operations Branch

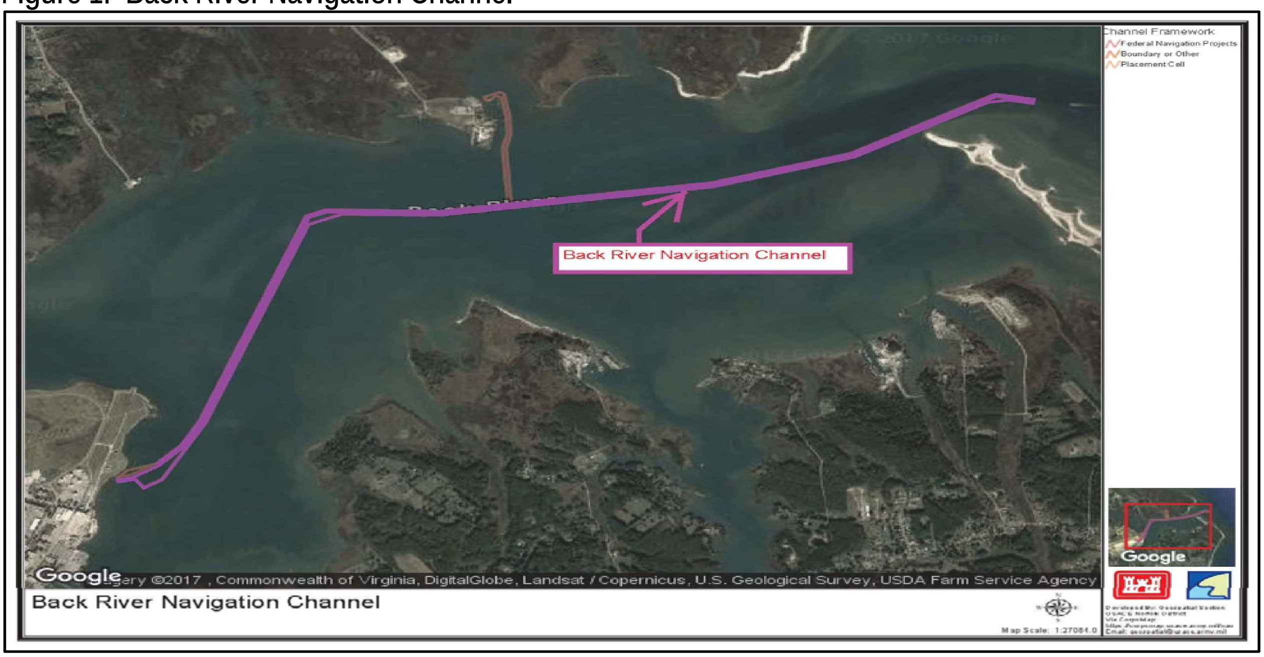
Coastal Zone Management Act (CZMA) Federal Consistency Determination
for Back River Navigation Channel, a Federally-maintained channel located in Back River at the
Joint Base Langley-Eustis-Langley (JBLE-Langley)
in Hampton, Virginia

On behalf of JBLE-Langley, this document provides the Commonwealth of Virginia with the U.S. Army Corps of Engineers (USACE), Norfolk District's Federal Consistency Determination (FCD) under CZMA section 307(c)(1) and 15 CFR Part 930, sub-part C, for the Back River Navigation Channel Dredging Project at the JBLE on Langley Air Force Basein Hampton, Virginia. The information in this FCD is provided pursuant to 15 CFR Section 930.39. This FCD is being submitted for coordination and concurrence from the Virginia Department of Environmental Quality (DEQ).

Proposed Federal Agency Activity

The proposed federal action is dredging of the Back River Navigation Channel with dredged material placement at Norfolk Ocean Disposal Site (NODS) located approximately 17-miles east of the mouth of the Chesapeake Bay in Federal waters of the Atlantic Ocean. Joint Base Langley-Eustis-Langley (JBLE-Langley) needs to perform maintenance and new work dredging of the Back River Navigation Channel to maintain safe navigation for its vessels (Figure 1). This channel provides access and safe navigation in support of national defense to the JBLE-Langley located in Hampton, Virginia from the Chesapeake Bay.

Figure 1. Back River Navigation Channel



Background

Established in 1917, JBLE-Langley is the oldest continuously active air force base in the United States. Located approximately 180 miles south of Washington, D.C. near the southern end of the lower Virginia Peninsula, the base is between the Northwest Branch and Southwest Branch of Back River, a tidal estuary of the Chesapeake Bay. JBLE-Langley covers approximately 2,883 acres and contains an airfield and support facilities, research and development facilities, testing facilities, fuel docking and storage facilities, ordnance housing, golf courses, and various recreational areas. JBLE-Langley is home to the 633d Air Base Wing, 1st Fighter Wing, 480th and 363d Intelligence, Surveillance, and Reconnaissance Wings, and the 192d Fighter Wing. The base also hosts the Global Cyberspace Integration Center field operating agency and Headquarters Air Combat Command. The base serves a large population made up of over 125,000 active duty, guard and reserve, family members, civilians, contractors, and retirees.

Back River an estuarine inlet of the Chesapeake Bay is located between the cities of Hampton and Poquoson, Virginia. The Back River Navigation Channel is approximately 19,500 feet in length with a surface area of 46 acres, 100 feet wide and -15 feet deep MLLW. The center of the project is located at latitude/longitude 37.10031 and -76.31950.

Scope of New Work and Maintenance Dredging

Dredging will be conducted mechanically (i.e. clamshell) to a maximum depth of -15 feet MLLW removing up to 205,000 cubic yards of (CY) material each dredging cycle, of which 35,000 CY is new work dredging for this cycle only. The new work dredging will occur within the approach to the newly constructed JBLE fuel pier.

The channel will be dredged by a mechanical dredge and placed onto ocean-going barges/scow for dredged material transport to the Norfolk Ocean Disposal Site (NODS) (Figure 2). Dredging is expected to commence in July/August 2018 and be completed within approximately 150 days to 180 days.

Norfolk Ocean Disposal Site (NODS)

The Back River Channel project dredged material will be transported to the NODS site for the purpose of ocean disposal in accordance with Section 103 of the Marine Protection, Research, and Sanctuaries Act (MPRSA). The USACE has MPRSA Section 103 permitting authority for the transport of dredged material for ocean disposal. MPRSA requires USEPA concurrence that the dredged material is suitable and complies with the limiting permissible concentration criteria. The Back River Channel project received USEPA Section 103 MPRSA concurrence on 30 August 2016. The USEPA concurrence is valid through 30 August 2019.

The center of the NODS is located 17 nautical miles east of the mouth of the Chesapeake Bay. The NODS is circular with a radius of four nautical miles and an area of approximately 50 square nautical miles. The center of the NODS site is located at latitude 36.98343 and longitude -75.64963. Water depths near the center of the site vary between 43 to 85 feet. Bottom topography is generally flat with depth contours running parallel to the coastline.

Currently the site is designated to receive new work and maintenance dredge material from Norfolk Harbor and the lower Chesapeake Bay. This site is authorized to receive appropriate dredge material from the Thimble Shoals, Cape Henry, Atlantic, Hampton Roads, and York Spit Federal navigation channels. An EIS, titled: “Final Environmental Impact Statement for the Designation of an Ocean Dredged Material Disposal Site Located Offshore Norfolk Virginia” was finalized in March of 1993.

Management of the NODS and dredged material placement operations at NODS are conducted in accordance with the Site Management and Monitoring Plan (SMMP). The SMMP for the NODS site establishes specific requirements for use of the site. The SMMP provides that only dredged material that has been evaluated in accordance the Marine Protection, Research, and Sanctuaries Act (MPRSA) Section 103 regulations may be placed at the site. The SMMP does not specify specific methods of placement, but does require that dredged material be evenly distributed to prevent unacceptable mounding and becoming a hazard to navigation. The management objective for the NODS area is to limit disposal quantities so as not exceed 1.3 billion cubic yards (BCY).

Figure 2. Norfolk Ocean Disposal Site (NODS)

Enforceable Policies

The Virginia Coastal Resources Management Program (VCP) contains the below enforceable policies (A-I).

A. Fisheries Management

This program stresses the conservation and enhancement of finfish and shellfish resources and the promotion of commercial and recreational fisheries to maximize food production and recreational opportunities. This program is administered by the Marine Resources Commission (VMRC) (Virginia Code §28.2-200 through §28.2-713) and the DGIF (Virginia Code §29.1-100 through §29.1-570).

The proposed activity will temporarily affect the use of the Back River Channel for commercial and recreational fishing. There will be temporary and localized increases in water column turbidity associated with dredging. Potential impacts to fisheries management will include temporary disturbance to feeding and localized movement patterns for species that may be within the project area.

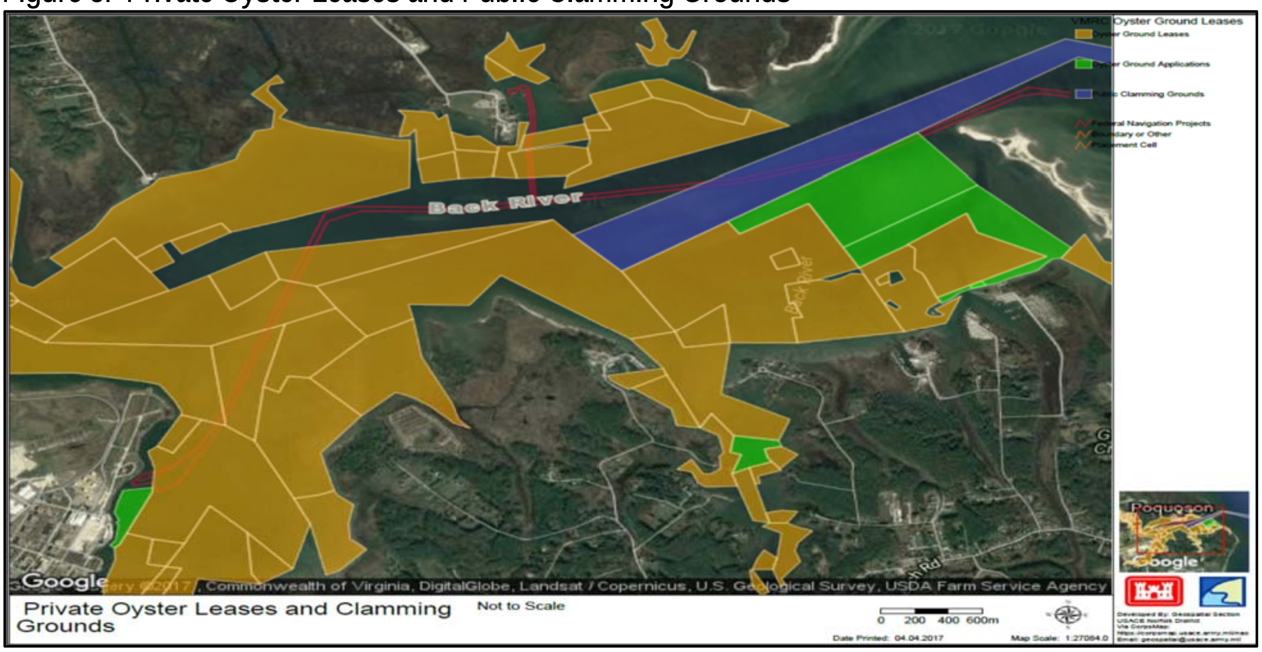
The proposed dredging area offers commercial and recreational fishing opportunities. However, segments of the channel have shoaled and silted. Restoring the dimensions of project will reestablish these opportunities. The project may improve marine and fisheries resources access for commercial and recreational interests by providing reliable navigable access in the channel.

Since the last dredging cycle in 2003, updated VMRC mapping indicates private oyster leases, pending private oyster leases, and public clamming grounds are located within the Back River Channel (Figure 3).

To resolve a potential issue for a pending private oyster lease within the channel, the Corps sent an email to protest the pending oyster lease. VMRC's response to USACE for the pending private oyster lease within the channel stated, "It is our policy to not lease Federal Project Channels. Any survey of this area will exclude the channel footprint."

According to the Constitution of Virginia, Article XI Subaqueous Guidelines, Section I (B) Authority Required for Use of Subaqueous Beds, "*Statutory Authority (approved by law) is, however, conferred on: 3. Construction and maintenance of Congressionally approved navigation or flood control projects undertaken by an authorized federal agency.*" Therefore, no further coordination is required for subaqueous beds located within the Back River Navigation Channel. Coordination with adjacent private oyster leaseholders and other agencies will be performed through Public Notice and agency reviews for NEPA, FCD, and the Joint Permit Application review process. The new work dredging area has been previously coordinated with the private oyster leaseholder.

Figure 3. Private Oyster Leases and Public Clamming Grounds



B. Subaqueous Lands Management

This management program for subaqueous lands establishes conditions for granting or denying permits to use state-owned bottomlands based on considerations of potential effects on marine and fisheries resources, wetlands, adjacent or nearby properties, anticipated public and private benefits, and water quality standards established by the Department of Environmental Quality, (DEQ) Water Division. The program is administered by the VMRC (Virginia Code §28.2-1200 through §28.2-1213).

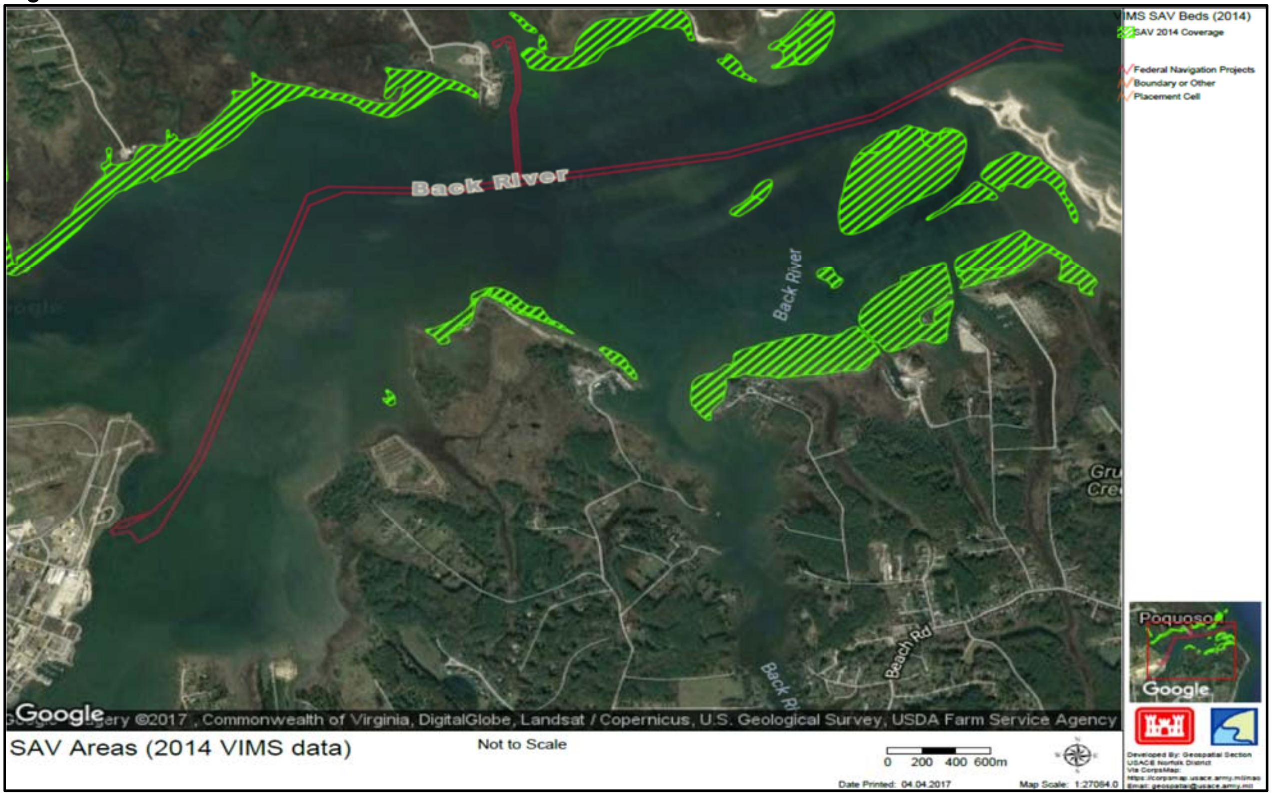
Back River Channel is a Federally-maintained navigation channel. Virginia code section 28.3-1203 prohibits use of State-owned lands unless the act is pursuant to a permit issued by the Commission unless the act is necessary for the following: Construction and maintenance of congressionally-approved navigation and flood control projects undertaken by the United State Army Corps of Engineers, United State Coast Guard, or other federal agency authorized by Congress to regulate navigation, navigable waters, or flood control. State-owned subaqueous lands will not be used for dredged material placement. Dredged material will be transported and placed at the NODS site under MPRSA Section 103 authority.

While USACE maintenance dredging is not regulated by the Commission and State-owned subaqueous lands are not proposed for placement of dredged material the following are resources identified in the Back River area. The Virginia Institute of Marine Science (VIMS) submerged aquatic vegetation (SAV) data mapper has not identified SAV in the channel. However, SAV is located adjacent to the project area (Figure 4). This figure shows the approximate location of SAV resources in 2014. SAVs such as eelgrass (Zostera marina) represent a distinct biotic component in shallow water habitat. Fish communities tend to be more abundant in SAV beds than in adjacent unvegetated areas. Many species of fish and shellfish use SAV for shelter and as a place to find food. The project is located in deepwater habitat. SAV resources are located within 300 feet of the channel toe in shallow water habitat. This area of the Back River Channel will require minimal dredging (approximately 7,000 cy of pay material, station 120+00 to 172+00 and 3,400 cy of pay material, station 80+00 to 120+00) and will likely only require approximately 5-days to complete. The sediments in these station ranges are predominantly sands that will not result in significant sediment re-suspension and we do not foresee impacts to SAV resources in that area. The majority of the dredging work will be required from the dog-leg in the channel (approximate station 80+00) to the fuel pier. There are no SAV resources in close proximity to this reach of the channel. The closest SAV are greater than 1,000-feet from these upstream portions of the channel.

The Back River Navigation Channel project would result in localized, temporary impacts to existing resources in the dredging area and placement sites. The Virginia Institute of Marine Science (VIMS) submerged aquatic vegetation (SAV) data mapper has not identified SAV in the channel. The project is located in deepwater habitat. SAV resources are located within 300 feet of the channel toe in shallow water habitat. The quantity of required dredging from the channel that is adjacent to SAV is less than 10% of the total cubic yards that will be dredged from the entire channel. The dredged material from the channel that is in proximity to the SAV beds predominantly consists of sand, which settles faster than other fine grain material. Dredging of the channel would temporarily increase turbidity in the waters adjacent to dredging operations. As SAV is constrained by light attenuation, this project may have a limited but temporary effect on SAV beds in proximity to the channel due to suspended sediment. The effects of this suspension are expected to be temporary in nature and not likely to adversely affect SAV resources.

Dredging of the channel to operational depths will maintain access and safe navigation, in support of national defense to the JBLE-Langley. The dredged material will be placed at the NODS which is within the territorial sea beyond state waters.

Figure 4. SAV Areas



C. Wetlands Management

The purpose of the wetlands management program is to preserve tidal and non-tidal wetlands, prevent their despoliation, and accommodate economic development in a manner consistent with wetlands preservation.

The USFWS National Wetlands Inventory (NWI) mapper has not identified any wetlands in the channel (Figure 5). Tidal estuarine emergent, non-tidal emergent, and palustrine forested wetlands can found within 1 mile of the project area adjacent to the Back River Navigation Channel and its tributaries. The Plum Tree National Wildlife Refuge (NWR) is located just north of the project area and consists of tidal and non-tidal wetlands. The Grandview Nature Preserve is located south of the project area and also consists of tidal and non-tidal wetlands. At the entrance of the channel (located north of the Grandview Nature Preserve) there is a tombolo and associated intertidal habitat within approximately 120 to 150 feet of the channel toe. The existing channel depth in this reach of the channel is greater than -15 feet MLLW. No other emergent wetland habitat is located in proximity to the project boundaries. Based on current information, no impacts to wetlands are anticipated.

Figure 5: NWI Map

D. Dunes Management

Dune protection is carried out pursuant to the Coastal Primary Sand Dune Protection Act and is intended to prevent destruction or alteration of primary dunes. This program is administered by the Marine Resources Commission (Virginia Code §28.2-1400 through §28.2-1420).

There are no sand dunes located in the project area; therefore, no impacts are anticipated.

E. Non-point Source Pollution Control

Virginia's Erosion and Sediment Control Law requires soil-disturbing projects to be designed to reduce soil erosion and to decrease inputs of chemical nutrients and sediments to the Chesapeake Bay, its tributaries, and other rivers and waters of the Commonwealth. This program is administered by DEQ (Virginia Code §62.1-44.15:51 et seq.).

Project activities will be marine based construction channelward of land areas with no upland soil disturbing activities that may result in soil erosion or require storm water management best management practices.

F. Point Source Pollution Control

The point source program is administered by the State Water Control Board (DEQ) pursuant to Virginia Code §62.1-44.15. Point source pollution control is accomplished through the implementation of the National Pollutant Discharge Elimination System permit program established pursuant to Section §402 of the federal Clean Water Act and administered in Virginia as the Virginia Pollutant Discharge Elimination System permit program. The Water Quality Certification requirements of §401 of the Clean Water Act of 1972 is administered under the Virginia Water Protection Permit program.

This project does not involve point source discharges subject to Section 402 of the Clean Water Act. Dredged material discharges are regulated under Section 404/401 of the Clean Water Act or Section 103 of the Marine Protection, Research, and Sanctuaries Act (MPRSA) and are exempt from NPDES regulations in accordance with 40 cfr 122.3. The transport of dredged material for the purpose of ocean disposal at NODS will be regulated under Section 103 of the MPRSA consistent with 33 cfr 324.3(2) "Federal agencies are not required to obtain and provide certification of compliance with effluent limitations and water quality standards from state or interstate pollution control agencies in connection with activities involving the transport of dredged material for dumping into ocean waters beyond the territorial sea.

G. Shoreline Sanitation

The purpose of this program is to regulate the installation of septic tanks, set standards concerning soil types suitable for septic tanks, and specify minimum distances that tanks must be placed away from streams, rivers, and other waters of the Commonwealth.

The proposed project does not involve septic tanks.

H. Air Pollution Control

The program implements the Federal Clean Air Act to provide a legally enforceable State Implementation Plan for the attainment and maintenance of the National Ambient Air Quality Standards (NAAQS). This program is administered by the State Air Pollution Control Board (DEQ) (Virginia Code §10.1-1300 through §10.1-1320).

This project will conform to the Virginia's State Implementation Plan (SIP). The project is located within the Hampton Roads Intrastate Air Quality Control Region (AQCR) in Virginia (40 CFR 81.93). The project site is in attainment for all NAAQS. Air emissions due to the dredging and placement activities for this project will be minor and temporary. This project has been analyzed for conformity applicability pursuant to regulations implementing Section 176(c) of the Clean Air Act. The EPA has ruled that certain Federal actions, such as maintenance dredging and debris disposal are presumed to conform, have *de minimus* effects and therefore are exempt from the conformity requirement 40 CFR 93.153(c)(2)(ix). Since the impacts to air quality would be negligible, a Record of Non-Applicability (RONA) was prepared in September 2017 (Attachment A).

I. Coastal Lands Management

Coastal Lands Management is a state-local cooperative program administered by DEQ's Water Division and 84 localities in Tidewater, Virginia established pursuant to the Chesapeake Bay Preservation Act (Virginia Code §62.1-44.15:67–62.1-44.15:79) and Chesapeake Bay Preservation Area Designation and Management Regulations (Virginia Administrative Code 9 Virginia Code 25-830-10 et seq.).

The proposed project does not involve land development.

<u>Advisory Policies for Geographic Area of Particular Concern</u>

a. Coastal Natural Resource Areas

Coastal Natural Resource Areas are areas that have been designated as vital to estuarine and marine ecosystems and/or are of great importance to areas immediately inland of the shoreline. These areas receive special attention from the Commonwealth because of their conservation, recreational, ecological, and aesthetic values. These areas include the following resources: wetlands, aquatic spawning, nursing, and feeding grounds, coastal primary sand dunes, barrier islands, significant wildlife habitat areas, public recreation areas, sand gravel resources, and underwater historic sites.

The project area may contain spawning, nursing, and/or feeding grounds for finfish and shellfish. Section 7 consultations under the Endangered Species Act (ESA) for the project activities in Back River Channel have been coordinated with NOAA Fisheries Protected Resources Division and U. S. Fish and Wildlife Service.

The Magnuson-Stevens Fishery Conservation and Management Act (16 United States Code 1801 et seq.)

established a management system for marine fisheries resources in the United States. Congress charged National Oceanic and Atmospheric Administration (NOAA) Fisheries and fishery management councils, along with other Federal and State/Commonwealth agencies and the fishing community, to identify habitats essential to managed species, which include marine, estuarine, and anadromous finfish, mollusks, and crustaceans. These habitats, referred to as Essential Fish Habitat (EFH), include "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." An EFH Assessment was coordinated with NOAA Fisheries Habitat Conservation Division (Attachment B).

b. Coastal Natural Hazard Areas

This policy covers areas vulnerable to continuing and severe erosion and areas susceptible to potential damage from wind, tidal, and storm related events including flooding. New buildings and other structures should be designed and sited to minimize the potential for property damage due to storms or shoreline erosion. The areas of concern are highly erodible areas and coastal high hazard areas, including flood plains.

The proposed project does not involve construction of buildings or structures in coastal natural hazard areas.

c. Waterfront Development Areas

These areas are vital to the Commonwealth because of the limited number of areas suitable for waterfront activities. The areas of concern are commercial ports, commercial fishing piers, and community waterfronts.

There are no commercial fishing piers and/or community waterfronts located within the project area. While this project includes no onshore development, it does support waterfront activities by providing safe, reliable navigation to the Back River Channel.

Advisory Policies for Shorefront Access Planning and Protection

a. Virginia Public Beaches

These public shoreline areas will be maintained to allow public access to recreational resources.

There are no public beaches within the project area; consequently this project will not affect public access to beaches.

b. Virginia Outdoors Plan (VOP)

The VOP, which is published by Virginia's Department of Conservation and Recreation (DCR), identifies recreational facilities in the Commonwealth that provide recreational access. Prior to initiating any project, consideration should be given to the proximity of the project site to recreational resources identified in the VOP.

This project is consistent with the Virginia Outdoor Plan for Region 23, Hampton Roads, whose main recreational activities revolve around water access and boating. This project will provide safe water access to the Back River Channel.

c. Parks, Natural Areas, and Wildlife Management Areas

The recreational values of these areas should be protected and maintained.

There are no parks, natural areas, or wildlife management areas within the project area. The Plum Tree National Wildlife Refuge (NWR) is located north of the Back River Channel. The Grandview Nature Preserve is located south of the project area.

d. ***Waterfront Recreational Land Acquisition***
It is the policy of the Commonwealth to protect areas, properties, lands, or any estate or interest therein, of scenic beauty, recreational utility, historical interest, or unusual features which may be acquired, preserved, and maintained for the citizens of the Commonwealth.

This project does not limit the ability of the Commonwealth in any way to acquire, preserve, or maintain waterfront recreational lands.

e. ***Waterfront Recreational Facilities***
Boat ramps, public landings, and bridges shall be designed, constructed, and maintained to provide points of water access when and where practicable.

This project does not involve the design, construction, or maintenance of any boat ramps, public landings, or bridges.

f. ***Waterfront Historic Properties***
The Commonwealth has a long history of settlement and development, and much of that history has involved both shorelines and near-shore areas. The protection and preservation of historic shorefront properties is primarily the responsibility of the Virginia Department of Historic Resources.

A Section 106 consultation with "no adverse effect" on historic resources was submitted to the Virginia Department of Historic Resources (VDHR). VDHR concurred with the 'no effect' determination in an email dated April 18, 2017 (Attachment C). This project will not affect historic properties or their viewshed.

Determination

Based upon the following information, data, and analysis of the Back River Navigation Channel project, the U.S. Army Corps of Engineers, Norfolk District, on behalf of the JBLE-Langley, finds that dredging and transport for the purpose of disposal in ocean waters at NODS is consistent to the maximum extent practicable with the enforceable policies of the Virginia Coastal Resources Management Program.

Pursuant to 15 CFR Section 930.41, the Virginia Coastal Resources Management Program has 60 days from the receipt of this letter in which to concur with or object to this Federal Consistency Determination, or to request an extension under 15 CFR section 930.41(b). Virginia's concurrence will be presumed if its response is not received by the U.S. Army Corps of Engineers on the 60th day from receipt of this determination.

J.R. Flowers, P.E.
FOR KEITH LOCKWOOD

27 SEPT. 2017
Date

Keith B. Lockwood
Chief, Operations Branch

Clean Air Act – General Conformity Rule
Record of Non-Applicability
for the JBLE-Langley
Back River Navigation Channel, a Federally-maintained channel
located in
Hampton and Poquoson, Virginia

Section 176(c) (42 U.S.C. § 7506) of the Clean Air Act (CAA) requires Federal agencies to ensure that emissions from Federal actions will conform to state implementation plans (SIP) designed to maintain an attainment designation for air pollutants as defined by the National Ambient Air Quality Standard (NAAQS). The conformity rule applies to Federal actions which cause emissions in areas designated as nonattainment under Section 107 of the CAA and maintenance areas established under Section 157A of the CAA. The Environmental Protection Agency's General Conformity Regulations also exempt certain categories of actions from the conformity analysis requirement.

The JBLE-Langley Back River Navigation Channel, a Federally-maintained channel is located in the Air Quality Control Region (AQCR) known as Hampton Roads Intrastate ACQR in Virginia (40 CFR 81.93). The project area is currently in attainment for all of the NAAQS criteria pollutants. The proposed action is dredging of the Back River Federal Navigation Channel with dredged material placement at the Norfolk Ocean Disposal Site (NODS). Previous maintenance dredging of the channel was completed in 2003. The Back River Navigation Channel, an estuarine inlet of the Chesapeake Bay is located between the cities of Hampton and Poquoson, Virginia. The channel is approximately 19,500 feet in length, 100 feet wide and -15 feet deep MLLW.

The JBLE-Langley needs to perform dredging of the Back River Navigation Channel to maintain an operational channel for its vessels. This channel provides access and safe navigation in support of national defense to the JBLE-Langley located in Hampton, Virginia from the Chesapeake Bay. Maintenance dredging of the channel is required to maintain an operational channel for vessel access to JBLE-Langley. Under the No-Action Alternative, ongoing shoaling would result in a continued reduction in operational depth of the channel. Eventually, the channel would reach hydrodynamic equilibrium and the channel would limit vessel access in support of national defense to JBLE-Langley.

We have considered the potential direct and indirect emissions from the Back River Federal Navigation Project, and reach the following conclusion(s):

[ ] The action is entirely outside of and will not cause any direct or indirect emissions in any nonattainment or maintenance area [see 40 CFR 93.153(b)].

[ ] The total direct and indirect emissions are below de minimis levels [40 CFR 93.153(c)(1) for the exemption, but for the applicable levels see 40 CFR 93.153(b)(1) for nonattainment areas or 40 CFR 93.153(b)(2) for maintenance areas].

[x] The following de minimis exemption to the conformity requirements applies: 40 CFR Part 93.153(c)(2)(ix) "Maintenance dredging and debris disposal where no new depths are required, applicable permits are secured, and disposal will be at an approved disposal site".

[ ] The action is on the agency's "presumed to conform" list at: [EPA regulation describing the "presumed to conform" process see 40 CFR 93.153(f)].

[ ] The facility has a facility-wide emissions budget approved by the State as part of the SIP, and the emissions from the proposed action are within the budget.

To the best of my knowledge the information provided is correct and accurate. I concur in the finding that the proposed action meets the exemptions stated above and thus will conform to the SIP.

Jason R. Flowers, P.E.
FOR KEITH LOCKWOOD.

27 SEPT 2017
Date

Keith B. Lockwood
Chief, Operations Branch

Nadal, Teresita I CIV USARMY CENAO (US)

From: David O'Brien - NOAA Federal <david.l.o'brien@noaa.gov>
Sent: Thursday, September 14, 2017 12:08 PM
To: Nadal, Teresita I CIV USARMY CENAO (US)
Cc: Pruhs, Robert S CIV USARMY CENAO (US)
Subject: [EXTERNAL] Back River Federal Navigation Project, Cities of Hampton and Poquoson, VA; EFH assessment

Hello Teri,

Thank you for providing the additional information regarding the Back River federal navigation project located in the Cities of Hampton and Poquoson, Virginia. We understand that the originally proposed use of an upland placement site is no longer a viable option for dredge material disposal due to potential impacts to tidal emergent and forested wetlands associated with dyke repair and enhancement. Material will now be dredged mechanically, loaded into barges and disposed at the Norfolk Open Disposal Site (NODS).

Based on the information you've provided, including the 300 ft. minimum distance from the navigation channel to the closest bed of submerged aquatic vegetation (SAV) as well as the volume of material to be dredged and the sediment's texture (sand) between stations 120+00 to 172+00 (approx. 7,000 cu. yds.) and stations 80+00 to 120+00 (approx. 3,400 cu. yds.), we rescind our previous recommendation for a time of year restriction (TOYR) on dredging activities which may now be conducted at any time of the year as dictated by the project schedule.

Please contact me if you have any questions. Should new information become available or the project revised in such a manner that affects the baseline for this essential fish habitat (EFH) determination, the EFH consultation must be re-initiated.

Regards,
Dave

David L. O'Brien
Fisheries Biologist
NOAA Fisheries Service
Virginia Field Office
1375 Greate Rd.
P.O. Box 1346
Gloucester Point, VA 23062
804-684-7828 phone
804-684-7910 fax
david.l.o'brien@noaa.gov

On Thu, Aug 24, 2017 at 10:25 AM, Nadal, Teresita I CIV USARMY CENAO (US) <Teresita.I.Nadal@usace.army.mil> wrote:

> Dave,
> The upland site previously coordinated has developed some complications for using the site for the Back River Channel. Recent geotechnical findings indicate the existing containment dikes will require significant

improvements to meet required factors of safety for slope stabilization. The site would require dike improvements that may permanently and temporarily impact emergent wetlands and forested wetlands potentially requiring mitigation. As a result, the project will be seeking appropriate permits for use of NODS for the dredged material placement. The NODS alternative will avoid impacts to vegetated wetlands and achieve the goal of restoring navigation to the Back River Channel in the most timely manner.

Per our previous discussion concerning SAV resources in the project area, we have attached a figure to this email showing SAV resources in the proximity of the channel. The closest SAV bed is located approximately 300-feet from the channel near the mouth of the Back River. This area of the Back River Channel will require minimal dredging (approximately 7,000 cy of pay material, station 120+00 to 172+00 and 3,400 cy of pay material, station 80+00 to 120+00) and will likely only require approximately 5-days to complete. The sediments in these station ranges are predominantly sands that will not result in significant sediment re-suspension and we do not foresee impacts to SAV resources in that area. The majority of the dredging work will be required from the dog-leg in the channel (approximate station 80+00) to the fuel pier. There are no SAV resources in close proximity to this reach of the channel. The closest SAV are greater than 1,000-feet from these upstream portions of the channel.

Maintenance dredging will be performed by a mechanical dredge with ocean disposal at the Norfolk Ocean Disposal Site. The contractor will need to be provided 150 to 180 days to complete the dredging. Accomplishing all dredging between mid-October through mid-March (5 months) will be logistically difficult considering winter sea-state conditions off-shore during the winter months which will limit the contractor's opportunity to safely transit to the off-shore placement site.

Based on the distance of the SAV resources to the upstream reaches of the channel (>1,000 feet), the minimal required work in the vicinity of the SAV at the mouth of Back River, and placement of the dredged material at NODS ocean site the potential impacts to the resource in Back River will be minimized. Therefore, I request your consideration to drop the recommended time of year restriction for dredging between mid-March and Mid-October. We have attached maps depicting the SAV beds locations in relation to the navigation channel. Please do not hesitate to contact me if you have any further questions.

VR ,

Teri

Teri Nadal
Environmental Manager
Ops Branch, Technical Support Section
U.S. Army Corps of Engineers
Norfolk District
(757) 201-7299

-----Original Message-----
From: David O'Brien - NOAA Federal [mailto:david.l.o'brien@noaa.gov]
Sent: Friday, July 28, 2017 3:40 PM
To: Nadal, Teresita I CIV USARMY CENAO (US) <Teresita.I.Nadal@usace.army.mil>
Subject: [Non-DoD Source] Back River Federal Navigation Project, Cities of Hampton and Poquoson, VA; EFH assessment

Hello Teri,

Sorry for the delay in getting back to you since we last spoke by phone, I've been out of the office the last several weeks following knee surgery.

I have reviewed the essential fish habitat (EFH) assessment you prepared for the Back River Federal Navigation project, located in the Cities of Poquoson and Hampton, Virginia. As you know, Back River is designated as EFH for fourteen (14) federally managed species and a habitat area of particular concern (HAPC) for sandbar shark. Back River also supports beds of submerged aquatic vegetation (SAV) which is a HAPC for numerous recreational and commercially important fisheries as well as forage species.

The Back River federal navigation channel serves the DLA fuel pier located on Joint Base Langley-Eustis-Langley (JBLE-Langley) as well as the City of Poquoson's marina at Messick Point. The project includes maintenance dredging along the 19,500 ft. long federal navigation channel to restore operational capacity and navigable depths as authorized to -15 ft. MLLW to the JBLE-Langley DLA fuel pier. Approximately 205,000 cubic yards of subaqueous bottom sediment will be dredged each maintenance cycle, anticipated to occur every 15 years. The initial dredge event includes approximately 35,000 cubic yards of new dredging required to access Langley's recently re-configured DLA fuel pier.

It has yet to be determined whether the federal navigation channel will be dredged by hydraulic or mechanical method. The preferred option is to hydraulically dredge and utilize a floating pipeline to pump material to the adjacent 18 acre Mears upland disposal site. The Mears site was last used in 2009 and has been used for dredge material disposal over the last 50 years. However, the Mears site requires restoration prior to accepting any additional dredge material and may not have sufficient capacity for this project. The second preferred option is to dredge via mechanical method with the excavated material deposited into barges or scows for transport offshore to the approved Norfolk Ocean Disposal Site (NODS) located 17 miles east of the Chesapeake Bay. The Back River federal navigation channel maintenance dredging is anticipated to begin in September 2018 and will continue for approximately 90 days.

As stated in your EFH assessment, SAV is located within 300 ft. of the federal navigation channel in some locations. In addition, a review of mapping by the Virginia Institute of Marine Science (VIMS) submerged aquatic vegetation monitoring program (VIMS, 2016 data) indicates SAV has colonized the area immediately adjacent the Mears disposal site. While NOAA supports the Corps' preferred alternative using a hydraulic dredge with upland disposal to reduce re-suspended sediment during dredging operations and avoid overboard placement of dredge material onto subaqueous bottom habitat at NODS, we recommend routing the floating pipeline into the Mears disposal site such that it avoids direct impacts to SAV if dredging is conducted hydraulically.

As stated, we generally prefer the use of a hydraulic dredge over mechanical dredging in fine-grained sediment due to its ability to generally reduce re-suspended sediment in the water column which adversely affects water quality. Similarly, re-suspended sediment may settle in sensitive areas adjacent the federal channel, such as SAV and shellfish beds. In order to minimize potential impacts to SAV adjacent the channel, dredging operations should be conducted outside the typical SAV growing season. Therefore, we recommend conducting dredging operations between mid-October and mid-March to the extent practicable. As you know the Virginia Marine Resources Commission (VMRC) has issued several shellfish leases within Back Creek immediately adjacent the federal channel. Therefore, we suggest working with VMRC and leaseholders to coordinate the timing of dredging operations to help reduce potential adverse impacts to shellfish aquaculture operations.

It is the opinion of NOAA Fisheries Service that the proposed maintenance dredging of the Back River federal navigation channel will affect EFH through the removal of the existing benthic community, temporarily increased turbidity and reduced water quality and direct impact to eggs and larvae of several designated species. However, we concur with your determination that the project impacts will not substantially adversely affect EFH, sandbar shark HAPC or SAV provided our recommendations stated above are incorporated into project planning and implementation.

Please note that EFH conservation recommendations require a response from the federal action agency within 30 days of receipt or 10 days before a permit is issued if CRs are not included as a special condition of the permit. In addition, a distinct and further EFH consultation must be reinitiated pursuant to 50 CFR 600.920 (j) if new information becomes available, or if the project is revised in such a manner that affects the basis of the EFH determination or EFH conservation recommendations.

This EFH determination does not address threatened and endangered species under purview of NOAA Fisheries Service. Therefore, please complete the Norfolk District Endangered Species Act Programmatic Consultation Verification Form or contact Mr. Brian Hopper, NOAA Protected Resources Division (410-573-4592) to discuss your project regrading federally listed sea turtles and Atlantic sturgeon.

Thank you for the opportunity to review and comment on this project. Please feel free to contact me if you have any questions.

Regards,
Dave

David L. O'Brien
Fisheries Biologist
NOAA Fisheries Service
Virginia Field Office
1375 Greate Rd.
P.O. Box 1346
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US Army Corps of Engineers
Norfolk District

Channel Station

SAV BEDS 2014

USACE Federal Navigation Channel

0 500 1,000 2,000 3,000 Feet

Map: BackRiver_Nadal
Developed By: Tammy Knecht
Date: 8/15/2017

APPENDIX C

Threatened and Endangered Species & Essential Fish Habitat

NOAA FISHERIES
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
Greater Atlantic Region

US Army Corps of Engineers®

GARFO ESA Section 7: 2017 NLAA Program Verification Form

Section 1: General Project Details

Application Number:	NAO- to be determined
Applicant(s):	Joint Base Langley-Eustis, Langley AFB
Permit Type (e.g. NWP, LOP, RGP, IP, Permit Modification):	IP
Anticipated project duration (e.g., start/end date of construction/permit duration)	90 days. Project is scheduled to begin in September/October 2018 and end in January 2019.

Project Type/Category (check all that apply to entire action):

☐	Aquaculture (shellfish) and artificial reef creation	☐	Transportation and development (e.g., culvert construction, bridge repair)
☒	Routine maintenance dredging and disposal/beach nourishment 170,000 cy	☐	Mitigation (fish/wildlife enhancement or restoration)
☐	Piers, ramps, floats, and other structures	☐	Bank stabilization and dam maintenance
☒	If other, describe project type/category: New dredging 35,000 cy and maintenance dredging to expand turning basin (approx. 1.5 acres, not in a critical habitat area) adjacent to existing dredging project		

Project/Action Description and Purpose:

The JBLE-Langley needs to perform maintenance and new work dredging of the Back River Federal Navigation Channel to maintain an operational channel for its vessels. This channel provides access and safe navigation in support of national defense to the JBLE-Langley located in Hampton, Virginia from the Chesapeake Bay.

The channel, an estuarine inlet of the Chesapeake Bay is located between the cities of Hampton and Poquoson, Virginia and is approximately 19,500 feet in length, 100 feet wide and -15 feet deep MLLW. Previous maintenance dredging of the Back River Navigation Channel, a federally maintained project, was completed in 2003. The average dredging frequency has been every 15 years. Dredging will be conducted by hydraulic cutterhead and/or mechanical to a maximum depth of -15 MLLW removing approximately 205,000 cubic yards of (CY) material each dredging cycle, of which 35,000 CY is new work dredging.

The channel may be dredged by hydraulic cutterhead dredged and placed via pipeline at an upland confined placement facility (Mears Site) or onto barges/scow for material transport to the Norfolk Ocean Disposal Site (NODS). The Mears Site has been previously used and is the preferred placement site. The channel may be dredged by mechanical dredge and placed onto barges/scow for material transport to NODS. The NODS is the alternate preferred site during the dredging cycles when the Mears Site is unavailable for receiving dredged material.

Total area of habitat modification (acres) by habitat type (e.g., 2.5 acres sand; 3 acres silt/mud, 0.25 acres cobble):	46 acres. The sediment composition varies from 6.2% sand and 93.8% silt/clay at the upstream segment of the channel to 95% sand and 5% silt/clay towards the mouth of the channel.
Project Latitude	37° 6.183333' north
Project Longitude	76° 19.292965' west

Section 2: ESA-listed species and/or critical habitat in the action area:

☒	Atlantic sturgeon (all DPSs) If not all DPSs, list which here:	☒	Kemp's ridley sea turtle
☐	Atlantic sturgeon critical habitat (proposed or designated) (GOM, NYB, Chesapeake Bay DPSs)	☒	Loggerhead sea turtle (NW Atlantic DPS)
☐	Shortnose sturgeon	☒	Leatherback sea turtle
☐	Atlantic salmon (GOM DPS)	☒	Right whale (N. Atlantic DPS)
☐	Atlantic salmon critical habitat (GOM DPS)	☐	Right whale critical habitat (N. Atlantic DPS)
☒	Green sea turtle (N. Atlantic DPS)	☒	Fin whale

Section 3: NLAA Determination (check all applicable fields):

a) GENERAL PDC		
☒	Yes, my project meets all of the General PDC (justification for PDC 8, below)	
	Width of water body in action area (m):	990 to 1,840 meters
	Max extent (m) of activity stressor into water body: (e.g., turbidity plume, sound pressure wave)	610 meters
☐	No, my project does not meet all the General PDC as indicated below (please check the PDC the action does NOT comply with below, and provide justification in Section 4 of this form):	
☐	1.	No work will individually or cumulatively have an adverse effect on ESA-listed species or designated critical habitat; no work will cause adverse modification or destruction to proposed critical habitat.

☐	2.	No work will occur in the tidally influenced portion of rivers/streams where Atlantic salmon presence is possible from April 10–November 7.
☐	3.	No work will occur in Atlantic or shortnose sturgeon spawning grounds as follows: i. New England: April 1–Aug. 31 ii. New York/Philadelphia: March 15–August 31 iii. Baltimore/Norfolk: March 15–July 1 and Sept. 15–Nov. 1
☐	4.	No work will occur in shortnose sturgeon overwintering grounds as follows: i. New England District: October 15–April 30 ii. New York/Philadelphia: Nov. 1–March 15 iii. Baltimore: Nov. 1–March 15
☐	5.	Within designated Atlantic salmon critical habitat, no work will affect spawning and rearing areas (PBFs 1-7).
☐	6.	Within proposed/designated Atlantic sturgeon critical habitat, no work will affect hard bottom substrate (e.g., rock, cobble, gravel, limestone, boulder, etc.) in low salinity waters (i.e., 0.0-0.5 parts per thousand) (PBF 1).
☐	7.	Work will not change temperature, water flow, salinity, or dissolved oxygen levels.
☐	8.	If it is possible for ESA-listed species to pass through the action area, a zone of passage with appropriate habitat for ESA-listed species (e.g., depth, water velocity, etc.) must be maintained (i.e., physical or biological stressors such as turbidity and sound pressure must not create barrier to passage).
☐	9.	Any work in designated North Atlantic right whale critical habitat must have no effect on the physical and biological features (PBFs).
☐	10.	The project will not adversely impact any submerged aquatic vegetation (SAV).
☐	11.	No blasting will occur.

b) The following stressors are applicable to the action (check all that apply—use table for guidance):	
☐	Sound Pressure
☒	Impingement/Entrapment/Capture
☒	Turbidity/Water Quality
☐	Entanglement
☒	Habitat Modification
☒	Vessel Traffic

	Stressor Category					
Activity Category	Entanglement	Sound Pressure	Impingement/ Entrapment/ Capture	Turbidity/ Sedimentation	Vessel Traffic	Habitat Mod.

Aquaculture (shellfish) and artificial reef creation	Y	N	N	Y	Y	Y
Routine maintenance dredging and disposal/beach nourishment	N	N	Y	Y	Y	Y
Piers, ramps, floats, and other structures	Y	Y	N	Y	Y	Y
Transportation and development (e.g., culvert construction, bridge repair)	N	Y	N	Y	Y	Y
Mitigation (fish/wildlife enhancement or restoration)	N	N	N	Y	Y	Y
Bank stabilization and dam maintenance	N	Y	N	Y	Y	Y

c) SOUND PRESSURE PDC		
☐	Yes, my project meets all of the Sound Pressure PDC below (attach analysis for PDC 14 if necessary). Please indicate the number, type(s), and diameter(s)/width(s) of all piles (e.g., 10-16" steel pipe piles; 20-14" timber piles): Please indicate the installation method (e.g., impact hammer, vibratory hammer):	
☐	No, my project does not meet all the Sound Pressure PDC as indicated below. (please check the PDC the action does NOT comply with below, and provide justification in Section 4 of this form):	
☐	12.	If the pile driving is occurring during a time of year when ESA-listed species may be present, and the anticipated noise is above the behavioral noise threshold of those species (please see SOPs), a 20 minute "soft start" is required to allow for animals to leave the project vicinity before sound pressure increases.
☐	13.	Any new pile supported structure must involve the installation of ≤ 50 piles (below MHW).
☐	14.	The project involves non-steel piles (or steel sheet piles) less than (≤) 24-inches in diameter (or width) and all underwater noise (pressure) is below (<) the physiological/injury noise threshold for ESA-species in the action area.

d) IMPINGEMENT/ENTRAINMENT/CAPTURE PDC		
☐	Yes, my project meets all of the Impingement/Entrainment/Capture PDC below. Please indicate mesh size for PDC 18 here:	
☒	No, my project does not meet all the Impingement/Entrainment/Capture PDC as indicated below (please check the PDC the action does NOT comply with below, and provide justification in Section 4 of this form):	
☐	15.	Only mechanical, cutterhead, and low volume hopper (e.g., CURRITUCK) dredges may be used.
☐	16.	No new dredging in proposed or designated Atlantic sturgeon or Atlantic salmon critical habitat (maintenance dredging still must meet all other PDCs). New dredging outside Atlantic sturgeon or salmon critical habitat is limited to one time dredge events (e.g., burying a utility line) and minor (≤ 2 acres) expansions of areas already subject to maintenance dredging (e.g., marina/harbor expansion).
☒	17.	Work behind cofferdams, turbidity curtains, and other methods to block access of animals to dredge footprint is required when operationally feasible and ESA-listed species may be present.
☐	18.	Temporary intakes related to construction must be equipped with appropriate sized mesh screening (as determined by GARFO section 7 biologist and/or according to Chapter 11 of the NOAA Fisheries Anadromous Salmonid Passage Facility Design) and must not have greater than 0.5 fps intake velocities, to prevent impingement or entrainment of any ESA-listed species life stage.
☐	19.	No new permanent intake structures related to cooling water, or any other inflow at facilities (e.g. water treatment plants, power plants, etc.).
e) TURBIDITY/WATER QUALITY PDC		
☐	Yes, my project meets all of the Turbidity/Water Quality PDC below.	
☒	No, my project does not meet all the Turbidity/Water Quality PDC as indicated below (please check the PDC the action does NOT comply with below, and provide justification in Section 4 of this form):	
☒	20.	Work behind cofferdams, turbidity curtains, or other methods to control turbidity are required when operationally feasible and ESA-listed species may be present.
☐	21.	In-water offshore disposal may only occur at designated disposal sites that have already been consulted on with GARFO.
☐	22.	Any temporary discharges must meet state water quality standards; no discharges of toxic substances.
☐	23.	Only repair of existing discharge pipes allowed; no new construction.

f) ENTANGLEMENT PDC		
☐	Yes, my project meets all of the Entanglement PDC below. The aquaculture gear type (e.g., cage on bottom) is:	
☐	No, my project does not meet all the Entanglement PDC as indicated below (please check the PDC the action does NOT comply with below, and provide justification in Section 4 of this form):	
☐	24.	Shell on bottom <50 acres with maximum of 4 corner marker buoys;
☐	25.	Cage on bottom with no loose floating lines <5 acres and minimal vertical lines (1 per string of cages, 4 corner marker buoys);
☐	26.	Floating cages in <3 acres in waters and shallower than -10 feet MLLW with no loose lines and minimal vertical lines (1 per string of cages, 4 corner marker buoys);
☐	27.	Floating upweller docks in >10 feet MLLW.
☐	28.	Any in-water lines, ropes, or chains must be made of materials and installed in a manner (properly spaced) to minimize the risk of entanglement by keeping lines taut or using methods to promote rigidity (e.g., sheathed or weighted lines that do not loop or entangle).
g) HABITAT MODIFICATION PDC		
☒	Yes, my project meets all of the Habitat Modification PDC below.	
☐	No, my project does not meet all the Habitat Modification PDC as indicated below (please check the PDC the action does NOT comply with below, and provide justification in Section 4 of this form):	
☐	29.	No conversion of habitat type (soft bottom to hard, or vice versa) for aquaculture or reef creation.
h) VESSEL TRAFFIC PDC		
☒	Yes, my project meets all of the Vessel Traffic PDC below. Below, please list separately the number of temporary project/construction vessels and the net increase of permanent non-commercial vessels (must be ≤ 2 per PDC 32): Temporary project/construction vessels: 3 vessels, mechanical or cutterhead dredge and 1 or 2 barge/scows Permanent net increase of non-commercial vessels: 0	
☐	No, my project does not meet all the Vessel Traffic PDC as indicated below (please check the PDC the action does NOT comply with below, and provide justification in Section 4 of this form):	
☐	30.	Speed limits below 10 knots for project vessels with buffers of 150 feet for all listed species (1,500 feet for right whales).

☐	31.	While dredging, dredge buffers of 300 feet in the vicinity of any listed species (1,500 feet for right whales), with speeds of 4 knots maximum.
☐	32.	The number of project vessels must be limited to the greatest extent possible, as appropriate to size and scale of project.
☐	33.	The permanent net increase in vessels resulting from a project (e.g., dock/float/pier/boating facility) must not exceed two non-commercial vessels. A project must not result in the permanent net increase of any commercial vessels (e.g., a ferry terminal).

Section 4: Justification for Review under the 2017 NLAA Program

If the action is not in compliance with all of the General PDC and appropriate stressor PDC, but you can provide justification and/or special conditions to demonstrate why the project still meets the NLAA determination (all effects are insignificant and/or discountable) and is consistent with the aggregate effects considered in the programmatic consultation, you may still certify your project through the NLAA program using this verification form. Please identify which PDC your project does not meet (e.g., PDC 9, PDC 15, PDC 22, etc.) and provide your rationale and justification for why the project is still eligible for the verification form:

PDC#	Justification
17	It is extremely unlikely that any sturgeon will be affected by impingement/capture because the width of the waterway at the project site would allow for highly mobile sturgeon and sea turtles ample amount of space to escape the relatively slow moving bucket or small cutterhead dredge; and because the subject project location is not an over wintering habitat area for sturgeon; therefore, the effects are discountable.
20	The proposed action will cause a temporary increase in the amount of turbidity in the action area; however, suspended sediment is expected to settle out of the water column within a few hours and any increase in turbidity will be short term. Based on this information, the effects of suspended sediment resulting from dredging activities on sturgeon are not capable of being meaningfully measured, evaluated or detected; therefore, effects to sturgeon from turbidity related to dredging activities are insignificant. As sea turtles are highly mobile they are likely to be able to avoid any sediment plume, minimizing any effect on sea turtle movements and thus all effects will be insignificant.

Section 5: USACE Verification of Determination

☐	In accordance with the 2017 NLAA Programmatic Consultation, the Corps has determined that the action complies with all applicable PDC and is not likely to adversely affect listed species.
☒	In accordance with the 2017 NLAA Programmatic Consultation, the Corps has determined that the action is not likely to adversely affect listed species per the justification and/or special conditions provided in Section 4.

USACE Signature:	Date:
NADAL.TERESITA.I.1290272064 Digitally signed by NADAL.TERESITA.I.1290272064 DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USA, cn=NADAL.TERESITA.I.1290272064 Date: 2017.05.19 08:20:52 -04'00'	May 19, 2017

Section 6: GARFO Concurrence

☐	In accordance with the 2017 NLAA Program, GARFO PRD concurs with USACE's determination that the action complies with all applicable PDC and is not likely to adversely affect listed species or critical habitat.
☒	In accordance with the 2017 NLAA Program, GARFO PRD concurs with USACE's determination that the action is not likely to adversely affect listed species or critical habitat per the justification and/or special conditions provided in Section 4.
☐	GARFO PRD does not concur with USACE's determination that the action complies with the applicable PDC (with or without justification), and recommends an individual Section 7 consultation to be completed independent from the 2017 NLAA Program.

GARFO Signature:	Date:
VACCARO.CHRISTINE.MICHELE.1399356799 Digitally signed by VACCARO.CHRISTINE.MICHELE.1399356799 DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=OTHER, cn=VACCARO.CHRISTINE.MICHELE.1399356799 Date: 2017.05.22 10:57:58 -04'00'	5/22/2017

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Virginia Ecological Services Field Office
6669 Short Lane
Gloucester, VA 23061-4410
Phone: (804) 693-6694 Fax: (804) 693-9032
http://www.fws.gov/northeast/virginiafield/

In Reply Refer To: March 28, 2017
Consultation Code: 05E2VA00-2017-SLI-2295
Event Code: 05E2VA00-2017-E-04243
Project Name: Back River Federal Navigation Channel

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.). Any activity proposed on National Wildlife Refuge lands must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 et seq.), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 et seq.), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm; http://www.towerkill.com; and http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List
- USFWS National Wildlife Refuges and Fish Hatcheries

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Virginia Ecological Services Field Office
6669 Short Lane
Gloucester, VA 23061-4410
(804) 693-6694

Project Summary

Consultation Code: 05E2VA00-2017-SLI-2295

Event Code: 05E2VA00-2017-E-04243

Project Name: Back River Federal Navigation Channel

Project Type: DREDGE / EXCAVATION

Project Description: This project is located in the Back River, an estuarine inlet of the Chesapeake
Bay between the cities of Hampton and Poquoson, Virginia. The Back River Federal Navigation
Channel is a 19,500 feet channel that connects JBLE-Langley with the Chesapeake Bay.

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/place/37.098276053701N76.33060061457988W

Counties: Hampton, VA | Poquoson, VA

Endangered Species Act Species

There is a total of 2 threatened, endangered, or candidate species on your species list. Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area. Please contact the designated FWS office if you have questions.

Birds

NAME	STATUS
Piping Plover *(Charadrius melodus)* Population: except Great Lakes watershed There is a **final** critical habitat designated for this species. Your location is outside the designated critical habitat. Species profile: https://ecos.fws.gov/ecp/species/6039	Threatened

Insects

NAME	STATUS
Northeastern Beach Tiger Beetle *(Cicindela dorsalis dorsalis)* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/8105	Threatened

Critical habitats

There are no critical habitats within your project area.

USFWS National Wildlife Refuges And Fish Hatcheries

Any activity proposed on National Wildlife Refuge lands must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

There are no refuges or fish hatcheries within your project area.

Species Conclusions Table

Project Name: Back River Navigation Channel

Date: March 28, 2017

Species / Resource Name	Conclusion	ESA Section 7 / Eagle Act Determination	Notes / Documentation
Piping plover	Species not present within the project area	No effect	The project is outside the designated critical habitat area for piping plover
Northeastern Beach Tiger Beetle	Species not present within the project area	No effect	No suitable habitat
Critical habitat	No critical habitat present	No effect	There are no critical habitats within the project area

VaFWIS Search Report Compiled on 2/9/2017, 1:33:44 PM

Help

Known or likely to occur within a **3 mile radius around point 37,06,45.6 -76,19,05.2** in **650 Hampton City, 735 Poquoson City, VA**

View Map of Site Location

489 Known or Likely Species ordered by Status Concern for Conservation
(displaying first 41) (41 species with Status* or Tier I** or Tier II**)

BOVA Code	Status*	Tier**	Common Name	Scientific Name
030074	FESE	Ia	Turtle, Kemp's ridley sea	Lepidochelys kempii
010032	FESE	Ib	Sturgeon, Atlantic	Acipenser oxyrinchus
030075	FESE	Ic	Turtle, leatherback sea	Dermochelys coriacea
120030	FESE	IVb	Manatee, West Indian	Trichechus manatus
030073	FESE		Turtle, hawksbill sea	Eretmochelys imbricata
030071	FTST	Ia	Turtle, loggerhead sea	Caretta caretta
040144	FTST	Ia	Knot, red	Calidris canutus rufa
050022	FTST	Ia	Bat, northern long-eared	Myotis septentrionalis
030072	FTST	Ib	Turtle, green sea	Chelonia mydas
040120	FTST	IIa	Plover, piping	Charadrius melodus
100361	FTST	IIa	Beetle, northeastern beach tiger	Cicindela dorsalis dorsalis
040118	SE	Ia	Plover, Wilson's	Charadrius wilsonia
040110	SE	Ia	Rail, black	Laterallus jamaicensis
050020	SE	Ia	Bat, little brown	Myotis lucifugus lucifugus
050027	SE	Ia	Bat, tri-colored	Perimyotis subflavus
020052	SE	IIa	Salamander, eastern tiger	Ambystoma tigrinum
030013	SE	IIa	Rattlesnake, canebrake	Crotalus horridus
040096	ST	Ia	Falcon, peregrine	Falco peregrinus
040293	ST	Ia	Shrike, loggerhead	Lanius ludovicianus
040379	ST	Ia	Sparrow, Henslow's	Ammodramus henslowii
040179	ST	Ia	Tern, gull-billed	Sterna nilotica
020044	ST	IIa	Salamander, Mabee's	Ambystoma mabeei
020002	ST	IIa	Treefrog, barking	Hyla gratiosa
040292	ST		Shrike, migrant loggerhead	Lanius ludovicianus migrans
030067	CC	IIa	Terrapin, northern diamond-backed	Malaclemys terrapin terrapin
030063	CC	IIIa	Turtle, spotted	Clemmys guttata
040040		Ia	Ibis, glossy	Plegadis falcinellus
040306		Ia	Warbler, golden-winged	Vermivora chrysoptera
040213		Ic	Owl, northern saw-whet	Aegolius acadicus

040052		IIa	Duck, American black	Anas rubripes
040033		IIa	Egret, snowy	Egretta thula
040029		IIa	Heron, little blue	Egretta caerulea caerulea
040036		IIa	Night-heron, yellow-crowned	Nyctanassa violacea violacea
040114		IIa	Oystercatcher, American	Haematopus palliatus
040192		IIa	Skimmer, black	Rynchops niger
040181		IIa	Tern, common	Sterna hirundo
040320		IIa	Warbler, cerulean	Setophaga cerulea
040140		IIa	Woodcock, American	Scolopax minor
040203		IIb	Cuckoo, black-billed	Coccyzus erythropthalmus
040105		IIb	Rail, king	Rallus elegans
040304		IIc	Warbler, Swainson's	Limnothlypis swainsonii

To view **All 489 species** View 489

*FE=Federal Endangered; FT=Federal Threatened; SE=State Endangered; ST=State Threatened; FP=Federal Proposed; FC=Federal Candidate; CC=Collection Concern

**I=VA Wildlife Action Plan - Tier I - Critical Conservation Need;
II=VA Wildlife Action Plan - Tier II - Very High Conservation Need;
III=VA Wildlife Action Plan - Tier III - High Conservation Need;
IV=VA Wildlife Action Plan - Tier IV - Moderate Conservation Need
Virginia Widlife Action Plan Conservation Opportunity Ranking:
a - On the ground management strategies/actions exist and can be feasibly implemented.;
b - On the ground actions or research needs have been identified but cannot feasibly be implemented at this time.;
c - No on the ground actions or research needs have been identified or all identified conservation opportunities have been exhausted.

Anadromous Fish Use Streams

N/A

Impediments to Fish Passage

N/A

Threatened and Endangered Waters

N/A

Managed Trout Streams

N/A

Bald Eagle Concentration Areas and Roosts

N/A

Bald Eagle Nests (5 records)

[**View Map of All Query Results Bald Eagle Nests**]

Nest	N Obs	Latest Date	DGIF Nest Status	View Map
HM0001	6	Jan 1 2003	HISTORIC	Yes
HM0401	15	Apr 19 2011	HISTORIC	Yes
HM0701	10	Apr 19 2011	Unknown	Yes
HM0702	10	Apr 19 2011	Unknown	Yes
HM0901	6	Apr 19 2011	Unknown	Yes

Displayed 5 Bald Eagle Nests

Habitat Predicted for Aquatic WAP Tier I & II Species

N/A

Habitat Predicted for Terrestrial WAP Tier I & II Species (11 Species)

View Map of Combined Terrestrial Habitat Predicted for 11 WAP Tier I & II Species Listed Below

ordered by Status Concern for Conservation

BOVA Code	Status*	Tier**	Common Name	Scientific Name	View Map
040120	FTST	IIa	Plover, piping	Charadrius melodus	Yes
100361	FTST	IIa	Beetle, northeastern beach tiger	Cicindela dorsalis dorsalis	Yes
040118	SE	Ia	Plover, Wilson's	Charadrius wilsonia	Yes
040110	SE	Ia	Rail, black	Laterallus jamaicensis	Yes
030013	SE	IIa	Rattlesnake, canebrake	Crotalus horridus	Yes
040379	ST	Ia	Sparrow, Henslow's	Ammodramus henslowii	Yes
020044	ST	IIa	Salamander, Mabee's	Ambystoma mabeei	Yes
030067	CC	IIa	Terrapin, northern diamond-backed	Malaclemys terrapin terrapin	Yes
040114		IIa	Oystercatcher, American	Haematopus palliatus	Yes
040381		IIIa	Sparrow, saltmarsh	Ammodramus caudacutus	Yes
040186		IIIa	Tern, least	Sterna antillarum	Yes

Virginia Breeding Bird Atlas Blocks (5 records)

View Map of All Query Results Virginia Breeding Bird Atlas Blocks

BBA ID	Atlas Quadrangle Block Name	Breeding Bird Atlas Species			View Map
		Different Species	Highest TE*	Highest Tier**	
60054	Hampton, CE	58		II	Yes
60053	Hampton, CW	50		II	Yes
60052	Hampton, NE	34	FTST	I	Yes
60051	Hampton, NW	51		II	Yes
60065	Poquoson East, SW	78		II	Yes

Public Holdings: (2 names)

Name	Agency	Level
Langley Air Force Base	U.S. Air Force	Federal
Plum Tree Island National Wildlife Refuge	U.S. Fish and Wildlife Service	Federal

Summary of BOVA Species Associated with Cities and Counties of the Commonwealth of Virginia:

FIPS Code	City and County Name	Different Species	Highest TE	Highest Tier
650	Hampton City	397	FESE	I
735	Poquoson City	354	FESE	I

USGS 7.5' Quadrangles:
Hampton
Poquoson East

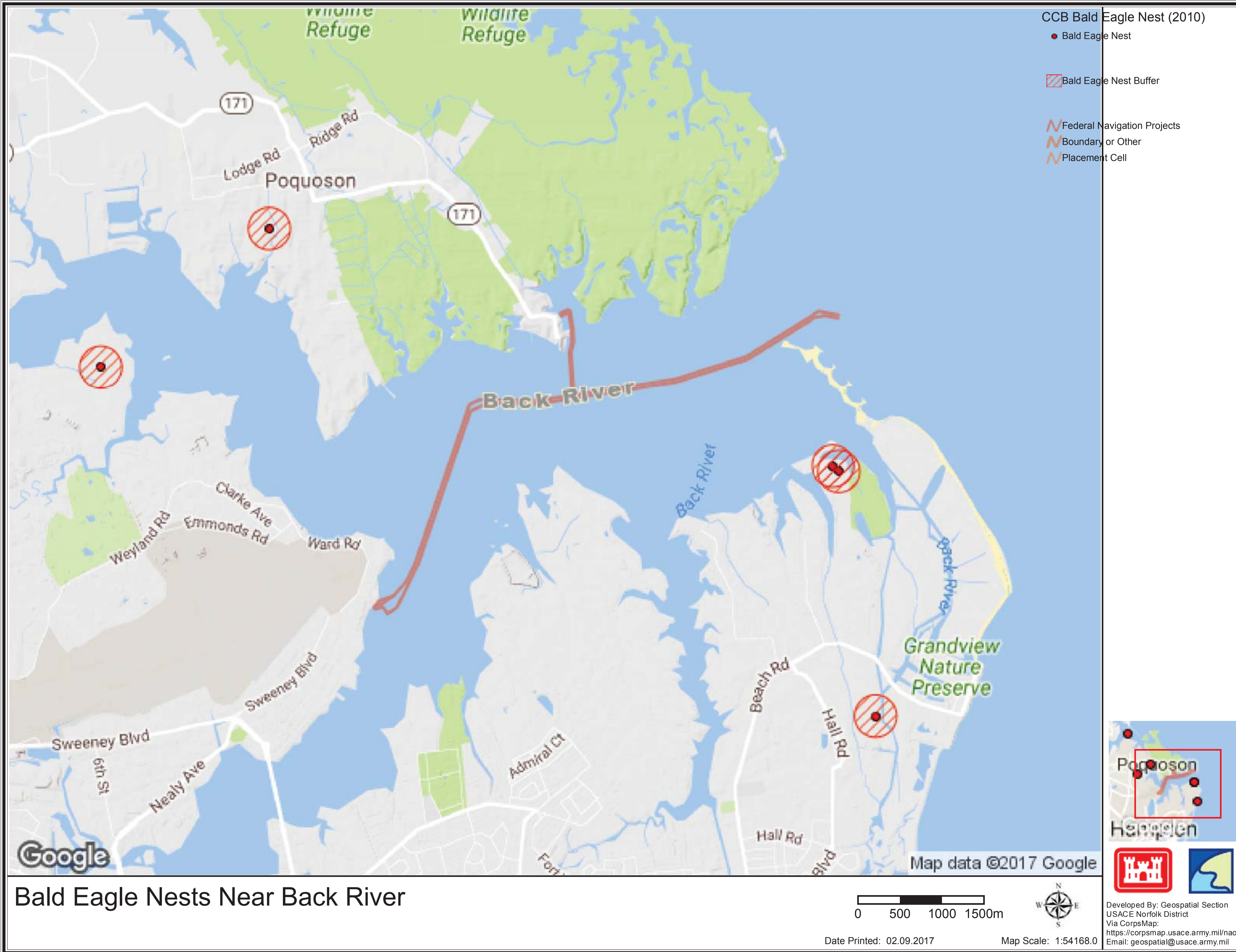
USGS NRCS Watersheds in Virginia:

N/A

USGS National 6th Order Watersheds Summary of Wildlife Action Plan Tier I, II, III, and IV Species:

HU6 Code	USGS 6th Order Hydrologic Unit	Different Species	Highest TE	Highest Tier
CB21	Lower Chesapeake Bay-Poquoson River	85	FESE	I
CB22	Northwest Branch Back River	88	FTSE	I
CB23	Southwest Branch Back River	78	FTSE	I
CB24	Lower Chesapeake Bay-Back River	91	FESE	I
CB47	Lower Chesapeake Bay	78	FESE	I

Compiled on 2/9/2017, 1:33:45 PM V798915.0 report=V searchType= R dist= 4828.032 poi= 37,06,45.6 -76,19,05.2



Bald Eagle Nests Near Back River

Natural Heritage Resources

Your Criteria

Taxonomic Group: Select All

Global Conservation Status Rank: Select All

State Conservation Status Rank: Select All

Federal Legal Status: Select All

State Legal Status: Select All

County: Hampton (City)

Watershed (8 digit HUC): 02080108 - Lynnhaven-Poquoson

Subwatershed (12 digit HUC): CB22 - Northwest Branch (Back River),CB23 - Southwest Branch (Back River)

Virginia Coastal Zone: Select All

Search Run: 2/9/2017 13:47:23 PM

Result Summary

Total Species returned: 5

Total Communities returned: 0

Click scientific names below to go to NatureServe report.

Click column headings for an explanation of species and community ranks.

Common Name/Natural Community	Scientific Name	Global Conservation Status Rank	State Conservation Status Rank	Federal Legal Status	State Legal Status	Statewide Occurrences	Virginia Coastal Zone
Hampton (City)							
Lynnhaven-Poquoson							
Northwest Branch (Back River)							
REPTILES							
Canebrake Rattlesnake	Crotalus horridus [Coastal Plain population]	G4T4	S1	None	LE	19	Y
VASCULAR PLANTS							
Virginia Least Trillium	Trillium pusillum var. virginianum	G3T2	S2	SOC	None	33	Y
Southwest Branch (Back River)							
AMPHIBIANS							
Mabee's Salamander	Ambystoma mabeei	G4	S1S2	None	LT	17	Y
REPTILES							
Canebrake Rattlesnake	Crotalus horridus [Coastal Plain population]	G4T4	S1	None	LE	19	Y
VASCULAR PLANTS							
Virginia Least Trillium	Trillium pusillum var. virginianum	G3T2	S2	SOC	None	33	Y

Note: On-line queries provide basic information from DCR's databases at the time of the request. They are NOT to be substituted for a project review or for on-site surveys required for environmental assessments of specific project areas.

For Additional Information on locations of Natural Heritage Resources please submit an information request.

To Contribute information on locations of natural heritage resources, please fill out and submit a rare species sighting form.

Nadal, Teresita I CIV USARMY CENAO (US)

From: David O'Brien - NOAA Federal <david.l.o'brien@noaa.gov>
Sent: Thursday, September 14, 2017 12:08 PM
To: Nadal, Teresita I CIV USARMY CENAO (US)
Cc: Pruhs, Robert S CIV USARMY CENAO (US)
Subject: [EXTERNAL] Back River Federal Navigation Project, Cities of Hampton and Poquoson, VA; EFH assessment

Hello Teri,

Thank you for providing the additional information regarding the Back River federal navigation project located in the Cities of Hampton and Poquoson, Virginia. We understand that the originally proposed use of an upland placement site is no longer a viable option for dredge material disposal due to potential impacts to tidal emergent and forested wetlands associated with dyke repair and enhancement. Material will now be dredged mechanically, loaded into barges and disposed at the Norfolk Open Disposal Site (NODS).

Based on the information you've provided, including the 300 ft. minimum distance from the navigation channel to the closest bed of submerged aquatic vegetation (SAV) as well as the volume of material to be dredged and the sediment's texture (sand) between stations 120+00 to 172+00 (approx. 7,000 cu. yds.) and stations 80+00 to 120+00 (approx. 3,400 cu. yds.), we rescind our previous recommendation for a time of year restriction (TOYR) on dredging activities which may now be conducted at any time of the year as dictated by the project schedule.

Please contact me if you have any questions. Should new information become available or the project revised in such a manner that affects the baseline for this essential fish habitat (EFH) determination, the EFH consultation must be re-initiated.

Regards,
Dave

David L. O'Brien
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Gloucester Point, VA 23062
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david.l.o'brien@noaa.gov

On Thu, Aug 24, 2017 at 10:25 AM, Nadal, Teresita I CIV USARMY CENAO (US) <Teresita.I.Nadal@usace.army.mil> wrote:

> Dave,
> The upland site previously coordinated has developed some complications for using the site for the Back River Channel. Recent geotechnical findings indicate the existing containment dikes will require significant

improvements to meet required factors of safety for slope stabilization. The site would require dike improvements that may permanently and temporarily impact emergent wetlands and forested wetlands potentially requiring mitigation. As a result, the project will be seeking appropriate permits for use of NODS for the dredged material placement. The NODS alternative will avoid impacts to vegetated wetlands and achieve the goal of restoring navigation to the Back River Channel in the most timely manner.

Per our previous discussion concerning SAV resources in the project area, we have attached a figure to this email showing SAV resources in the proximity of the channel. The closest SAV bed is located approximately 300-feet from the channel near the mouth of the Back River. This area of the Back River Channel will require minimal dredging (approximately 7,000 cy of pay material, station 120+00 to 172+00 and 3,400 cy of pay material, station 80+00 to 120+00) and will likely only require approximately 5-days to complete. The sediments in these station ranges are predominantly sands that will not result in significant sediment re-suspension and we do not foresee impacts to SAV resources in that area. The majority of the dredging work will be required from the dog-leg in the channel (approximate station 80+00) to the fuel pier. There are no SAV resources in close proximity to this reach of the channel. The closest SAV are greater than 1,000-feet from these upstream portions of the channel.

Maintenance dredging will be performed by a mechanical dredge with ocean disposal at the Norfolk Ocean Disposal Site. The contractor will need to be provided 150 to 180 days to complete the dredging. Accomplishing all dredging between mid-October through mid-March (5 months) will be logistically difficult considering winter sea-state conditions off-shore during the winter months which will limit the contractor's opportunity to safely transit to the off-shore placement site.

Based on the distance of the SAV resources to the upstream reaches of the channel (>1,000 feet), the minimal required work in the vicinity of the SAV at the mouth of Back River, and placement of the dredged material at NODS ocean site the potential impacts to the resource in Back River will be minimized. Therefore, I request your consideration to drop the recommended time of year restriction for dredging between mid-March and Mid-October. We have attached maps depicting the SAV beds locations in relation to the navigation channel. Please do not hesitate to contact me if you have any further questions.

VR ,

Teri

Teri Nadal
Environmental Manager
Ops Branch, Technical Support Section
U.S. Army Corps of Engineers
Norfolk District
(757) 201-7299

-----Original Message-----
From: David O'Brien - NOAA Federal [mailto:david.l.o'brien@noaa.gov]
Sent: Friday, July 28, 2017 3:40 PM
To: Nadal, Teresita I CIV USARMY CENAO (US) <Teresita.I.Nadal@usace.army.mil>
Subject: [Non-DoD Source] Back River Federal Navigation Project, Cities of Hampton and Poquoson, VA; EFH assessment

Hello Teri,

Sorry for the delay in getting back to you since we last spoke by phone, I've been out of the office the last several weeks following knee surgery.

I have reviewed the essential fish habitat (EFH) assessment you prepared for the Back River Federal Navigation project, located in the Cities of Poquoson and Hampton, Virginia. As you know, Back River is designated as EFH for fourteen (14) federally managed species and a habitat area of particular concern (HAPC) for sandbar shark. Back River also supports beds of submerged aquatic vegetation (SAV) which is a HAPC for numerous recreational and commercially important fisheries as well as forage species.

The Back River federal navigation channel serves the DLA fuel pier located on Joint Base Langley-Eustis-Langley (JBLE-Langley) as well as the City of Poquoson's marina at Messick Point. The project includes maintenance dredging along the 19,500 ft. long federal navigation channel to restore operational capacity and navigable depths as authorized to -15 ft. MLLW to the JBLE-Langley DLA fuel pier. Approximately 205,000 cubic yards of subaqueous bottom sediment will be dredged each maintenance cycle, anticipated to occur every 15 years. The initial dredge event includes approximately 35,000 cubic yards of new dredging required to access Langley's recently re-configured DLA fuel pier.

It has yet to be determined whether the federal navigation channel will be dredged by hydraulic or mechanical method. The preferred option is to hydraulically dredge and utilize a floating pipeline to pump material to the adjacent 18 acre Mears upland disposal site. The Mears site was last used in 2009 and has been used for dredge material disposal over the last 50 years. However, the Mears site requires restoration prior to accepting any additional dredge material and may not have sufficient capacity for this project. The second preferred option is to dredge via mechanical method with the excavated material deposited into barges or scows for transport offshore to the approved Norfolk Ocean Disposal Site (NODS) located 17 miles east of the Chesapeake Bay. The Back River federal navigation channel maintenance dredging is anticipated to begin in September 2018 and will continue for approximately 90 days.

As stated in your EFH assessment, SAV is located within 300 ft. of the federal navigation channel in some locations. In addition, a review of mapping by the Virginia Institute of Marine Science (VIMS) submerged aquatic vegetation monitoring program (VIMS, 2016 data) indicates SAV has colonized the area immediately adjacent the Mears disposal site. While NOAA supports the Corps' preferred alternative using a hydraulic dredge with upland disposal to reduce re-suspended sediment during dredging operations and avoid overboard placement of dredge material onto subaqueous bottom habitat at NODS, we recommend routing the floating pipeline into the Mears disposal site such that it avoids direct impacts to SAV if dredging is conducted hydraulically.

As stated, we generally prefer the use of a hydraulic dredge over mechanical dredging in fine-grained sediment due to its ability to generally reduce re-suspended sediment in the water column which adversely affects water quality. Similarly, re-suspended sediment may settle in sensitive areas adjacent the federal channel, such as SAV and shellfish beds. In order to minimize potential impacts to SAV adjacent the channel, dredging operations should be conducted outside the typical SAV growing season. Therefore, we recommend conducting dredging operations between mid-October and mid-March to the extent practicable. As you know the Virginia Marine Resources Commission (VMRC) has issued several shellfish leases within Back Creek immediately adjacent the federal channel. Therefore, we suggest working with VMRC and leaseholders to coordinate the timing of dredging operations to help reduce potential adverse impacts to shellfish aquaculture operations.

It is the opinion of NOAA Fisheries Service that the proposed maintenance dredging of the Back River federal navigation channel will affect EFH through the removal of the existing benthic community, temporarily increased turbidity and reduced water quality and direct impact to eggs and larvae of several designated species. However, we concur with your determination that the project impacts will not substantially adversely affect EFH, sandbar shark HAPC or SAV provided our recommendations stated above are incorporated into project planning and implementation.

Please note that EFH conservation recommendations require a response from the federal action agency within 30 days of receipt or 10 days before a permit is issued if CRs are not included as a special condition of the permit. In addition, a distinct and further EFH consultation must be reinitiated pursuant to 50 CFR 600.920 (j) if new information becomes available, or if the project is revised in such a manner that affects the basis of the EFH determination or EFH conservation recommendations.

This EFH determination does not address threatened and endangered species under purview of NOAA Fisheries Service. Therefore, please complete the Norfolk District Endangered Species Act Programmatic Consultation Verification Form or contact Mr. Brian Hopper, NOAA Protected Resources Division (410-573-4592) to discuss your project regrading federally listed sea turtles and Atlantic sturgeon.

Thank you for the opportunity to review and comment on this project. Please feel free to contact me if you have any questions.

Regards,
Dave

David L. O'Brien
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david.l.o'brien@noaa.gov <mailto:david.l.o'brien@noaa.gov>

US Army Corps of Engineers
Norfolk District

Channel Station

SAV BEDS 2014

USACE Federal Navigation Channel

0 500 1,000 2,000 3,000 Feet

Map: BackRiver_Nadal
Developed By: Tammy Knecht
Date: 8/15/2017

EFH ASSESSMENT WORKSHEET FOR FEDERAL AGENCIES (modified 3/2016)

PROJECT NAME: Back River Federal Navigation Project

DATE: 03/28/2017

PROJECT NO.: TBD

LOCATION (Water body, county, physical address): Back River, Hampton, Poquoson,VA

PREPARER: Teri Nadal

Step 1: Use the Habitat Conservation Division EFH webpage's Guide to Essential Fish Habitat Designations in the Northeastern United States to generate the list of designated EFH for federally-managed species for the geographic area of interest (http://www.greateratlantic.fisheries.noaa.gov/hcd/index2a.htm). Use the species list as part of the initial screening process to determine if EFH for those species occurs in the vicinity of the proposed action. The list can be included as an attachment to the worksheet. Make a preliminary determination on the need to conduct an EFH consultation.

1. INITIAL CONSIDERATIONS		
EFH Designations	**Yes**	**No**
Is the action located in or adjacent to EFH designated for eggs? **List the species:** See attachment	✓	☐
Is the action located in or adjacent to EFH designated for larvae? **List the species:** See attachment	✓	☐
Is the action located in or adjacent to EFH designated for juveniles? **List the species:** See attachment	✓	☐
Is the action located in or adjacent to EFH designated for adults or spawning adults? List the species: See attachment	✓	☐
If you answered no to all questions above, then EFH consultation is not required - go to Section 5. If you answered yes to any of the above questions proceed to Section 2 and complete remainder of the worksheet.	✓	☐

Step 2: In order to assess impacts, it is critical to know the habitat characteristics of the site before the activity is undertaken. Use existing information, to the extent possible, in answering these questions. Identify the sources of the information provided and provide as much description as available. These should not be yes or no answers. Please note that there may be circumstances in which new information must be collected to appropriately characterize the site and assess impacts. Project plans that show the location and extent of sensitive habitats, as well as water depths, the HTL, MHW and MLW should be provided.

2. SITE CHARACTERISTICS

Site Characteristics	Description
Is the site intertidal, sub-tidal, or water column?	Dredging is subtidal. Placement site will be at the previously used Mears upland confined facility or ocean disposal site (water column NODS).
What are the sediment characteristics?	The sediment composition varies from 6.2 % sand at the upstream segment of the channel to 95% sand towards the mouth of the channel.
Is there submerged aquatic vegetation (SAV) at or adjacent to project site? If so describe the SAV species and spatial extent.	SAV is located at a distance of approximately 300 feet from the toe of the channel. There is no information on the species identified in the VIMS SAV mapper or Corpsmap. Corpsmap with VIMS SAV 2014 data (Figure 3).
Are there wetlands present on or adjacent to the site? If so, describe the spatial extent and vegetation types.	Estuarine, marine, & freshwater emergent wetlands can be found adjacent to the project area. The closest wetlands identified are estuarine and marine wetlands adjacent to the entrance of the channel at a distance of approximately 150 feet from the toe of the channel (Figure 4).
Is there shellfish present at or adjacent to the project site? If so, please describe the spatial extent and species present.	5 VMRC private oyster leases, 1 pending oyster lease, (approx 650,000 sq ft), and part of of a VMRC public clamming ground (approx 250,000 sq ft) are located within the channel (Figure 5).
Are there mudflats present at or adjacent to the project site? If so please describe the spatial extent.	No mudflats are present.
Is there rocky or cobble bottom habitat present at or adjacent to the project site? If so, please describe the spatial extent.	No rocky or cobble habitat is present.
Is Habitat Area of Particular Concern (HAPC) designated at or near the site? If so for which species, what type habitat type, size, characteristics?	Important nursery and pupping grounds have been identified in shallow areas and the mouth of the Chesapeake Bay for sandbar shark.
What is the typical salinity, depth and water temperature regime/range?	The average salinity range is 14.8 - 23.5 ppt. Temperature range 33 - 85 degrees farenhiet.
What is the normal frequency of site disturbance, both natural and man-made?	Maintenance dredging is performed approximately every 15 years.

What is the area of proposed impact (work footprint & far afield)?	1,950,000 square feet

<u>Step 3</u>: This section is used to describe the anticipated impacts from the proposed action on the physical/chemical/biological environment at the project site and areas adjacent to the site that may be affected.

3. DESCRIPTION OF IMPACTS

Impacts	Y	N	Description
Nature and duration of activity(s). Clearly describe the activities proposed and the duration of any disturbances.			Mechanical or hydraulic dredging (approximately 3 months) and ocean placement (3 months) to a maximum depth of 15ft MLLW. Dredged material will be transported by pipeline to an upland confined disposal facility or by barge/scow for disposal at the authorized ocean placement site.
Will the benthic community be disturbed? If no, why not? If yes, describe in detail how the benthos will be impacted.	✓	☐	Dredging and material placement will impact non-motile benthic organisms through direct removal of substrate and placement activities at the ocean disposal site. Once dredging is complete, benthic organisms will repopulate the area.
Will SAV be impacted? If no, why not? If yes, describe in detail how the SAV will be impacted. Consider both direct and indirect impacts. Provide details of any SAV survey conducted at the site.	☐	✓	No. SAV are located at an approximate distance of 300 feet from the toe channel.
Will salt marsh habitat be impacted? If no, why not? If yes, describe in detail how wetlands will be impacted. What is the aerial extent of the impacts? Are the effects temporary or permanent?	☐	✓	There are no salt marsh within the project area.
Will mudflat habitat be impacted? If no, why not? If yes, describe in detail how mudflats will be impacted. What is the aerial extent of the impacts? Are the effects temporary or permanent?	☐	✓	There are no mudflats within the project area.
Will shellfish habitat be impacted? If so, provide in detail how the shellfish habitat will be impacted. What is the aerial extent of the impact?	☐	✓	

Provide details of any shellfish survey conducted at the site.	☐	☑	No survey has been conducted.
Will hard bottom (rocky, cobble, gravel) habitat be impacted at the site? If so, provide in detail how the hard bottom will be impacted. What is the aerial extent of the impact?	☐	☑	No
Will sediments be altered and/or sedimentation rates change? If no, why not? If yes, describe how.	☑	☐	Dredging will remove sediments from the channel. Sedimentation rates will increase at the ocean placement site.
Will turbidity increase? If no, why not? If yes, describe the causes, the extent of the effects, and the duration.	☑	☐	Yes, there will be a temporary increase in turbidity during dredging operations and at the placement material at the ocean site.
Will water depth change? What are the current and proposed depths?	☑	☐	The water depth within the Back River channel will be restored to the maintained depth of -15ft.
Will contaminants be released into sediments or water column? If yes, describe the nature of the contaminants and the extent of the effects.	☐	☑	The dredged material has been evaluated in accordance with the MPRSA Section 103 regulations for ocean disposal.
Will tidal flow, currents, or wave patterns be altered? If no, why not? If yes, describe in detail how.	☐	☑	
Will water quality be altered? If no, why not? If yes, describe in detail how. If the effects are temporary, describe the duration of the impact.	☐	☑	
Will ambient noise levels change? If no, why not? If yes, describe in detail how. If the effects are temporary, describe the duration and degree of impact.	☐	☑	

Does the action have the potential to impact prey species of federally managed fish with EFH designations?	✓	☐	

Step 4: This section is used to evaluate the consequences of the proposed action on the functions and values of EFH as well as the vulnerability of the EFH species and their life stages. Identify which species (from the list generated in Step 1) will be adversely impacted from the action. Assessment of EFH impacts should be based upon the site characteristics identified in Step 2 and the nature of the impacts described within Step 3. The Guide to EFH Descriptions webpage (http://www.greateratlantic.fisheries.noaa.gov/hcd/list.htm) should be used during this assessment to determine the ecological parameters/preferences associated with each species listed and the potential impact to those parameters.

4. EFH ASSESSMENT			
Functions and Values	Y	N	Describe habitat type, species and life stages to be adversely impacted
Will functions and values of EFH be impacted for:			
Spawning If yes, describe in detail how, and for which species. Describe how adverse effects will be avoided and minimized.	☐	✓	
Nursery If yes, describe in detail how and for which species. Describe how adverse effects will be avoided and minimized.	✓	☐	Important nursery and pupping grounds in shallow waters during the summer for sandbar shark.
Forage If yes, describe in detail how and for which species. Describe how adverse effects will be avoided and minimized.	☐	✓	Species are are able to relocate and forage in other areas during dredging operations.
Shelter If yes, describe in detail how and for which species. Describe how adverse effects will be avoided and minimized.	☐	✓	Species are able to relocate during dredging operations.

Will impacts be temporary or permanent? Describe the duration of the impacts.			Impacts will be minor and temporary. Dredging activities are expected to be performed for approximately 90 days.
Will compensatory mitigation be used? If no, why not? Describe plans for mitigation and how this will offset impacts to EFH. Include a conceptual compensatory mitigation plan, if applicable.	☐	☑	

Step 5: This section provides the federal agency's determination on the degree of impact to EFH from the proposed action. The EFH determination also dictates the type of EFH consultation that will be required with NOAA Fisheries.

Please note: if information provided in the worksheet is insufficient to allow NOAA Fisheries to complete the EFH consultation additional information will be requested.

5. DETERMINATION OF IMPACT

	/	Federal Agency's EFH Determination
Overall degree of adverse effects on EFH (not including compensatory mitigation) will be: (check the appropriate statement)	☐	**There is no adverse effect on EFH or no EFH is designated at the project site.** **EFH Consultation is not required**
	☑	**The adverse effect on EFH is not substantial. This means that the adverse effects are either no more than minimal, temporary, or that they can be alleviated with minor project modifications or conservation recommendations.** **This is a request for an abbreviated EFH consultation.**
	☐	**The adverse effect on EFH is substantial.** **This is a request for an expanded EFH consultation**

Joint Base Langley-Eustis-Langley (JBLE-Langley) needs to perform maintenance and new work dredging of the Back River Federal Navigation Channel to maintain an operational channel for its vessels. This channel provides access and safe navigation in support of national defense to the JBLE-Langley located in Hampton, Virginia from the Chesapeake Bay.

The Back River Federal Navigation Channel, an estuarine inlet of the Chesapeake Bay is located between the cities of Hampton and Poquoson, Virginia. The channel is approximately 19,500 feet in length with a surface area of 46 acres, 100 feet wide and -15 feet deep MLLW. The center of the project is located at 37° 6.183333' north latitude and 76° 19.292965' west longitude.

Dredging will be conducted by hydraulic cutterhead and/or mechanical to a maximum depth of -15 MLLW removing approximately 205,000 cubic yards of (CY) material each dredging cycle, of which 35,000 CY is new work dredging. The salinity range is 14.8 - 23.5 ppt.

The channel may be dredged by hydraulic cutterhead dredge and placed via pipeline at an upland confined placement facility (Mears Site) or by a mechanical dredge and placed onto barges/scow for material transport to the Norfolk Ocean Disposal Site (NODS). The Mears Site has been previously used and is the preferred placement site. The NODS is the alternate preferred site during the dredging cycles when the Mears Site is unavailable for receiving dredged material. Dredging is expected to commence in September 2018 and be completed within approximately 90 days. Currently, there are no time of year restrictions.

Since the last dredging cycle, new private oyster leases and pending leases are located within the Back River Navigation Channel. The Corps received an email response from VMRC on private oyster leases that states, “It is our policy to not lease Federal Project Channels. Any survey of this area will exclude the channel footprint.” Therefore, further coordination with the private oyster holders that are located within the Back River Navigation Channel is not required. The new work dredging area has been previously coordinated with the private oyster leaseholder. A portion of a public clamming ground is also located within the channel. According to the *“Regulation: Pertaining to Shellfish Management Areas Virginia Marine Resources Commission "Pertaining to Shellfish Management Areas" Regulation 4 VAC 20-560-10 ET. SEQ.*
Statutory Authority (approved by law) is, however, conferred on:
3. Construction and maintenance of Congressionally approved navigation or flood control projects undertaken by an authorized federal agency.”
Therefore, no additional special coordination is required for public clamming areas or the private oyster leases that are depicted in the federal channel.

The Mears Site is located in the City of Hampton. The upland confined placement facility is located on a small peninsula to the southwest of Stoney Point, across the Southwest Branch of Back River from JBLE-Langley. The Mears Site is approximately 18 acres and has been in use for more than 50 years. The Mears Site is the preferred placement site. The site will need to be restored prior to dredged material placement and may not have sufficient capacity for dredged material placement. The center of the site is located at 37° 5.350304' north latitude and 76° 19.424286' west longitude. Dredged material placement operations at the Mears Site typically have occurred via hydraulic pipeline to the upland confined placement facility. The pipeline will consist of floating pipeline to the shoreline.

The center of the Norfolk Ocean Disposal Site (NODS) is located 17 nautical miles east of the mouth of the Chesapeake Bay. The NODS is circular with a radius of four nautical miles and an area of approximately 50 square nautical miles. The center of the NODS site is located at 36° 59' north latitude and 75° 39' west longitude. Water depths near the center of the site vary between 43 to 85 feet. Bottom topography is generally flat with depth contours running parallel to the coastline.

If the Mears Site were unavailable, the dredged material would be transported for ocean disposal at NODS. The material within the channel has been tested and meets the requirements for ocean placement. The approximate number of trips to NODS depends on the capacity of the scow and will range from 50 to 100 trips.

The Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended by the Sustainable Fisheries Act of 1996, requires all Federal agencies to consult with the National Marine Fisheries Service (NMFS) on all actions, or proposed actions, permitted, funded, or undertaken by the agency that may adversely affect Essential Fish Habitat (EFH). Congress defines EFH as, "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity". The MSA governs the EFH and requires the identification of EFH for managed species as well as measures to conserve and enhance the habitat necessary for fish to carry out their life cycles. The NMFS oversees the EFH designations, and gives guidance to minimize harm to EFH. Habitat Areas of Particular Concern (HAPC) are subsets of EFH and are given special consideration to adverse impacts. The project site lies adjacent to EFH for several species including: eggs, larvae, juvenile and adult Atlantic butterfish (*Peprilus triacanthus*); juvenile and adult black sea bass (*Centropristus striata*); juvenile and adult bluefish *(Pomatomus saltatrix*); eggs, larvae, juvenile, and adult stages of cobia (*Rachycentron canadum*); larvae and juvenile dusty shark *Charcharinus obscurus)*; eggs, larvae, juvenile, and adult king mackerel (*Scomberomorus cavalla*); eggs, larvae, juvenile, and adult red drum (*Sciaenops occelatus*); larvae, juvenile and adult sandbar shark *(Charcharinus plumbeus)*; eggs, larvae, juvenile, and adult Spanish mackerel (*Scomberomorus maculatus)*; larvae, juvenile and adult summer flounder (*Paralicthys dentatus*); juvenile and adult windowpane flounder (*Scopthalmus aquosus*); juvenile and adult Clearnose Skate, Little Skate and Winter Skate. In addition to these EFH designations, the area has been designated as a HAPC for larvae, juvenile and adult life cycles of the sandbar shark.

The proposed maintenance dredging duration for the Back River Federal Navigation Channel project is 90 days. The project will result in the temporary loss of benthic organisms in the channel footprint. Maintenance dredging and material placement site impacts will be minor and temporary. Any fish within the area would relocate and return once work is complete. This project does not have the potential to substantially adversely affect EFH for the species of concern by loss of forage and/or shelter habitat. We have made the determination that the proposed activity may affect, but is not likely to substantially adversely affect, EFH and HAPC.

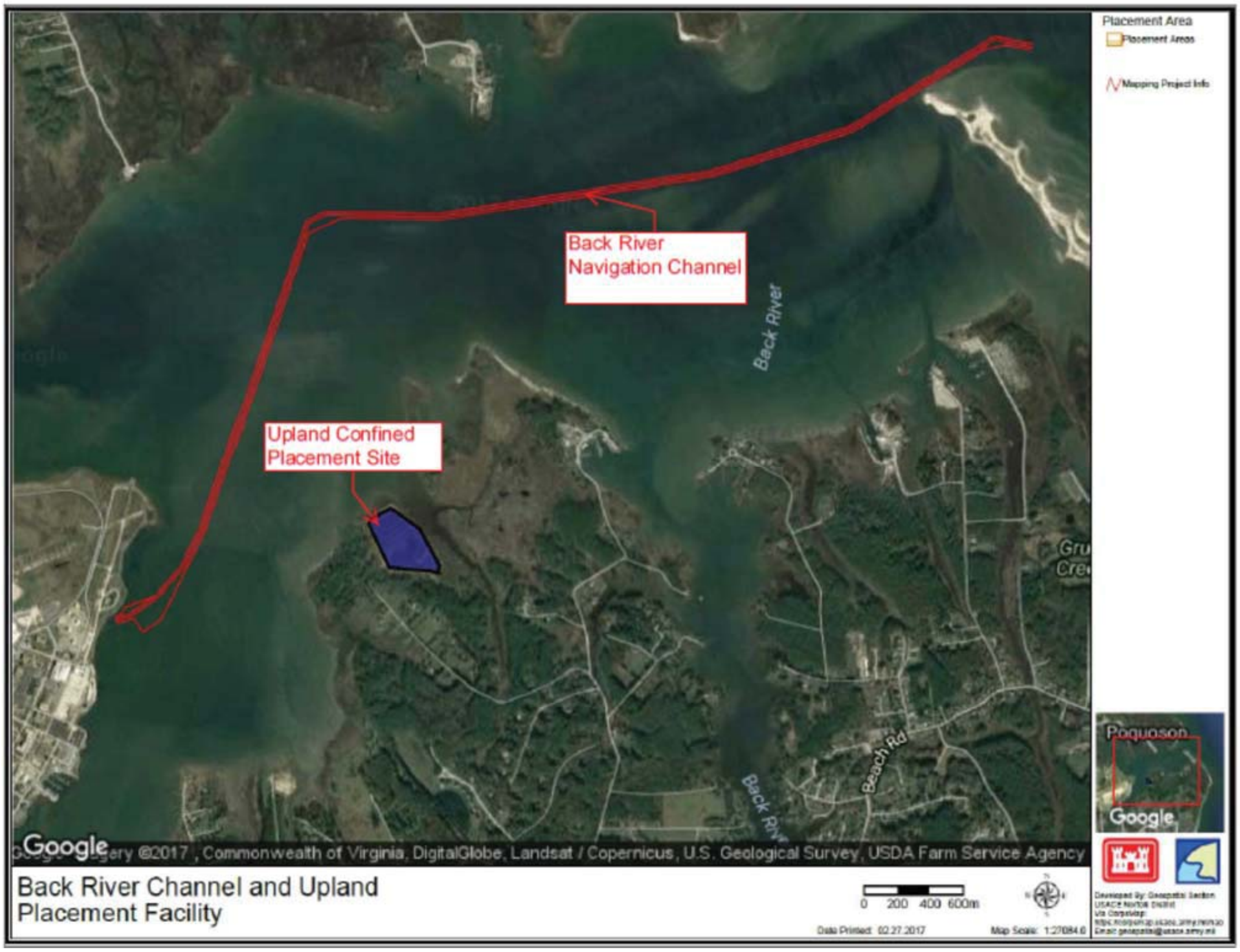


Figure 1. Back River Navigation Channel and Mears Site

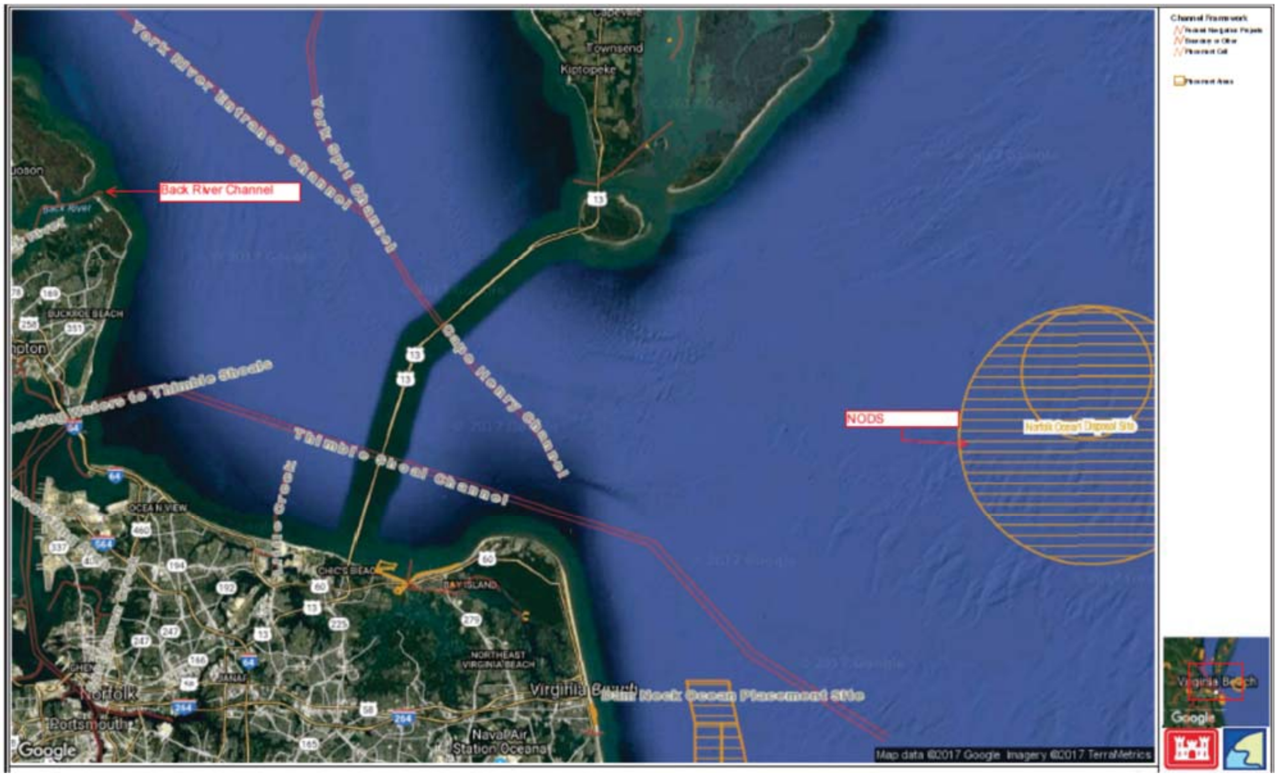


Figure 2. Norfolk Ocean Disposal Site (NODS)

https://www.greateratlantic.fisheries.noaa.gov/hcd/STATES4/virginia/virginia/37007620.html

Accessed January 20, 2017

Summary of Essential Fish Habitat (EFH) Designations

10� x 10� Square Coordinates:

Boundary	North	East	South	West
Coordinate	37° 10.0 N	76° 20.0 W	37° 00.0 N	76° 30.0 W

Square Description (i.e. habitat, landmarks, coastline markers): Waters within the square within Chesapeake Bay affecting the following: the Northwest and Southwest Branches of the Back River, Hampton, VA., Newmarket Creek, Willoughby Pt., Hampton River, Black Kiln Creek, Amorys Wharf, Lloyd Bay, Bennet Creek, White Horse Cove, Bay Pt., Roberts Creek, Hunts Pt., Lambs Creek, Quarter March Creek, Poquoson River, Yorkville, VA., Patricks Creek, and southeast Fish Neck.

Species	Eggs	Larvae	Juveniles	Adults
Atlantic butterfish *(Peprilus triacanthus)*	X	X	X	X
black sea bass *(Centropristis striata)*	n/a		X	X
bluefish *(Pomatomus saltatrix)*			X	X
cobia *(Rachycentron canadum)*	X	X	X	X
dusky shark *(Carcharhinus obscurus)*		X	X	
king mackerel *(Scomberomorus cavalla)*	X	X	X	X
red drum *(Sciaenops occelatus)*	X	X	X	X
sandbar shark *(Carcharhinus plumbeus)*		X	X	X
sandbar shark *(Carcharhinus plumbeus)*		HAPC	HAPC	HAPC
Spanish mackerel *(Scomberomorus maculatus)*	X	X	X	X
summer flounder *(Paralichthys dentatus)*		X	X	X
windowpane flounder *(Scophthalmus aquosus)*			X	X

Back River Federal Navigation Channel

Nearest SAV is at distance 300 feet (VIMS 2014 data) Not to Scale

Figure 3

Date Printed: 02.08.2017

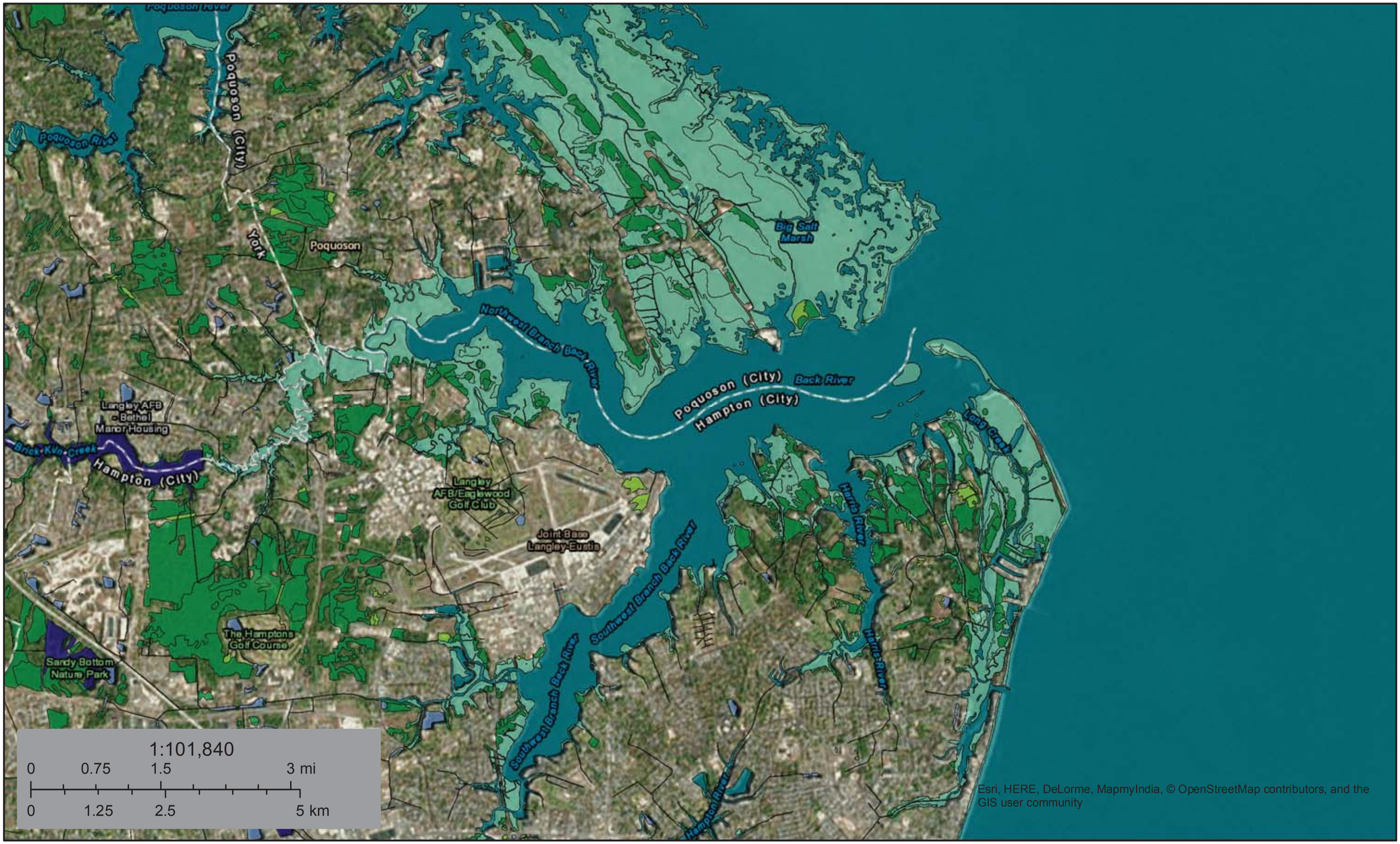
Map Scale: 1:27084.0

Developed By: Geospatial Section
USACE Norfolk District
Via CorpsMap:
https://corpsmap.usace.army.mil/nao
Email: geospatial@usace.army.mil

U.S. Fish and Wildlife Service

National Wetlands Inventory

Back River Wetlands February 2017



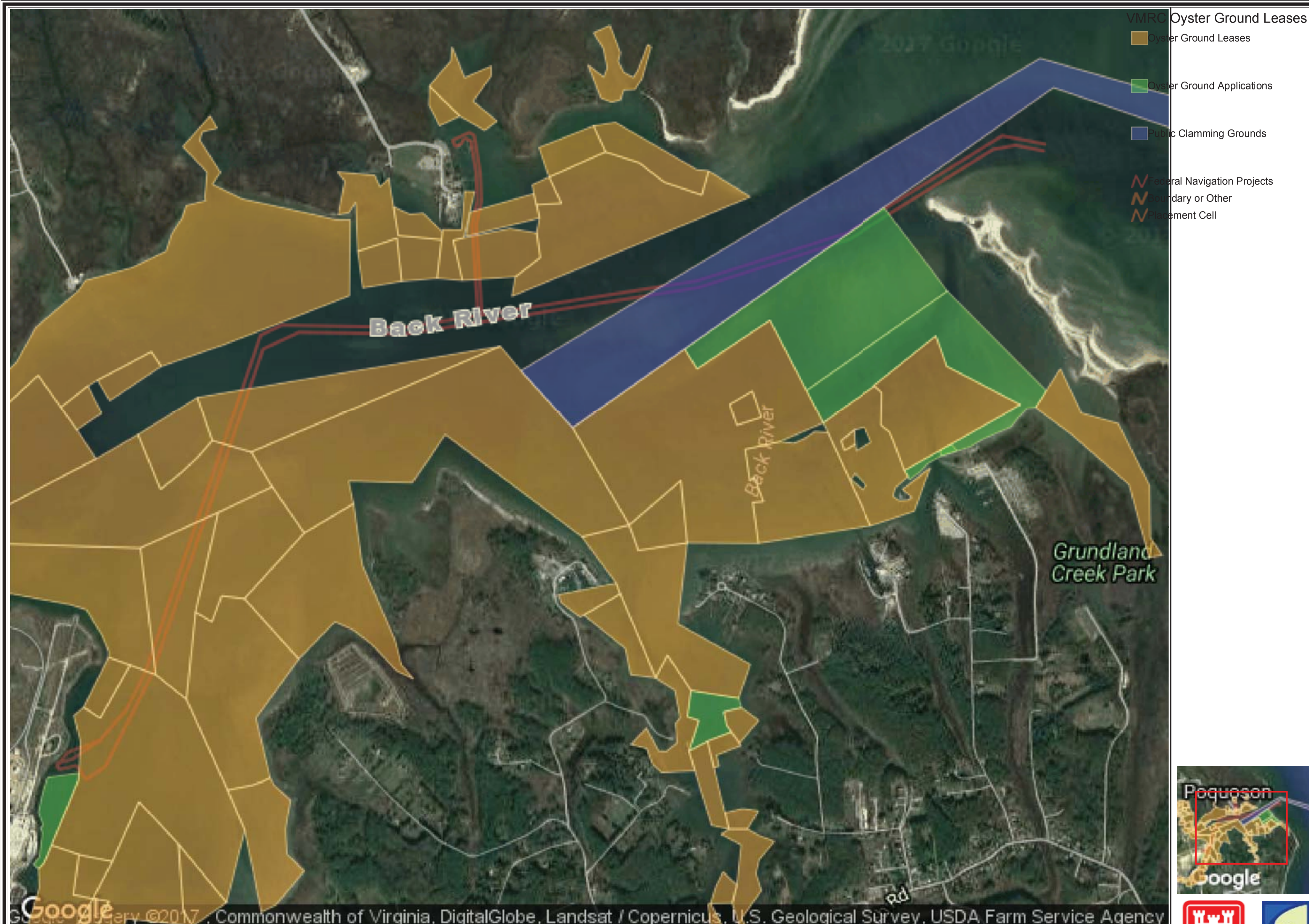
February 2, 2017

- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Other
- Riverine

This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.

Figure 4

National Wetlands Inventory (NWI)
This page was produced by the NWI mapper



Back River Oyster and Clanmming Grounds

Figure 5

0 200 400 600m

Date Printed: 02.13.2017

Map Scale: 1:27084.0

Developed By: Geospatial Section
USACE Norfolk District
Via CorpsMap:
https://corpsmap.usace.army.mil/nao
Email: geospatial@usace.army.mil

APPENDIX D

M.P.R.S.A. Section 103 Evaluation

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

AUG 3 0 2016

Mr. Elizabeth G. Waring
Operations Branch
U.S. Army Corps of Engineers, Norfolk District
Fort Norfolk, 803 Front Street
Norfolk, VA 23510-1096

Dear Ms. Waring:

Thank you for your August 3, 2016 request for concurrence on the suitability for ocean disposal of dredged material into the Norfolk Ocean Disposal Site (NODS) from Joint Base Langley – Eustis, Langley Air Force Base (JBLE-Langley), Back River Channel, pursuant to Section 103 of the Marine Protection Research and Sanctuaries Act (MPRSA). Section 103 of the MPRSA specifies that all proposed operations involving transportation and dumping of dredged material into ocean waters be evaluated for potential environmental impacts. The Secretary of the Army has responsibility for this evaluation using criteria developed by the Administrator of the U.S. Environmental Protection Agency (EPA).

EPA Region 3 has reviewed the Evaluation of Dredged Material for the JBLE-Langley, Back River Channel, and Replicate Tissue Concentrations Rerun for BRC 02/03, DU2, Replicate B, provided by the Norfolk District of the U.S Army Corps of Engineers (Corps) in accordance with Section 103 of the MPRSA. Based on this review and contingent upon the conditions in this letter, EPA concurs that the proposed dredged material meets the Ocean Disposal Criteria (40 CFR 227) and can be placed in the NODS.

Project Overview

The Back River Channel is a Federally-maintained navigation channel located in Hampton, VA adjacent to JBLE. The channel is the primary access for fuel barges that service Langley Fuel Piers in support of JBLE mission requirements. It provides safe navigation from the Chesapeake Bay and to the Messick Point Federal Navigation Channel. Maintenance dredging is necessary to restore full channel depth that has been reduced due to sedimentation. The JBLE-Langley, Back River Channel project requires the removal of approximately 205,000 cubic yards (cy) of maintenance material to a maximum depth of -15 ft MLLW. The material is proposed for placement in the NODS in accordance with 40 CFR. § 228.15. The request to place dredged material in the NODS is among placement options for the JBLE-Langley, Back River Channel project.

EPA Region 3 conducted an independent determination of compliance with the Ocean Disposal Criteria based on the following:

Exclusionary Criteria

In accordance with 40 CFR § 227.13(b), dredged material that meets the criteria set forth in the following paragraphs (b)(1), (2), or (3) of this section is environmentally acceptable for ocean dumping without further testing under this section:

(1) Dredged material is composed predominantly of sand, gravel, rock, or any other naturally occurring bottom material with particle sizes larger than silt, **and** the material is found in areas of high current or wave energy such as streams with large bed loads or coastal areas with shifting bars and channels; or

(2) Dredged material is for beach nourishment or restoration and is composed predominantly of sand, gravel or shell with particle sizes compatible with material on the receiving beaches; or

(3) When the material proposed for dumping is substantially the same as the substrate at the proposed disposal site; **and** the site from which the material would be dredged is far removed from known existing and historical sources of pollution so as to provide reasonable assurance that such material has not been contaminated by such pollution.

The material in the JBLE-Langley, Back River Channel does not meet the exclusionary criteria set forth under 40 CFR § 227.13(b).

Evaluation of the Liquid Phase – Water Quality Criteria (WQC)

JBLE-Langley, Back River Channel is a maintenance project that was divided into six dredging units (DU) to evaluate sediment within the dredging footprint. Core borings were collected from eight locations within DUs 1-4 and sediment grabs were collected from four locations within DUs 5 and 6. Core borings and sediment samples were collected below sediment surface to the project depth of -15 ft MLLW to accommodate for the variable sediment types. The Willoughby Bank and Atlantic Ocean reference sites were chosen to accommodate changes in sediment grain size throughout the channel.

In four of the six DUs, ammonia was detected in the full strength elutriates in concentrations exceeding acute water quality criteria (5.88 mg/L). The laboratory reporting limit for cyanide (10 ug/L) and silver (5 ug/L) also exceeded acute water quality criteria (1 ug/L and 1.9 ug/L, respectively). The dilution factor for cyanide was used to determine the Limiting Permissible Concentration (LPC) compliance for water quality criteria as it was the most conservative.

A minimum 9-fold dilution is required in each DU to comply with the acute and chronic cyanide criteria inside the boundary of the NODS. Results of the STFATE model indicated that a 99- to 101-fold dilution would occur 4 hours following placement for all four DUs and within the boundaries of the disposal zone. This calculation was based on barge placement volumes up to 4,000cy at the center of the NODS.

Based on the information above, the liquid phase of the material is in compliance with 40 CFR § 227.6(c)(1) and 227.27(a)(1).

Evaluation of the Liquid and Suspended Particulate Phases – Suspended Particulate Phase Bioassay-Water Column Toxicity

Bioassays were conducted in each DU using the following three species: *Mytilus galloprovincialis* (blue mussel), *Americamysis bahia* (opossum shrimp), and *Menidia beryllina* (inland silverside). There was statistically significant abnormal development of *M. galloprovincialis* in DUs 2 and 3 (52% and 73%, respectively) compared to the lab controls (98% and 89%, respectively). However, the 48-hour Median Effective Concentration (EC_{50}) value was greater than 100% in each of these DUs. There was no statistically significant effects to organism survival of *A.bahia* or *M. beryllina*; both species had a 96-hour Median Lethal Concentration (LC_{50}) value greater than 100% in all dredging units.

The water column LPC for ocean placement is equivalent to 0.01 of EC_{50} within a 4-hour dilution period. The most conservative LPC value for *M. galloprovincialis* would require a 99-fold dilution for placement at NODS. Neither *A.bahia* nor *M. beryllina* exhibited acute toxicity as a result of the site elutriates. Results of the STFATE model indicated that a 99-101 fold dilution would occur within the site boundary in 4 hours for placement volumes of 32,000 to 62,000cy to meet the LPC. Therefore, the suspended particulate phase of the material complies with 40 CFR § 227.6(c)(2) and 227.27(b).

Solid Phase Toxicity Evaluation-Benthic Toxicity

Ten-day toxicity tests were conducted on project materials using two benthic species, *Ampelisca abdita* and *Leptocheirus plumulosus*. From the six DUs, one composite from each unit was evaluated. The survival rate for *A. abdita* ranged from 86-95% compared to the survival rate in the Willoughby Bank and Atlantic Ocean reference sediments at 89 and 85% respectively. The survival rate for *L. plumulosus* ranged from 95-99% compared to the survival rate in the Willoughby Bank and Atlantic Ocean reference sediments at 99 and 97% respectively.

The dredged material does not meet the LPC for benthic toxicity when bioassay organisms' mortality is statistically greater than in the reference sediment **and** exceeds mortality in the reference sediment by at least 20%. Mortality in the dredged material is not statistically greater than in the reference sediment, and does not exceed mortality in the reference sediment by 20%. Therefore, the dredged material meets the LPC for benthic toxicity and complies with the benthic bioassay criteria set forth in 40 CFR § 227.13(c)(3).

Solid Phase Bioaccumulation Evaluation

Twenty-eight day bioaccumulation tests were conducted on the solid phase of the project material for the contaminants of concern using two appropriate sensitive benthic marine organisms, *Nereis virens* (sand worm) and *Macoma nasuta* (blunt nose clam). Tissue analyses were conducted for metals, PAHs, dioxin and furan congeners, PCBs, and chlorinated pesticides in DUs 1-4; tissue analyses were conducted for metals, dioxin/furans, and select pesticides in DUs 5-6.

Mean concentrations of OCDD in DU 2 statistically exceeded mean concentrations detected in tissues exposed to the Willoughby Bank reference material. Mean concentrations of lead and nickel exceeded mean concentrations detected in tissues exposed to the Atlantic Ocean reference material. Other contaminants were detected at concentrations statistically exceeding that of reference material, but did not statistically exceed the mean concentrations of pre-test tissue. Contaminant concentrations in tissues exposed to project material were compared to the U.S. Food and Drug Administration (FDA) Action/Guidance/Tolerance (Action) Levels. The comparison resulted in none of the contaminant concentrations, for which there are FDA Action Levels, exceeded such thresholds in the tissues of organisms exposed to the project material.

When bioaccumulation of contaminants in dredged material tests exceeds that in the reference, general risk-based evaluations must be conducted to evaluate compliance with 40 CFR § 227.13(c)(3). EPA Region 3 conducted such an evaluation and determined there is no potential for undesirable effects due to bioaccumulation as a result of the presence of individual chemicals or of the solid phase of the material as a whole. Accordingly, the solid phase of the material proposed for disposal meets the ocean disposal criteria set forth in 40 CFR § 227.6(c)(3) and 227.27(b).

In accordance with the Water Resources Development Act of 1992 amendments to MPRSA, disposal activities must be conducted in accordance with the NODS Management and Monitoring Plan (SMMP) including the following:

- Disposal will occur within boundaries of the site and at least 100 meters (300 ft.) from the perimeter of the disposal site;
- The disposal site shall be surveyed before and after the project to ensure proper placement of materials and compliance with NODS conditions;
- Each disposal vessel will have an Electronic Tracking System and the Corps will maintain all data associated with the project; and
- The Corps will provide EPA with a disposal summary report following completion of the project.

Again, this concurrence is conditioned upon implementation of the above requirements and is valid for a term of three years from August 26, 2016. Use of the NODS after August 26, 2019 will require further evaluation of the proposed dredged material. Should you have any questions regarding this concurrence or use of the NODS, please contact me or Mrs. Kristin Regan at 215-814-2711.

Sincerely,

John Forren, Associate Director
Environmental Assessment & Innovation Division
U.S. EPA, Region III

EVALUATION OF DREDGED MATERIAL

BACK RIVER CHANNEL
JOINT BASE LANGLEY-EUSTIS, HAMPTON, VIRGINIA

FINAL

Prepared for

U.S. Army Corps of Engineers
Norfolk District
803 Front St.
Norfolk, Virginia 23510

Prepared by

EA Engineering, Science, and Technology, Inc., PBC
225 Schilling Circle
Suite 400
Hunt Valley, Maryland 21031
(410) 584-7000

September 2016

EVALUATION OF DREDGED MATERIAL

BACK RIVER CHANNEL
JOINT BASE LANGLEY-EUSTIS, HAMPTON, VIRGINIA

FINAL REPORT

SEPTEMBER 2016

Prepared for

U.S. Army Corps of Engineers
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803 Front St.
Norfolk, Virginia 23510

Prepared by

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Suite 400
Hunt Valley, Maryland 21031
(410) 584-7000

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EXECUTIVE SUMMARY

Back River Channel is a Federally-maintained navigation channel located adjacent to Joint Base Langley-Eustis (JBLE) in Hampton, Virginia (Figure ES-1). The channel provides for safe navigation from the Chesapeake Bay to JBLE. The channel is the primary access for fuel barges servicing the Langley Fuel Piers in support of JBLE mission requirements. The channel also provides access to the Messick Point Federal Navigation Channel. Sedimentation has reduced the channel depths from required dimensions. Maintenance dredging is necessary to restore full channel depth to ensure safe navigation for vessels utilizing the channel.

An evaluation of the dredged material is required prior to dredging and placement to ensure that the material is appropriate for available placement options. Placement options for the JBLE Back River Channel project include ocean at the Norfolk Ocean Disposal Site (NODS) and upland placement (Figure ES-1). Data collected for the JBLE Back River Channel were used to document compliance with Section 103 of the Marine Protection, Research, and Sanctuaries Act (MPRSA) for ocean placement at the NODS. In addition, test results were evaluated with respect to criteria for placement at Port Tobacco at Weanack and applicable Commonwealth of Virginia regulations for other regional upland placement options.

EA Engineering, Science, and Technology, Inc., PBC was contracted by the U.S. Army Corps of Engineers (USACE)-Norfolk District to evaluate the sediment characteristics for the JBLE Back River Channel project with respect to the requirements for ocean and upland placement. Specific dredged material placement options include: ocean placement at the NODS (Figure ES-2), upland placement at Port Tobacco at Weanack (Figure ES-2), and placement at other approved regional upland locations (Figure ES-2). The evaluation consisted of collecting sediment cores and sediment grab samples to a depth of -15 feet (ft) mean lower low water; collecting surficial sediment at the Willoughby Bank and Atlantic Ocean reference sites and the Chesapeake Bay control site; collecting site water/elutriate preparation water; collecting receiving water from the NODS; conducting analytical testing of bulk sediment, site water, receiving water, and standard elutriate samples; conducting ecotoxicological testing of sediment (water column bioassays, whole sediment bioassays, and bioaccumulation studies); conducting analytical testing of aquatic organism tissue as appropriate; Short Term Fate (STFATE) modeling of dredged material placement at the NODS; and evaluating test results with respect to the Ocean Dumping Regulations in title 40 of the Code of Federal Regulations (CFR) Parts 220-228 and also with respect to requirements for placement at Port Tobacco at Weanack and Virginia regulations for other upland placement options.

ES.1 TECHNICAL APPROACH

This investigation was designed to identify, analyze, and evaluate the physical, chemical, and ecotoxicological characteristics of sediment and water samples that are representative of the maintenance dredging material in the JBLE Back River Channel. Areas where shoaling had occurred were targeted in the selection of sampling locations.

A total of 12 locations were sampled in the JBLE Back River Channel (two locations in each dredging unit [DU]). Eight locations were sampled with a vibracorer and four were sampled with a Van Veen sampler. Sediment from multiple sampling locations within each DU was composited together for analysis (Figure ES-2). Site water was collected from one site within the dredging footprint for site water and standard elutriate preparation. In addition, two reference sediment samples, one from the Willoughby Bank reference site comprised of silty sand material and one from the Atlantic Ocean reference site comprised of sandy material, and sediment from the Chesapeake Bay Control Site (for amphipod bioassays) were collected (Figure ES-2). Receiving water was also collected from a location within the NODS and submitted for chemical analysis for use in STFATE modeling. Sampling took place from 6 to 10 December 2015. Field sampling and analytical components of the JBLE Back River Channel project were consistent with other regional studies for ocean placement, and consistent with the guidance defined in 40 CFR 227 of the MPRSA.

Analytical testing of the bulk sediments, site and receiving water, standard elutriates, and tissue was conducted by TestAmerica-Pittsburgh, located in Pittsburgh, Pennsylvania. The analytical program included the following tasks:

- Physical analyses of sediment from twelve discrete locations, six composite sediment samples, the Willoughby Bank reference sediment, and the Atlantic Ocean reference sediment included grain size (sieve and hydrometer), Atterberg Limits, specific gravity, and total solids.

- Preparation and analysis of six standard elutriates using sediment composites and site water to simulate the potential release of metals and organic constituents during ocean placement.

- Chemical analysis of bulk sediment, site water, and standard elutriates for the following project-specific target analytes: acid volatile sulfide (sediment only), simultaneously extracted metals (sediment only), butyltins, semivolatile organic compound (SVOCs), metals (including mercury), chlorinated pesticides, polycyclic aromatic hydrocarbon (PAHs), polychlorinated biphenyl (PCB) congeners, dioxin/furan congeners, cyanide, total sulfides, ammonia, and total organic carbon.

- Chemical analysis of discrete sediment samples to determine suitability for placement at alternate upland disposal sites. Analyses included: total petroleum hydrocarbons (TPH) (gasoline range [TPH-GRO, C6-C10] and diesel range [TPH-DRO, C10-C34]); PCB aroclors; benzene, toluene, ethylene, and xylene (BTEX); extractable organic halides (EOX); Toxicity Characteristic Leachate Procedure (TCLP) plus ignitability, corrosivity, reactivity; paint filter test; pH; flashpoint; potential acidity; neutralization potential; acid base accounting; calcium carbonate equivalence; pyritic sulfur (fizz rating); and saturated paste pH and conductivity.

- Chemical analysis of aquatic organism tissue: metals (including mercury), PAHs (DU1, DU2, DU3, and DU4 only), PCBs (DU1 and DU2 only) dioxin and furan congeners, and select chlorinated pesticides (DU1, DU2, DU3, DU4, and DU5 only) (dichlorodiphenyltrichloroethane [DDT] series, beta-benzenehexachloride [BHC], dacthal, endrin, endrin aldehyde, methoxychlor, and mirex only).

ES.2 UPLAND PLACEMENT OPTIONS

ES.2.1 POTENTIAL SUITABILITY FOR PLACEMENT

The 12 discrete samples from JBLE Back River Channel were analyzed with respect to requirements for placement at Port Tobacco at Weanack and Virginia regulations for other upland placement options.

The data in this report are intended to be used to assess potential suitability for placement at Port Tobacco at Weanack and other regional upland locations. Facility-specific confirmatory sampling and testing may be required during the transport and placement process. Port Tobacco at Weanack requires minimum testing of one composite sample per 50,000 cubic yards (cy) of *in situ* material. In addition, a minimum of three samples per material is required regardless of volume.

ES.2.2 SUMMARY OF RESULTS

In the 12 discrete samples, none of the tested constituents (metals, PAHs, PCBs, pesticides, or SVOCs) exceeded the Virginia Exclusion Criteria. The acid-base accounting values (soil suitability) in DU1 through DU4 indicate the material is considered suitable for placement at the Weanack facility and could support agricultural growth as is, without the addition of any soil amendments. The acid-base accounting values in DU5 and DU6 indicate that the material would require additional soil amendment (lime) to meet agricultural use requirements at the Weanack facility. Additional coordination with the Weanack facility would be required to determine material acceptability.

Additional analytical testing, including the paint filter test, EOX, BTEX, and TCLP was conducted to evaluate the feasibility of other upland placement options. Results indicated that five samples passed through the paint filter (BRC-08 through BRC-12 contained free liquid), that none of the samples were flammable, and that sediment pH was near neutral (ranging from 6.26 to 8.12). EOX was not detected, and BTEX constituents were either not detected or estimated below the laboratory reporting limit. In addition, TPH-GRO was not detected, and TPH-DRO concentrations ranged from 9.6 (BRC-12) to 230 (BRC-04) milligrams per kilogram (mg/kg).

For TCLP, of the 38 chemical constituents tested, only 5— arsenic, barium, cadmium, lead, and selenium—were detected at low concentrations and were each estimated below the laboratory reporting limit in the JBLE Back River Channel leachate. The concentrations of the detected chemical constituents were compared to the limiting concentration of contaminants for toxicity characteristics (40 CFR 261.24). Concentrations of detected constituents were well below the toxicity characteristic criteria. The results also indicate that the materials were not corrosive or ignitable. Therefore, the sediments from JBLE Back River Channel would not be considered a hazardous waste per United States Environmental Protection Agency (USEPA) criteria and would not require management in accordance with Virginia Hazardous Waste Management regulations (9 Virginia Administrative Code [VAC] 20-60).

With the exception of BRC-04, TPH concentrations were less than 50 mg/kg and BTEX was less than 10 mg/kg, indicating that the material may be used as fill material as per 9VAC20-81-660 specifications. Based on the TPH-DRO concentration, material from BRC-04 would not be suitable as fill material, but could be approved for permitted landfills equipped with liners and leachate collection systems.

ES.3 OCEAN PLACEMENT OPTIONS

ES.3.1 LIMITING PERMISSIBLE CONCENTRATION COMPLIANCE

A total of twelve discrete, six composite, and two field duplicate sediment samples were analyzed for ocean placement. The samples were evaluated with respect to the Ocean Dumping Regulations in 40 CFR 220-228.

Compliance with Section 103 of the MPRSA includes determining limiting Permissible Concentration (LPC) compliance in four areas:

- Water Quality Criteria (WQC)
- Water column toxicity
- Benthic toxicity
- Benthic bioaccumulation.

If LPC compliance is not met in one of more of these components, then ocean placement requirements are not met. Each of the above components involves a series of steps to determine whether the tested sediment meets LPC requirements.

To determine whether the sediments from the JBLE Back River Channel meet the acute WQC and water column toxicity LPC requirements, STFATE modeling was conducted using the specifications of the placement site (i.e., dimensions and water column properties) to determine if the standard elutriate concentrations would meet the LPC for ocean placement.

Water Quality Criteria (WQC)

The LPC for the WQC is the concentration which:

- Does not exceed the WQC outside the site boundary during the first 4 hours, and
- Does not exceed the WQC *anywhere* in the marine environment after 4 hours.

STFATE modeling was conducted to confirm that sufficient dilution would be achieved to meet the WQC LPC and to confirm that the sediment plume would stay within the boundary of the NODS placement site within the 4-hour period required by the MPRSA. STFATE modeling was conducted using the specifications of the NODS (i.e., dimensions and water column properties), physical characteristics of the sediment collected from the each DU within the JBLE Back River Channel footprint (i.e., grain size and specific gravity), and the concentrations of the chemical(s) in the elutriate that exceeded applicable WQC. Multiple modeling scenarios were conducted for each DU to determine the maximum volume of material per single placement event that would meet the LPC.

Water Column Toxicity
The LPC for water column toxicity is the concentration that does not exceed 0.01 of the median effective concentration (EC_{50})/median lethal concentration (LC_{50}) within a 4-hour dilution period inside the boundary of the ocean placement site. STFATE modeling was conducted to confirm that sufficient dilution would be achieved to meet the water column toxicity LPC and to confirm that the sediment plume would stay within the boundary of the NODS placement site within the 4-hour period required by the MPRSA. STFATE modeling was conducted using the specifications of the NODS (i.e., dimensions and water column properties) and physical characteristics of the sediment collected from the each DU within the JBLE Back River Channel footprint (i.e., grain size and specific gravity). Multiple modeling scenarios were conducted for each DU to determine the maximum volume of material per single placement event that would meet the LPC.

Benthic Toxicity
Dredged material does not meet the benthic toxicity LPC when mean test organism mortality:

- Is statistically greater than in the reference sediment, **AND**

- Exceeds mortality (or other appropriate end point) in the reference sediment by at least 10 percent (or 20 percentage points for amphipods).

Benthic Bioaccumulation
Following exposure to sediments from the JBLE Back River Channel, tissue samples of *N. virens* and *M. nasuta* were analyzed for lipids, moisture content, metals (including mercury), PAHs (DU1, DU2, DU3, and DU4 only), PCBs (DU1 and DU2 only) dioxin and furan congeners, and select chlorinated pesticides (DU1, DU2, DU3, DU4, and DU5 only) (DDT series, beta-BHC, dacthal, endrin, endrin aldehyde, methoxychlor, and mirex only). Mean concentrations of analytes detected in the tissue samples exposed to sediment from the project footprint were statistically compared to the mean concentrations of analytes detected in the tissue exposed to sediment from applicable reference sites to evaluate the potential for adverse impacts.

If the mean tissue concentrations statistically exceeded mean reference site concentrations, then mean concentrations were:

- Statistically compared to pre-test tissue concentrations

- Evaluated for analytical variability within the data set (reporting limiting substitutions for non-detected data, outliers, and compliance with laboratory quality assurance/quality control requirements)

- Analytes that statistically exceeded both reference and pre-test concentrations were statistically compared to USEPA Region 4 background concentrations for the South Atlantic Bight (USACE/USEPA 2008).

Dredged material does not meet the benthic bioaccumulation LPC if the tissue concentrations are statistically greater than United States Food and Drug Administration (USFDA) Action/Guidance/Tolerance Levels. When tissue concentrations of contaminants of concern in organisms exposed to dredged material statistically exceed those of organisms exposed to the reference material, the dredged material has the potential to result in benthic bioaccumulation of contaminants. If the tissue concentrations statistically exceed those of organisms exposed to the reference site, the tissue concentrations are further evaluated to determine if placement of dredged material is likely to cause adverse effects. The results of the benthic tissue analysis were reviewed in consultation with USEPA Region 3 and USACE Norfolk District to determine which constituents met the LPC for benthic bioaccumulation.

Results of the LPC compliance for each dredging area are summarized in Table ES-1 and discussed in the following sections.

ES.3.2 SUMMARY OF RESULTS

The sediments from locations BRC-01 through BRC-09 in the JBLE Back River Channel were predominantly comprised of fine-grained material, ranging from 69 to 97.2 percent silt+clay. Sediments from BRC-10 through BRC-12 were predominantly comprised of sand, ranging from 61.3 to 95 percent sand. The DU composites indicated that DU1, DU2, DU3, and DU4 were predominantly comprised of fine-grained clays with some sand, DU 5 was predominantly sand with some silt/clay, and DU6 was predominantly sand. The Willoughby Bank reference site and the Atlantic Ocean reference site were each predominantly comprised of fine sand (77.5 and 84.7 percent, respectively).

Three metals (arsenic, mercury, and nickel), three individual PAHs (acenaphthene, acenaphthylene, and naphthalene); total PCBs; and three chlorinated pesticides (4’4-dichlorodiphenyldichloroethane, 4’4-dichlorodiphenyldichloroethylene, and 4’4-DDT) were detected in at least one sample at concentrations between the threshold effects level and probable effects level (PEL). One sample, the field duplicate for BRC-09, had a 4’4-DDT concentration that exceeded the PEL.

Water Quality Criteria and Water Column Toxicity

Comparison of chemical concentrations detected in the standard elutriates created from site sediments and site water indicated that one constituent (ammonia) was detected in the full strength elutriates from four of the six DUs at concentrations that exceeded the USEPA saltwater acute WQC for the protection of aquatic life. The laboratory reporting limits for cyanide and silver also exceeded respective acute WQC. For the organic constituents, (PAHs, PCB congeners, dioxin and furan congeners, chlorinated pesticides, organophosphorus pesticides, SVOCs, and butyltins) few constituents were detected, and most of the concentrations were low and estimated below the laboratory reporting limit. Cyanide was used in the STFATE modeling to provide the most conservative dilution required for each DU. STFATE modeling indicated that sufficient dilution of the elutriates would occur to meet the acute WQC for cyanide within the 4 hours following placement and the plume would stay within the site boundary (Table ES-1).

For water column toxicity, each of the water column bioassays for *Mytilus galloprovincialis* had an EC_{50} of >100 percent elutriate, and the LC_{50} for the *Americamysis bahia* and *Menidia beryllina* bioassays was also greater than 100 percent elutriate. Therefore, a dilution of approximately 99-fold is required for each of the elutriates from the JBLE Back River Channel to achieve the LPC for water column toxicity for ocean placement at the NODS (Table ES-1).

To maximize the dredged material volume that could be placed at the NODS during a single placement event and achieve compliance with the LPC for water column toxicity, STFATE model scenarios were conducted. Results of the STFATE modeling indicated that placement events ranging from 32,000 (DU2) to 62,000 (DU6) cy met the LPC for water column toxicity. Within 4 hours following placement, dilutions ranging from 99- to 101-fold would be achieved and the leading edge of the sediment plume would travel 4,810 ft for each of the DUs, remaining inside the NODS site boundary (Table ES-1).

Benthic Toxicity

Survival in the whole sediment bioassays was not statistically different from the reference sites for either *Ampelisca abdita* or *Leptocheirus plumulosus.* Therefore, sediment from the JBLE Back River Channel meets the LPC requirement for benthic toxicity.

Benthic Bioaccumulation

For DU1, DU2, DU3, and DU4, none of the mean concentrations of metals, PAHs, or PCBs statistically exceeded mean Willoughby Bank reference site concentrations. Although mean concentrations of 1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin in the worm tissue exposed to sediment from DU3 and mean concentrations of octachlorodibenzodioxin (OCDD) in the clam tissue exposed to sediment from DU4 statistically exceeded the mean concentrations detected in tissues exposed to the sediment from the Willoughby Bank reference site, they did not exceed the mean pre-test tissue concentrations. Therefore, the mean concentration of these analytes was likely elevated prior to, not caused by, exposure to the JBLE Back River Channel samples. Mean OCDD concentrations in the worm tissue exposed to the Back River channel samples from DU2 and DU4 statistically exceeded mean reference and mean pre-test tissue concentrations. There are no USEPA Region 4 background concentrations for OCDD, however, this dioxin congener is the least toxic with a toxicity equivalency factor value of 0.0003. In addition, none of the dioxin toxicity equivalency quotients (TEQs) statistically exceeded the reference site TEQs. None of the upper confidence level of the mean (UCLM) values for JBLE Back River Channel tissues exposed to sediment from DU1, DU2, DU3, or DU4 samples exceeded the USFDA Action/Guidance/Tolerance Levels for metals, total PCBs (ND=RL) or 4’4’-DDT.

For DU6, none of the mean concentrations of metals, PAHs, dioxins, or PCBs statistically exceeded mean Atlantic Ocean reference site concentrations. Although mean concentrations of cadmium and OCDD for DU5 statistically exceeded the mean concentrations detected in tissues exposed to the sediment from the Atlantic Ocean reference site, they did not exceed the mean pre-test tissue concentrations. Mean concentrations of lead and nickel in clam tissue from DU5 statistically exceeded the mean concentration of tissue for both mean reference and pre-test tissue.

The UCLM values for these metals were compared to the Region 4 background concentrations for South Atlantic Bight, and the UCLMs did not exceed the background ranges.

Based on the assessment of chemical analyses performed on tissues exposed to sediment from the JBLE Back River Channel and reference site sediments, it is anticipated that ocean placement of the dredged material from the JBLE Back River Channel at the NODS is not expected to result in ecologically significant bioaccumulation of contaminants. Therefore, the dredged material from the JBLE Back River Channel meets the LPC for benthic bioaccumulation, and complies with the benthic criteria of 40 CFR 227.13(c)(3).

Sediments from the JBLE Back River Channel meet the criteria for the LPC for WQC, water column toxicity, benthic toxicity, and benthic bioaccumulation, indicating that ocean placement of the dredged material at the NODS is a viable placement option. Based on the results of the STFATE modeling, placements ranging from 32,000-62,000 cy per placement event complies with the LPC for WQC and water column toxicity.

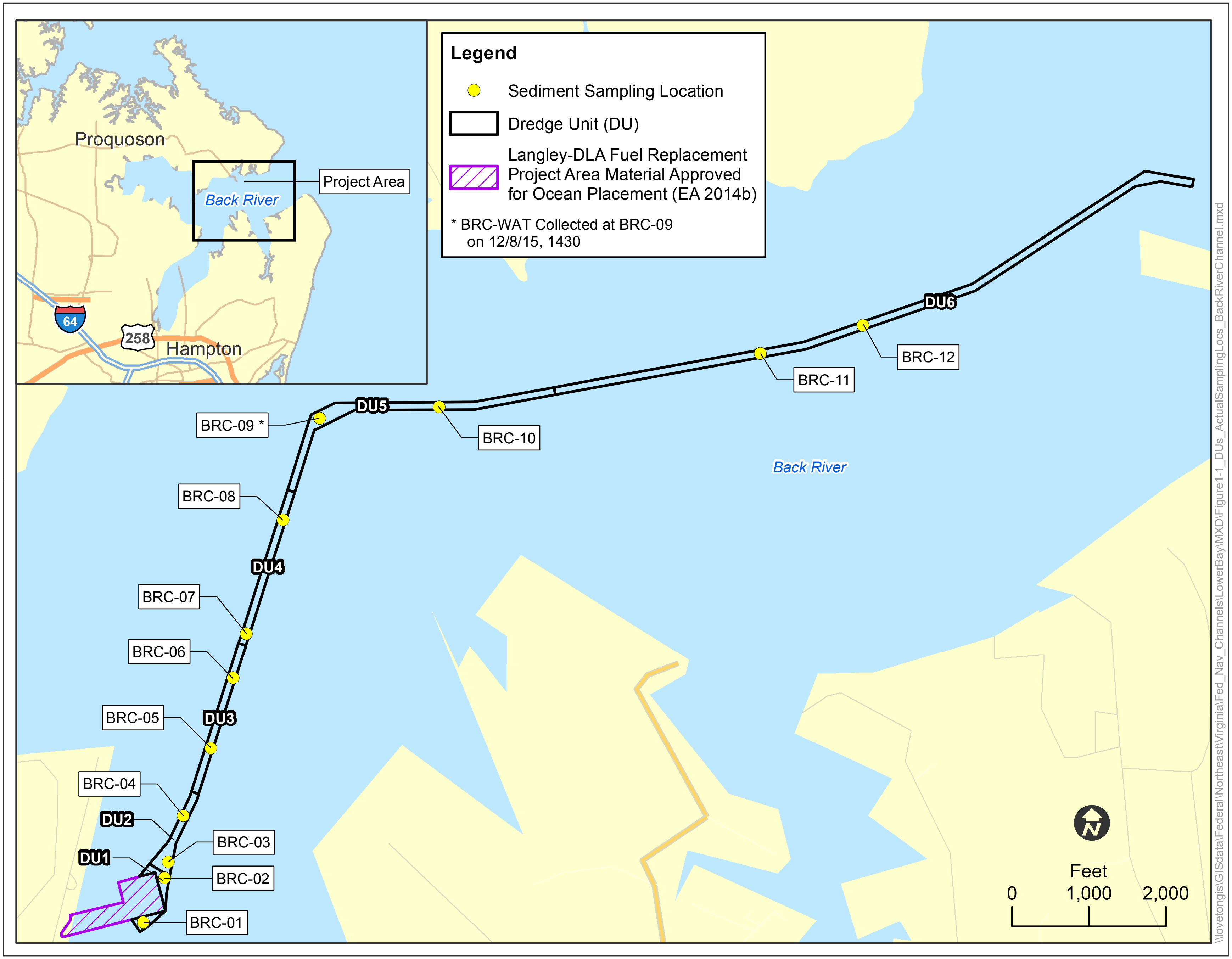

Figure ES-1. Sampling Locations and Dredging Units for the Back River Channel Project.

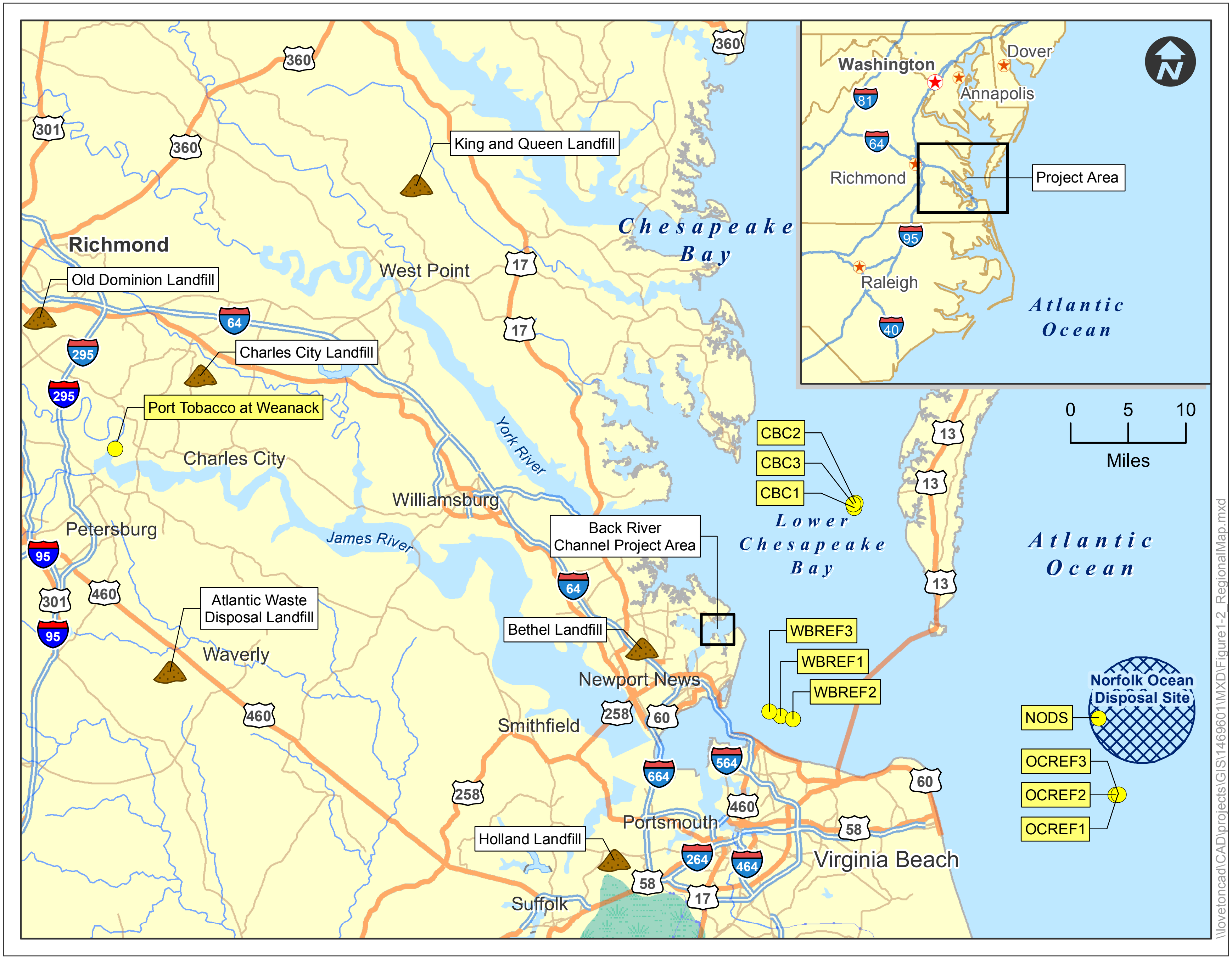

Figure ES-2. Back River Channel Project Area, Reference Locations (WBREF- and OCREF-), Chesapeake Bay Control Site (CBC-), Norfolk Ocean Disposal Site (NODS), and Potential Upland Placement Sites.

TABLE ES-1. SUMMARY OF RESULTS FOR BULK SEDIMENT, ELUTRIATE, AND ECOTOXICOLOGICAL TESTING

JBLE BACK RIVER CHANNEL, HAMPTON, VIRGINIA (DECEMBER 2015)

Dredging Unit (DU)	Sediment Sample ID	SEDIMENT		STANDARD ELUTRIATES		BIOASSAY TESTS								BIOACCUMULATION		MEETS LIMITING PREMISSIBLE CONCENTRATION?			
						WATER COLUMN						WHOLE SEDIMENT		TISSUE CONCENTRATIONS THAT STATISTICALLY EXCEEDED REFERENCE AND PRE-TEST CONCENTRATIONS					
		COMPARISON TO REGIONAL SQGs [(a)]		COMPARISON TO USEPA WQC FOR AQUATIC LIFE [(b)]	Maximum Dilution required for all constituents exceeding LPC to meet LPC[(c)]	*Mytilus galloprovincialis* (Blue Mussel)		*Menidia beryllina*(Inland Silverside)		*Americamysis bahia* (Opossum Shrimp)		Statistical comparison between survival in test and reference sediment				Water Quality Criteria	Water Column Toxicity	Benthic Toxicity	Benthic Bioaccumulation
		Threshold Effects Level (TEL) Exceedances	Probable Effects Level (PEL) Exceedances			48-hour EC_{50} (% elutriate)	dilution required to comply with 0.01 EC_{50} within 4-hr	96-hour LC_{50} (% elutriate)	dilution required to comply with 0.01 LC_{50} within 4-hr	96-hour LC_{50} (% elutriate)	dilution required to comply with 0.01 LC_{50} within 4-hr	*Ampelisca abdita* (Estuarine Amphipod)	*Leptocheirus plumulosus* (Estuarine Amphipod)	*Nereis virens* (Sand Worm)	*Macoma nasuta* (Blunt Nose Clam)				
DU1	**BRC-01**	Arsenic, Dibenzo(a,h)anthracene, Total PCBs (ND=RL)	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
DU1	**BRC-02**	Arsenic, Dibenzo(a,h)anthracene	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
DU1	**BRC-01/02**	Arsenic, Dibenzo(a,h)anthracene, Total PCBs (ND=RL), 4'4-DDT	None	Ammonia, Cyanide[(e)], Silver [(e)]	9	>100	99	>100	99	>100	99	No Statistical Difference	No Statistical Difference	No Exceedances	No Exceedances	Yes Placement volumes up to 37,000 cy	Yes Placement volumes up to 37,000 cy	Yes	Yes
DU2	**BRC-03**	Arsenic, Dibenzo(a,h)anthracene, Total PCBs (ND=RL)	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
DU2	**BRC-04**	Arsenic, Mercury, Nickel, Dibenzo(a,h)anthracene, Total PCBs (ND=RL)	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
DU2	**BRC-03/04**	Arsenic, Acenaphthylene, Acenaphthylene, Dibenzo(a,h)anthracene, Total PCBs (ND=RL)	None	Ammonia, Cyanide[(e)], Silver [(e)]	9	>100	99	>100	99	>100	99	No Statistical Difference	No Statistical Difference	OCDD	No Exceedances	Yes Placement volumes up to 32,000 cy	Yes Placement volumes up to 32,000 cy	Yes	Yes
DU3	**BRC-05**	Arsenic, Nickel, Dibenzo(a,h)anthracene, Total PCBs (ND=RL)	None	N/A	N/A	>100	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Yes
DU3	**BRC-06**	Dibenzo(a,h)anthracene, Total PCBs (ND=RL)	None	N/A	N/A	>100	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Yes
DU3	**BRC-05/06**	Arsenic, Dibenzo(a,h)anthracene, Total PCBs (ND=RL)	None	Ammonia, Cyanide[(e)], Silver [(e)]	9	>100	99	>100	99	>100	99	No Statistical Difference	No Statistical Difference	No Exceedances	No Exceedances	Yes Placement volumes up to 32,000 cy	Yes Placement volumes up to 32,000 cy	Yes	Yes
DU4	**BRC-07**	Arsenic, Dibenzo(a,h)anthracene, Total PCBs (ND=RL)	None	N/A	N/A	>100	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Yes
DU4	**BRC-08**	Dibenzo(a,h)anthracene, Total PCBs (ND=RL)	None	N/A	N/A	>100	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Yes
DU4	**BRC-07/08**	Total PCBs (ND=RL)	None	Ammonia, Cyanide[(e)], Silver [(e)]	9	>100	99	>100	99	>100	99	No Statistical Difference	No Statistical Difference	OCDD	No Exceedances	Yes Placement volumes up to 36,000 cy	Yes Placement volumes up to 36,000 cy	Yes	Yes
DU5	**BRC-09**	Total PCBs (ND=RL), 4,4'-DDT	None	N/A	N/A	>100	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Yes
DU5	**BRC-09-FD**	Total PCBs (ND=RL), 4,4'-DDD, 4'4-DDE	4,4'-DDT	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
DU5	**BRC-10**	Total PCBs (ND=RL)	None	N/A	N/A	>100	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Yes
DU5	**BRC-10-FD**	'Total PCBs (ND=RL)	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
DU5	**BRC-09/10**	Total PCBs (ND=RL)	None	Cyanide[(e)], Silver [(e)]	9	>100	99	>100	99	>100	99	No Statistical Difference	No Statistical Difference	No Exceedances	Lead, Nickel	Yes Placement volumes up to 41,000 cy	Yes Placement volumes up to 41,000 cy	Yes	Yes
DU6	**BRC-11**	Total PCBs (ND=RL)	None	N/A	N/A	>100	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Yes
DU6	**BRC-12**	Total PCBs (ND=RL)	None	N/A	N/A	>100	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Yes
DU6	**BRC-11/12**	Total PCBs (ND=RL)	None	Cyanide[(e)], Silver [(e)]	9	>100	99	>100	99	>100	99	No Statistical Difference	No Statistical Difference	No Exceedances	No Exceedances	Yes Placement volumes up to 62,000 cy	Yes Placement volumes up to 62,000 cy	Yes	Yes

(a) SQG = sediment quality guideline; ***Source:*** MacDonald et al. 1996 Ecotoxicology 5: 253-278., CCME 2001. Canadian Sediment Quality Guidelines for the Protection of Aquatic Life.

(b) WQC = water quality criteria; ***Source*** : USEPA 2015. *National Recommended Water Quality Criteria.*

(c) Dilution required is to to achieve acute WQC, which must occur within 4 hours inside placement boundary to meet LPC.

(d) Statistical significance analyzed at p=0.05; survival (LC_{50}) or effect (EC_{50}) in 100% elutriate concentration significantly lower than the control.

(e) Laboratory reporting limit exceeds acute water quality criterion.

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LIST OF ACRONYMS AND ABBREVIATIONS

°C	Degrees Celsius
µg/kg	Microgram(s) per kilogram
µg/L	Microgram(s) per liter
µL	Microliter(s)
ATSDR	Agency for Toxic Substances and Disease Registry
AVS	Acid volatile sulfides
BHC	Benzenehexachloride
BTEX	Benzene, toluene, ethylene, and xylene
CAB	Cellulose acetate butyrate
CCME	Canadian Council of Ministers of the Environment
CFR	Code of Federal Regulations
COC	Chain-of-custody
cy	Cubic yard(s)
DDD	Dichlorodiphenyldichloroethane
DDE	Dichlorodiphenyldichloroethylene
DDT	Dichlorodiphenyltrichloroethane
DI	De-ionized
DO	Dissolved oxygen
DOC	Dissolved organic carbon
DU	Dredging unit
EA	EA Engineering, Science, and Technology, Inc., PBC
EC_{50}	Median effective concentration
EOX	Extractable organic halides
ft	Foot (feet)
GC	Gas chromatograph
HOV	Homogeneity of variances
HPAH	High molecular weight PAH
HPCDD	Heptachlorodibenzo-p-dioxin
ICR	Ignitability, corrosivity, reactivity
ID	Identification
ITM	Inland Testing Manual
JBLE	Joint Base Langley-Eustis
L	Liter(s)

LIST OF ACRONYMS AND ABBREVIATIONS (continued)

Langley-DLA	Langley-Defense Logistics Agency
LC_{50}	Median lethal concentration
LCS	Laboratory control sample
LPAH	Low molecular weight PAH
LPC	Limiting permissible concentration
MDL	Method detection limit
mg/kg	Milligram(s) per kilogram
mg/L	Milligram(s) per liter
mL	Milliliter(s)
MLLW	Mean lower low water
MPRSA	Marine Protection, Research, and Sanctuaries Act
MS	Mass spectrometry
MS/MSD	Matrix spike/matrix spike duplicate
ND	Not detected
ng/kg	Nanogram(s) per kilogram
ng/L	Nanogram(s) per liter
NH_3-N	Ammonia
NH_4Cl	Ammonium chloride
NOAA	National Oceanic and Atmospheric Administration
NODS	Norfolk Ocean Disposal Site
OCDD	Octachlorodibenzodioxin
PAH	Polycyclic aromatic hydrocarbon
PCB	Polychlorinated biphenyl
PEL	Probable effects level
pg/L	Picogram(s) per liter
ppt	Part(s) per thousand
pptr	Part(s) per trillion
QA	Quality assurance
QAPP	Quality Assurance Project Plan
QC	Quality control
RL	Reporting limit
SAP	Sampling and Analysis Plan
SEM	Simultaneously extracted metals
SERIM	Southeast Regional Implementation Manual
SET	Standard Elutriate Test
SOP	Standard operating procedure
SQG	Sediment Quality Guideline
SRM	Standard reference material

LIST OF ACRONYMS AND ABBREVIATIONS (continued)

STFATE	Short-term fate
SVOC	Semivolatile organic compound
TCDD	Tetrachlorodibenzo-p-dioxin
TCLP	Toxicity Characteristic Leachate Procedure
TDL	Target detection limit
TEF	Toxicity equivalency factor
TEL	Threshold effects level
TEQ	Toxicity equivalency quotient
TKN	Total Kjeldahl nitrogen
TOC	Total organic carbon
TPH	Total petroleum hydrocarbons
TPH-DRO	Total petroleum hydrocarbons-diesel range
TPH-GRO	Total petroleum hydrocarbons-gasoline range
UCLM	Upper Confidence Level of the Mean
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USFDA	United States Food and Drug Administration
VAC	Virginia Administrative Code
VDEQ	Virginia Department of Environmental Quality
VPA	Virginia Pollution Abatement
WES	Waterways Experiment Station
WHO	World Health Organization
WQC	Water Quality Criteria

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1. PROJECT DESCRIPTION

Back River Channel is a Federally-maintained navigation channel located adjacent to Joint Base Langley-Eustis (JBLE) in Hampton, Virginia (Figure 1-1). The channel provides for safe navigation from the Chesapeake Bay to JBLE. The channel is the primary access for fuel barges servicing the Langley Fuel Piers in support of JBLE mission requirements. The channel also provides access to the Messick Point Federal Navigation Channel. Sedimentation has reduced the channel depths from required dimensions. Maintenance dredging is necessary to restore full channel depth to ensure safe navigation for vessels utilizing the channel.

An evaluation of the dredged material is required prior to dredging and placement to ensure that the material is appropriate for available placement options. Placement options for the Back River Channel project include ocean placement at the Norfolk Ocean Disposal Site (NODS) and upland placement. The purpose of this project was to collect the data that are necessary to document the Tier II (sediment and elutriate) and Tier III (ecotoxicological) characteristics of the sediments to facilitate placement of the dredged material at the NODS (Figure 1-2). Data collected for the Back River Channel project were used to document compliance with Section 103 of the Marine Protection, Research and Sanctuaries Act (MPRSA) for the transport of dredged material for the purpose ocean placement at the NODS. In addition, test results were evaluated with respect to criteria for placement at Port Tobacco at Weanack and applicable Commonwealth of Virginia regulations for other upland placement options.

EA Engineering, Science, and Technology, Inc., PBC (EA) was contracted by the United States Army Corps of Engineers (USACE)–Norfolk District to evaluate sediment characteristics for the JBLE Back River Channel project with respect to the requirements for ocean and upland placement. Specific dredged material placement options include: ocean placement at the NODS (Figure 1-2), upland placement at Port Tobacco at Weanack (Figure 1-2), and placement at other approved regional upland locations (Figure 1-2). The evaluation consisted of collecting sediment cores and sediment grab samples to a depth of -15 feet (ft) mean lower low water (MLLW); collecting surficial sediment at the Willoughby Bank and Atlantic Ocean reference sites and the Chesapeake Bay control site; collecting site water/elutriate preparation water; collecting receiving water from the NODS; conducting analytical testing of bulk sediment site water, receiving water, and six standard elutriate samples; conducting ecotoxicological testing of sediment (water column bioassays, whole sediment bioassays, and bioaccumulation studies); conducting analytical testing of aquatic organism tissue as appropriate; short-term fate (STFATE) modeling of dredged material placement at the NODS; and evaluating test results with respect to the Ocean Dumping Regulations in Title 40 of the Code of Federal Regulations (CFR), Parts 220-228 and also with respect to requirements for placement at Port Tobacco at Weanack and Commonwealth of Virginia regulations for other upland placement options.

The transport of dredged material for the purpose of ocean placement is regulated under Section 103 of the MPRSA of 1972 (Public Law 92-532). This law states that any proposed placement of dredged material into ocean waters must be evaluated through the use of criteria published by the United States Environmental Protection Agency (USEPA) in 40 CFR 220-228. The primary purpose of Section 103 of the MPRSA is to limit and regulate adverse environmental impacts of ocean placement of dredged material. Dredged material proposed for ocean placement must comply with 40 CFR 220-228 (Ocean Dumping Regulations) and 33 CFR 320-330 and 335-338 (USACE Regulations for Discharge of Dredged Materials into Waters in U.S. or Ocean Water) prior to being issued an ocean placement permit. The technical evaluation of potential contaminant-related impacts that may be associated with ocean placement of dredged material is conducted in accordance with 40 CFR 220-228 and the *Ocean Testing Manual* (USEPA/USACE 1991). The criteria defined in 40 CFR 227 are used to determine compliance.

This project also included the testing of 12 individual samples required for the upland placement of the JBLE Back River Channel sediments at regional landfills or at Port Tobacco at Weanack. The Weanack facility is an existing pit mine reclamation site southeast of Richmond, Virginia, in Charles City, Virginia, along the James River (Figure 1-2). It is authorized to accept dredged material and equipment is located onsite at the Weanack facility for mechanical offloading of barges up to 55 ft wide. For larger barges or hydraulic offloading, an outside contractor is required. The facility currently has a Virginia Pollution Abatement (VPA) permit (Virginia Pollutant Discharge Elimination System Permit No. VPA00579-Weanack Land LLLP) that allows placement of material from any location that meets the established threshold values for permit-specified physical attributes and chemical constituents (Virginia Department of Environmental Quality [VDEQ] 2014).

1.1 PROJECT PURPOSE AND BACKGROUND

The purpose of this project was to collect data to characterize the physical, chemical, and ecotoxicological quality of the sediments from the JBLE Back River Channel project footprint and to determine if the material is suitable for ocean placement or other upland placement options. Because there are limited near-shore facilities capable of accepting the dredged material, placement options for the dredged material include: (1) mechanical dredging followed by dredged material placement by bottom dumping scows at NODS; (2) mechanical dredging followed by dredged material placement at Port Tobacco at Weanack; and (3) mechanical dredging followed by alternative upland placement (e.g., landfill). Ocean placement, if determined to be feasible, would eliminate or reduce the volume of material required to be placed upland. Upland placement capacity is limited in the southern Virginia region and is preferential to projects with sediments that cannot meet the requirements for ocean or open-water placement.

Back River Channel is a Federally maintained project, and the project provides for a channel that is 19,264 ft in length and 100 ft wide. Existing water depths range from -5 to -14.5 ft MLLW. Maintenance dredging will restore channel depths to a maximum of -15 ft MLLW including required, allowable, and non-pay overdepths. Previous maintenance dredging of the Back River Channel was completed 9 April through 25 May 2002. Approximately 206,776 cubic yards (cy) of dredged material was removed and placed at a privately-owned upland placement site. The most recent bathymetric survey (September 2015) indicates approximately 205,000 cy of material will need to be removed to remove critical shoaling and restore safe navigation. The area to be dredged has been divided into six dredging units (DUs) that each contain approximately equal volume (approximately 30,000 cy) of material to be removed.

The Back River Channel project area leads to the Langley-Defense Logistics Agency (Langley-DLA) Fuel Pier Replacement Project area (Figure 1-1). The proposed Langley-DLA Fuel Pier Replacement Project will require the dredging and placement of approximately 65,000 cy of material from the proposed berthing area and turning basin footprint prior to construction. At the request of the USACE-Norfolk District, USEPA-Region 3 conducted an independent evaluation and granted concurrence for all dredged material from the Langley-DLA project to be placed at the NODS (EA 2014b).

The NODS is located in the Atlantic Ocean approximately 17 miles east of Cape Henry and is approximately 50 square nautical miles in size (40 CFR 228) (Figure 1-2). The site has unlimited capacity and is designated to provide capacity for long-term management of dredged material from the lower Chesapeake Bay and suitable materials from Norfolk Harbor (USEPA Region 3 2001). The designation of the site in 40 CFR 228.15 indicates the "site shall be limited to suitable dredged material which passed the criteria for ocean dumping" which are described in Section 103 of the MPRSA.

1.2 PROJECT OBJECTIVES

The overall objective of the sampling effort was to collect and analyze sediment and water samples to determine the suitability of the dredged material for various placement alternatives (Table 1-1). Chemical concentrations of acid volatile sulfide (AVS)/simultaneously extracted metals (SEM) ratios (sediment only), priority pollutant metals, semivolatile organic compounds (SVOCs), chlorinated pesticides, organophosphorus pesticides, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyl (PCBs) congeners, dioxin and furan congeners, butyltins, cyanide, ammonia, total Kjeldahl nitrogen (TKN), total phosphorus, nitrate+nitrite, and total organic carbon (TOC) will be identified in Back River Channel sediment, reference sediment, site water, and standard elutriate samples. Total petroleum hydrocarbons (TPH) (gasoline range [TPH-GRO, C6-C10] and diesel range [TPH-DRO, C10-C34]); PCB aroclors; benzene, toluene, ethylene, and xylene (BTEX); extractable organic halides (EOX); Toxicity Characteristic Leachate Procedure (TCLP) plus ignitability, corrosivity, reactivity (ICR); paint filter test; pH; flashpoint; potential acidity; neutralization potential; acid base accounting; calcium carbonate equivalence; pyritic sulfur (fizz rating); and saturated paste pH and conductivity will be conducted for Back River Channel sediment samples only. In addition to the analytes listed above, total PCB aroclors, total PCB congeners, total dichlorodiphenyltrichloroethane (DDT), total PAHs, and dioxin toxicity equivalency quotients (TEQs) were calculated.

Physical testing for the Back River Channel project included grain size (sieve and hydrometer), Atterberg Limits, specific gravity, and total solids.

Specific objectives of the JBLE Back River Channel study were to:

- Collect the required volume of sediment and water for physical and chemical analysis, elutriate preparation, and applicable bioassays and bioaccumulation studies.

- Collect sediment cores from eight locations and sediment grabs from four locations within the navigation channel within positioning accuracy appropriate for the project objectives.

- Sample twelve discrete locations in the navigation channel and create six sediment composite samples (See Table 1-2 for compositing scheme).

- Submit sediment composite samples for physical and chemical analysis, standard elutriate analysis, ecotoxicological characteristics, and potential for bioaccumulation (as appropriate).

- Submit discrete sediment samples from each of the twelve locations for bulk sediment testing required for ocean placement and placement at upland sites, including landfills and Weanack, LLC.

- Collect surficial sediment from the Willoughby Bank and Atlantic Ocean reference sites, and from the USEPA-designated lower Chesapeake Bay control site.

- Collect and transfer sediment to appropriate laboratory-prepared containers and preserve/hold samples for analysis according to protocols that ensure sample integrity.

- Collect site water from one location in the dredging footprint and receiving water from one location at the NODS.

- Test and characterize sediments with respect to physical characteristics, chemical characteristics, ecotoxicological characteristics, and potential for bioaccumulation.

- Test site water and standard elutriates with regard to chemical characteristics and ecotoxicological characteristics.

- Conduct water column bioassays to assess potential water column impacts related to open water/ocean placement.

- Conduct whole sediment bioassays to assess potential benthic impacts related to open water/ocean placement.

- Conduct 28-day bioaccumulation to assess the potential for uptake of contaminants from sediments into the tissue of benthic organisms.

- Conduct STFATE modeling to assess compliance with the Limiting Permissible Concentration (LPC) as per 40 CFR 227.

- Evaluate physical, chemical, and ecotoxicological data for the JBLE Back River Channel sediments to determine the feasibility of ocean placement for the dredged material.

- Provide data for upland placement at permitted facilities in accordance with facility permits:

— Compare chemical concentrations in bulk sediment to the site-specific criteria for the Weanack facility (Virginia Exclusion Criteria).

— Determine the potential for sediment acidity and soil amendments (lime addition) after upland placement by calculating the acid-base accounting values.

— Compare BTEX, EOX, and TPH concentrations in bulk sediment to the Commonwealth of Virginia Disposal criteria for soil contaminated with petroleum products (9 Virginia Administrative Code [VAC] 20-81-660).

— Compare chemical constituents in the TCLP leachate to maximum concentrations of contaminants for toxicity characteristics (40 CFR 261.24) to determine if the material requires management as a hazardous waste or if the material could be placed in an approved upland site.

- Evaluate physical and chemical data for the Back River Channel sediments to determine the feasibility of upland placement at the Port Tobacco at Weanack facility or other upland placement alternatives.

1.3 TECHNICAL APPROACH

This investigation was designed to identify, analyze, and evaluate the physical and chemical characteristics of sediment and water samples that are representative of the proposed dredging area. Sampling locations and coordinates were determined in consultation with USACE-Norfolk District and USEPA Region 3. The project schedule, key personnel, field sampling plan, laboratory Quality Assurance Project Plan (QAPP), and Ecotoxicology QAPP for the project were documented in the Sampling and Analysis Plan (SAP) (EA 2015d); the Site Safety and Health Plan (EA 2015e) was submitted separately. All documents were approved by the USACE-Norfolk District and submitted to USEPA-Region 3 prior to implementation of the project.

The project approach consisted of obtaining sediment cores and grab samples from twelve locations in the JBLE Back River Channel, collecting surficial sediment from two reference areas and the Chesapeake Bay control site, and collecting site water in the dredging footprint and at the NODS. Details of the field sampling program, analytical methods, and testing protocols are detailed in the SAP (EA 2015d).

The dredging footprint was divided into six DUs that each contain approximately equal volume (30,000 cy) of material to be removed based on the September 2015 bathymetric survey:

- DU1: 27,627 cy
- DU2: 31,412 cy
- DU3: 30,892 cy
- DU4: 29,678 cy
- DU5: 30,314 cy
- DU6: 27,714 cy.

Two discrete samples were taken from each DU (12 total) and analyzed for physical and chemical analysis for ocean placement and upland placement. One composite sample for each DU was created from the two discrete sampling locations within it. Composite samples were submitted for physical and chemical analysis for ocean placement, standard elutriate analysis, ecotoxicological characteristics, and potential for bioaccumulation. Existing water depths in DU1 through DU4 range from approximately -5 to -12.2 ft MLLW and required core sampling to represent the full dredging prism to -15 ft MLLW. Water depths in DU5 and DU6 ranged from -13 to -14.5 ft MLLW and the dredging prism was fully represented with grab sampling.

Upon completion of field activities, samples were submitted to TestAmerica-Pittsburgh for bulk sediment and elutriate testing and to EA's ecotoxicology laboratory for ecotoxicological testing and bioaccumulation exposures.

The sampling and analytical components (list of target analytes, target detection limits [TDLs], methodologies, elutriate preparation procedures, and sample holding times) of the JBLE Back River Channel dredged material evaluation were derived from the following guidance documents:

- USEPA/USACE. 1991. *Evaluation of Dredged Material Proposal for Ocean Disposal, Testing Manual* (commonly called "The Green Book").
- USEPA/USACE. 1995 (EPA-823-B-95-001). *QA/QC Guidance for Sampling and Analysis of Sediments, Water, and Tissues for Dredged Material Evaluations*.
- USEPA/USACE. 1998 (EPA-823-B-98-004). *Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S.-Testing Manual (Inland Testing Manual).*
- USEPA. 2001. *Methods for Collection, Storage, and Manipulation of Sediments for Chemical and Toxicological Analyses: Technical Manual.*
- USEPA Region 3. 2000. *Mid-Atlantic Regional Implementation Manual (RIM): Dredged Material Evaluation for Norfolk and Dam Neck Ocean Disposal Sites.*
- USEPA/USACE. 2008. *Southeast Regional Implementation Manual (SERIM) for Requirements and Procedures for Evaluation of Ocean Disposal of Dredged Material in Southeastern U.S. Atlantic and Gulf Coast Waters.* EPA 904-B-08-001. US Environmental Protection Agency, Region 4 and US Army Corps of Engineers, South Atlantic Division, Atlanta, GA.

1.3.1 Field Sampling Program

The field sampling program included the following tasks:

- Collection of sediment to a depth of -15 ft MLLW in 12 locations in the JBLE Back River Channel. This was achieved by using a vibracore at eight locations and a Van Veen sampler at four locations.

- Creation of six sediment composite samples, analyzed for physical and chemical analysis, standard elutriate analysis, and ecotoxicological testing.

- Collection of surficial sediment from the Willoughby Bank reference site, the Atlantic Ocean reference site, and from the USEPA-designated lower Chesapeake by control site.

- Collection of site water/elutriate preparation water from one location in the dredging foot print and receiving water from one location at the NODS.

1.3.2 Analytical Testing of Bulk Sediment, Site Water, Receiving Water and Standard Elutriates

Analytical testing of sediment, site water, receiving water, and standard elutriate samples for the JBLE Back River Channel project was conducted by TestAmerica Laboratories located in Pittsburgh, Pennsylvania.

The analytical testing program is summarized in Table 1-1 and included the following tasks:

- Physical analyses of sediment from twelve discrete locations, six composite sediment samples, the Willoughby Bank reference sediment, and the Atlantic Ocean reference sediment included grain size (sieve and hydrometer), Atterberg Limits, specific gravity, and total solids.

- Preparation and analysis of six standard elutriates using sediment composites and site water to simulate the potential release of metals and organic constituents during ocean placement.

- Chemical analysis of bulk sediment, site water, and standard elutriates for the following project-specific target analytes: AVS/SEM (sediment only), butyltins, SVOCs, metals (including mercury), chlorinated pesticides, organophosphorus pesticides, PAHs, PCB congeners, dioxin/furan congeners, cyanide, total sulfides, ammonia, and TOC.

- Chemical analysis of discrete sediment samples to determine suitability for placement at alternate upland disposal sites. Analyses included: TPH-GRO and TPH-DRO, PCB aroclors, BTEX, EOX, TCLP plus ICR, paint filter test, pH, flashpoint, potential acidity, neutralization potential, acid base accounting, calcium carbonate equivalence, pyritic sulfur (fizz rating), and saturated paste pH and conductivity.

- Calculation of AVS/SEM ratio (sediment only), total PCB aroclors (sediment only), total PCB congeners, total DDT, total PAHs, and dioxin TEQs.

A list of the sample identifications (IDs) and compositing scheme for the JBLE Back River Channel Project, Lower Chesapeake Bay control site, Willoughby Bay reference site, and the NODS are provided in Tables 1-2 and 1-3.

In addition to sediment, water, and standard elutriate samples, quality control (QC) samples were submitted to the laboratory. Equipment blanks and matrix spike/matrix spike duplicate (MS/MSD), duplicates, and standard reference material (SRM) samples were analyzed. Analytical methods, target analytes, holding times, reporting limits (RLs), and laboratory quality assurance(QA)/QC protocols are described and addressed in the Analytical Chemistry - QAPP (Attachment II of the SAP, EA 2015d).

1.3.3 Ecotoxicological Testing

The ecotoxicological testing program was conducted by EA's Ecotoxicology Laboratory in Hunt Valley, Maryland and included water column bioassays, whole sediment bioassays, and bioaccumulation studies for the DU composites from JBLE Back River Channel, the reference samples from Willoughby Bank and Atlantic Ocean reference sites, and the Chesapeake Bay Control Site (whole sediment bioassays only).

The ecotoxicological testing program for the JBLE Back River Channel project followed protocols provided by the following guidance documents:

- USEPA/USACE. 1991. *Evaluation of Dredged Material Proposal for Ocean Disposal, Testing Manual* (commonly called "The Green Book").

- USEPA/USACE. 1995 (EPA-823-B-95-001). *QA/QC Guidance for Sampling and Analysis of Sediments, Water, and Tissues for Dredged Material Evaluations*.

- USEPA/USACE. 1998 (EPA-823-B-98-004). *Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S.-Inland Testing Manual (ITM).*

- USEPA Region 3. 2000. *Mid-Atlantic Regional Implementation Manual (RIM): Dredged Material Evaluation for Norfolk and Dam Neck Ocean Disposal Sites.*

- USEPA. 2001. *Methods for Collection, Storage, and Manipulation of Sediments for Chemical and Toxicological Analyses: Technical Manual.*

- USEPA. 2002. *Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms.* Fifth Edition. EPA-821-R-02-012. U.S. Environmental Protection Agency, Office of Water, Washington, D.C.

- USEPA/USACE. 2008. *Southeast Regional Implementation Manual (SERIM) for Requirements and Procedures for Evaluation of Ocean Disposal of Dredged Material in Southeastern U.S. Atlantic and Gulf Coast Waters.* EPA 904-B-08-001. US Environmental Protection Agency, Region 4 and US Army Corps of Engineers, South Atlantic Division, Atlanta, GA.

- Verbal and/or written communications with USEPA Region 3 and USACE-Norfolk District.

The ecotoxicological testing program included the following tasks:

- 96-hour water column bioassays with *Americamysis bahia* and *Menidia beryllina* and 48-hour water column bioassays with *Mytilus galloprovincialis.*

- 10-day intermittent flow-through whole sediment bioassays with *Leptocheirus plumulosus* and *Ampelisca abdita*.

- 28-day whole sediment bioaccumulation studies with *Nereis virens* and *Macoma nasuta*.

Interstitial ammonia was measured in the sediment prior to initiation of the whole sediment bioassays to determine if the sediments required ammonia purging prior to test initiation. Sediments were purged until the ammonia concentrations were less than 20 milligrams per liter (mg/L) at test initiation.

A one percent elutriate solution was added to the water column testing protocol for *A. bahia* (opossum shrimp), *M. beryllina* (inland silverside) and *M. galloprovincialis* (blue mussel), in addition to the 10, 50 and 100 percent elutriate solutions tested as part of the standard protocol. The purpose of the addition of the one percent elutriate was to more accurately calculate the median lethal concentration (LC_{50}) or median effective concentration (EC_{50}) values for each bioassay.

Detailed information regarding test preparation and protocols is described and addressed in an Ecotoxicology QAPP (Attachment III of the SAP EA 2015d).

1.3.4 Analytical Testing of Aquatic Organism Tissue

Target analytes for tissue testing were determined on a DU basis and were based on concentrations of metals and organics detected in the bulk sediments and consultation with USEPA Region 3 and USACE Norfolk District. Tissue analysis included: lipids, moisture content, metals (including mercury), PAHs (DU1, DU2, DU3, and DU4 only), PCBs (DU1 and DU2 only) dioxin and furan congeners, and select chlorinated pesticides (DU1, DU2, DU3, DU4, and DU5 only) (DDT series, beta-benzenehexachloride [BHC], dacthal, endrin, endrin aldehyde, methoxychlor, and mirex only). Tissue analysis information is provided in the Analytical Chemistry QAPP (Attachment II of the SAP, EA 2015d).

1.4 DATA ANALYSIS

1.4.1 Ocean Placement

Data analysis for ocean placement included the following tasks:

- Chemical concentrations in the bulk sediment were compared to concentrations at the reference site and to Sediment Quality Guidelines (SQGs) (MacDonald 1994; MacDonald et al. 1996; Canadian Council of Ministers of the Environment [CCME] 2001).

- Chemical concentrations in standard elutriate samples were compared to USEPA saltwater acute water quality criteria (WQC) for aquatic life (USEPA 2016).

- For the water column bioassays, LC_{50} and EC_{50} values were calculated for survival and effect data, respectively. In addition, results were statistically analyzed to determine if organism survival in the JBLE Back River Channel water column bioassays was significantly lower than organism survival in the laboratory control samples (LCS).

- STFATE modeling was conducted for JBLE Back River Channel elutriate data to determine if chemical constituents detected in the standard elutriate and the LC_{50}/EC_{50} data meet the LPC for WQC and water column toxicity, respectively.

- For the whole sediment bioassays, survival data were statistically compared to the survival in the reference sediment to determine if survival in JBLE Back River Channel sediments was significantly lower than survival in the reference sediment.

- In the 28-day bioaccumulation tests, survival in the JBLE Back River Channel sediment samples was statistically compared to survival in the reference sediment to determine if survival was significantly lower than the reference sediment.

- Concentrations of metals and organics in the worm and clam tissue were statistically compared against United States Food and Drug Administration (USFDA) Action/Guidance/Tolerance Levels to determine if analyte concentrations in tissue were significantly higher than USFDA Action/Guidance/Tolerance Levels;

- Chemical concentrations in organisms (clams and worms) exposed to JBLE Back River Channel sediments were statistically compared to chemical concentrations in organisms exposed to the reference sediment to determine if uptake of contaminants was significantly higher in organisms exposed to the JBLE Back River Channel sediments.

- For tissue samples that statistically exceeded reference site concentrations and pre-test tissue concentrations, mean concentrations were statistically compared to USEPA Region 4 background tissue concentrations for the South Atlantic Bight (USEPA/USACE 2008). USEPA Region 4 background values were used for comparison because there are no values for comparison in USEPA Region 3.

1.4.2 Upland Placement

Data analysis for upland placement included the following tasks:

- Comparison of chemical concentrations in bulk sediment to the site-specific criteria (Virginia Exclusion Criteria) for the Port Tobacco at Weanack facility (Table 1-4 and Appendix B).

- Determination of the potential for sediment acidity and requirement for soil amendments (lime addition) after upland placement by calculating the acid-base accounting values.

- Comparison of BTEX, EOX, and TPH concentrations in bulk sediment to the Virginia Disposal criteria for soil contaminated with petroleum products (9VAC20-81-660).

- Comparison of chemical constituents in the TCLP leachate to maximum concentrations of contaminants for toxicity characteristics (40 CFR 261.24) to determine if the material requires management as a hazardous waste or if the material is suitable for placement at approved upland sites.

- Evaluation of physical and chemical data for the JBLE Back River Channel sediments to determine the feasibility of placement at Port Tobacco at Weanack facility and other upland placement alternatives.

1.5 LIMITING PERMISSIBLE CONCENTRATION

For placement at the NODS, a tiered-testing procedure was required to determine compliance with the LPC as defined by federal regulations (40 CFR 220-228). The tiered-testing procedure has four levels of testing that result in the information necessary to determine if dredged material is suitable for ocean placement. Tier I (evaluate existing/historical data from the site) and Tier II (sediment and standard elutriate testing [SET]) utilize existing information and relatively rapid physical/chemical tests to predict environmental effects. Tier III (ecotoxicological testing) and Tier IV (ecological risk assessment) involve intensive biological testing to evaluate impacts of ocean placement of dredged material. Testing is only required until the data are sufficient to determine compliance or noncompliance with the LPC. If the available information is sufficient to demonstrate that the LPC is met once Tier III is completed, no further testing is required. Tier IV is typically only required in unusual circumstances, where a compliance determination cannot be made after completion of the first three tiers (USEPA/USACE 1991).

Compliance with Section 103 of the MPRSA requires meeting the LPC in four specific cases:

- WQC
- Water column toxicity
- Benthic toxicity
- Benthic bioaccumulation.

If LPC compliance is not met in one or more of these components, then the ocean placement requirements are not met. Each of the above components involves a series of steps to determine whether the tested sediment meets the LPC (Figure 1-3).

Water Quality Criteria

To evaluate LPC compliance, standard elutriates were prepared using the sediment and site water from the project area. A standard elutriate is a sediment/water mixture that is thoroughly mixed for 30 minutes, allowed to settle, and the supernatant is siphoned off and analyzed for dissolved chemical constituents. Standard elutriates are used to simulate the potential release of dissolved chemical constituents during ocean placement of dredged material.

To determine whether the sediments from the JBLE Back River Channel meet the acute WQC LPC requirement, STFATE modeling was conducted using the specifications of the placement site (i.e., dimensions and water column properties) to determine if the standard elutriate concentrations would meet the LPC for ocean placement.

The LPC for the WQC is the concentration which:

1) Does not exceed the WQC outside the site boundary during the first 4 hours, and
2) Does not exceed the WQC *anywhere* in the marine environment after 4 hours.

STFATE modeling was conducted to confirm that sufficient dilution would be achieved to meet the WQC LPC and to confirm that the sediment plume would stay within the boundary of the NODS placement site within the 4-hour period required by the MPRSA. STFATE modeling was conducted using the specifications of the NODS (i.e., dimensions and water column properties), physical characteristics of the sediment collected from the each DU within the JBLE Back River Channel footprint (i.e., grain size and specific gravity), and the concentrations of the chemical(s) in the elutriate that exceeded applicable WQC.

Water Column Toxicity

Water column bioassays were conducted on six DU composite samples, collected from within the dredging footprint to evaluate the LPC. The purpose of the testing was to evaluate toxicity of standard elutriates prepared from the sediment samples from within the dredging footprint. The testing program for the JBLE Back River Channel samples consisted of acute water column bioassays with *M. galloprovincialis* (blue mussel), *A. bahia* (opossum shrimp), and *M. beryllina* (inland silverside). The bioassays evaluated the effects of exposure to the elutriate samples on survival or normal embryo development of the test organisms. The LC_{50} or EC_{50} were calculated for each test.

The LPC for water column toxicity is the concentration that does not exceed 0.01 of the EC_{50}/LC_{50} within a 4-hour dilution period inside the boundary of the ocean placement site. STFATE modeling was conducted to confirm that sufficient dilution would be achieved to meet the water column toxicity LPC and to confirm that the sediment plume would stay within the boundary of the NODS placement site within the 4-hour period required by the MPRSA. STFATE modeling was conducted using the specifications of the NODS (i.e., dimensions and water column properties) and physical characteristics of the sediment collected from the each DU within the JBLE Back River Channel footprint (i.e., grain size and specific gravity). Multiple modeling scenarios were conducted for each DU to determine the maximum volume of material per single placement event that would meet the LPC.

Benthic Toxicity
Whole sediment bioassays were conducted to evaluate the LPC using sediment from each of the channels. Ten-day whole sediment bioassays were conducted with two estuarine/marine amphipods, *A. abdita* and *L. plumulosus*. Dredged material does not meet the benthic toxicity LPC when mean test organism mortality:

- Is statistically greater than in the reference sediment, **AND**
- Exceeds mortality (or other appropriate end point) in the reference sediment by at least 10 percent (or 20 percentage points for amphipods).

Benthic Bioaccumulation

Twenty eight-day bioaccumulation exposures were conducted to evaluate the potential for uptake of constituents from the sediment into organism tissue. *N. virens* (sand worm) and *M. nasuta* (blunt-nose clam) were exposed to sediment from the channels for 28 days.

Following exposure to sediments from the JBLE Back River Channel, tissue samples of *N. virens* and *M. nasuta* were analyzed for metals, PAHs, dioxin/furan congeners, select chlorinated pesticides, and select SVOCs. When tissue concentrations of contaminants of concern in organisms exposed to dredged material statistically exceed those of organisms exposed to the reference material, the dredged material has the potential to result in benthic bioaccumulation of contaminants. If the tissue concentrations statistically exceed those of organisms exposed to the reference site, the bioaccumulation is evaluated to determine if placement of dredged material is likely to cause ecologically significant bioaccumulation.

Dredged material does not meet the benthic bioaccumulation LPC if the tissue concentrations are statistically greater than USFDA Action/Guidance/Tolerance Levels.

1.6 REPORT ORGANIZATION

This data report contains a comprehensive summary of the sampling program and the results of bulk sediment, site water, standard elutriate, and ecotoxicological testing for the JBLE Back River Channel project. An overview of the field sampling program is provided in Chapter 2. Chapter 3 presents the analytical methods used in the sediment, site water, receiving water, standard elutriate, and tissue analyses. Bulk sediment results are provided in Chapter 4. Standard elutriate, site water, and receiving water results are provided in Chapter 5. Whole sediment and water column bioassay results are provided in Chapter 6 and bioaccumulation testing and tissue evaluation are presented in Chapter 7. Chapter 8 presents a review of ocean placement LPC compliance and an evaluation with respect to upland placement options. References cited in this report are provided in Chapter 9.

1.7 REPORT APPENDICES AND ATTACHMENTS

The following data are incorporated into the appendices, which are included on the enclosed CD as PDF files:

Appendix A – Field Logbooks. A copy of the field logbook that was maintained during the sediment/site water sampling is provided in this appendix.

Appendix B – Port Tobacco At Weanack Land Reclamation Site Screening Tables. A copy of the tables comparing the chemical constituents in the JBLE Back River Channel sediment samples to the Weanack facility screening criteria are provided in this appendix.

Appendix C – Analytical Results for Bulk Sediment Samples. Copies of the chain-of-custody (COC) forms and the laboratory (TestAmerica) analytical data reports (including laboratory QA/QC documentation) for the sediment, including reference and control sediment, analyses are provided in this appendix.

Appendix D – Analytical Results for Site Water, Receiving Water, Standard Elutriate, and Equipment Blank Samples. Copies of the COC forms and the laboratory (TestAmerica) analytical data reports (including the laboratory QA/QC documentation) for the site water, NODS water, standard elutriate, and equipment blank analyses are provided in this appendix.

Appendix E – Analytical Results for Tissue Samples. Copies of the COC forms and the laboratory (TestAmerica) analytical data reports (including QA/QC documentation) are provided in this appendix. Analytical data for each individual replicate are provided in summary tables in this appendix, as well as a detailed description of the statistical methods and calculations used in the tissue evaluation.

Appendix F – STFATE Modeling. A summary of the STFATE Model input parameters and copies of the output files for assessing LPC compliance are provided in this appendix.

Appendix G – Ecotoxicological Report. A copy of the full ecotoxicology report is provided in this appendix. This report includes test methods and results, COC documentation, laboratory data sheets, and documentation of laboratory QA/QC procedures.

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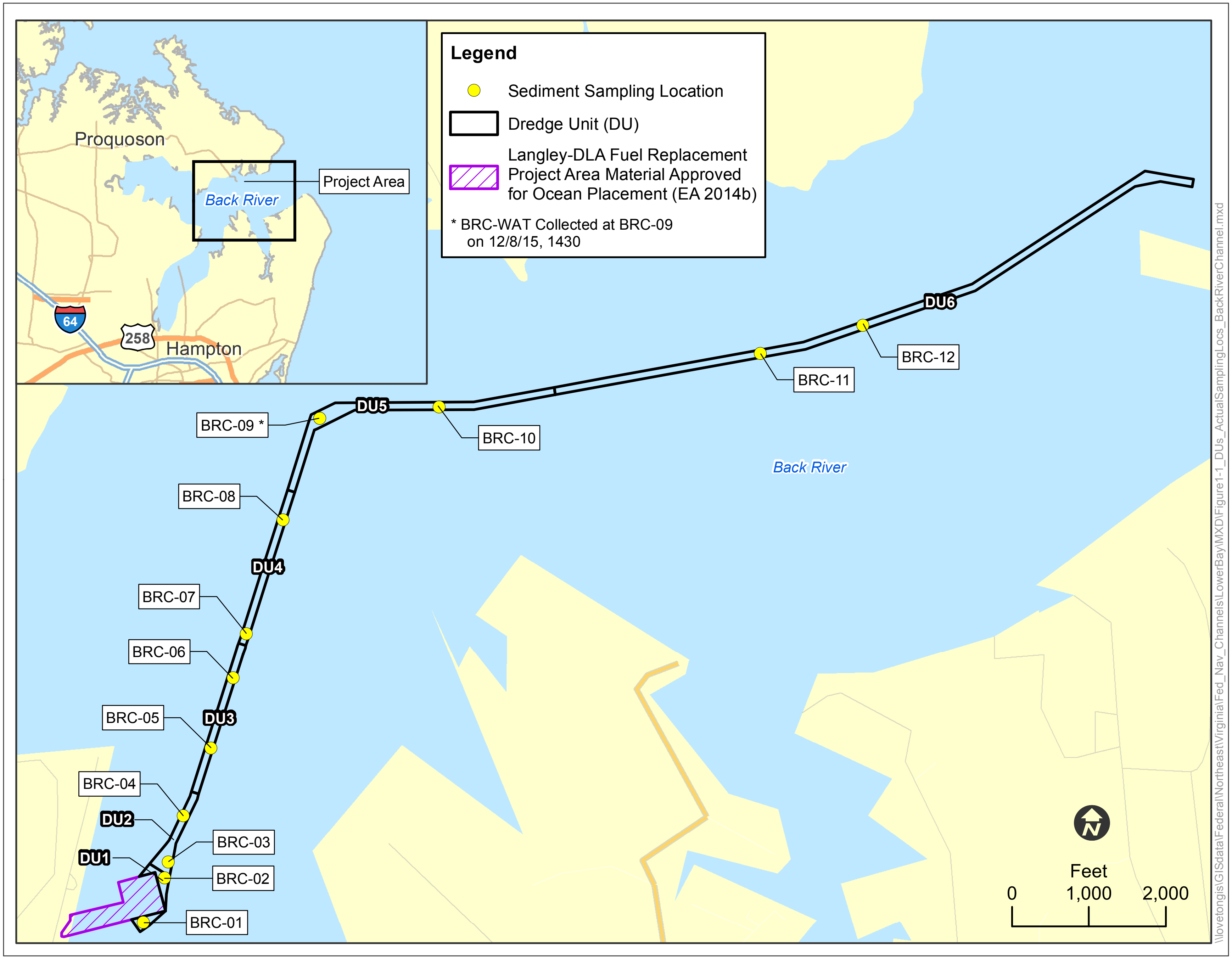


Figure 1-1. Sampling Locations and Dredging Units for the Back River Channel Project.

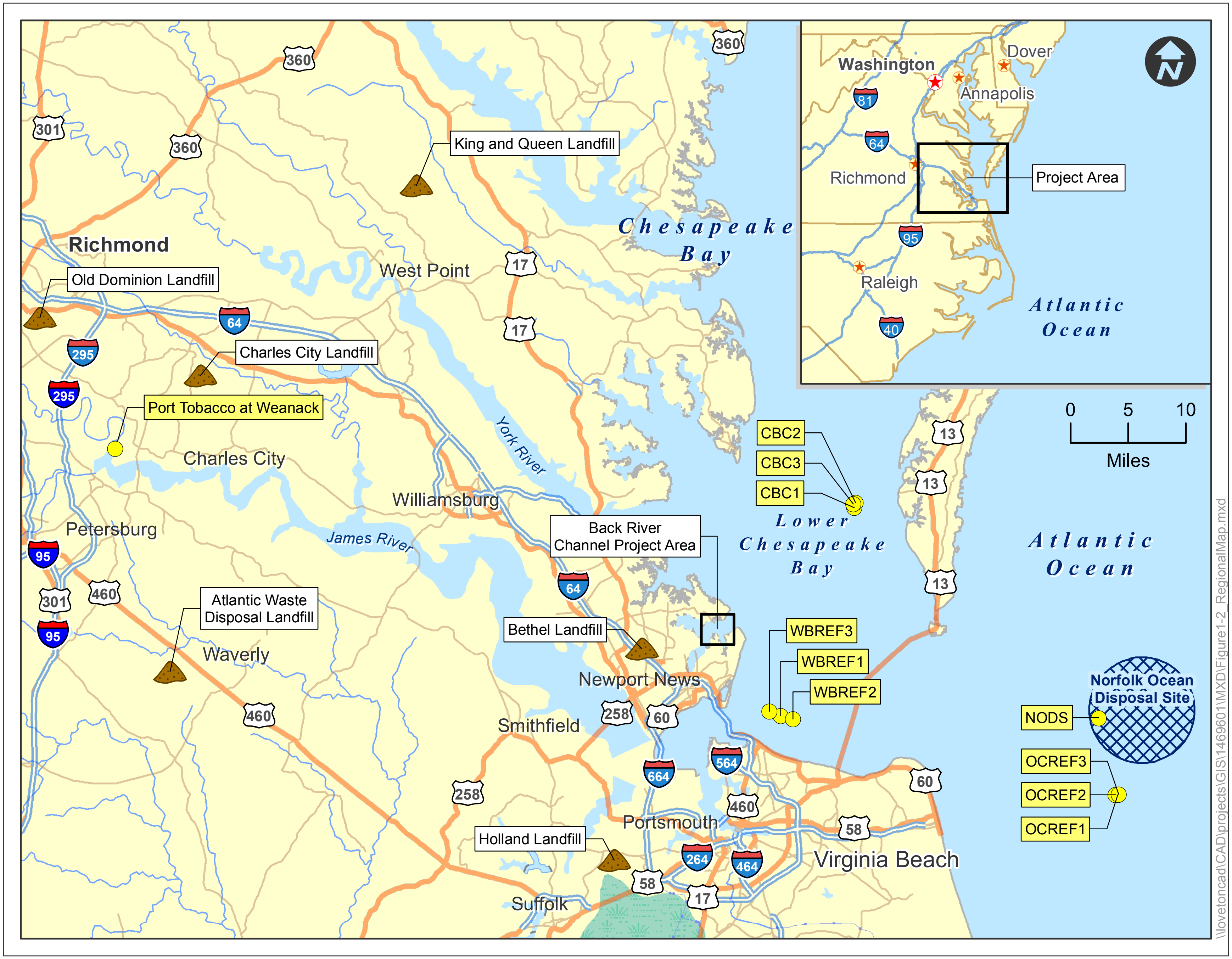
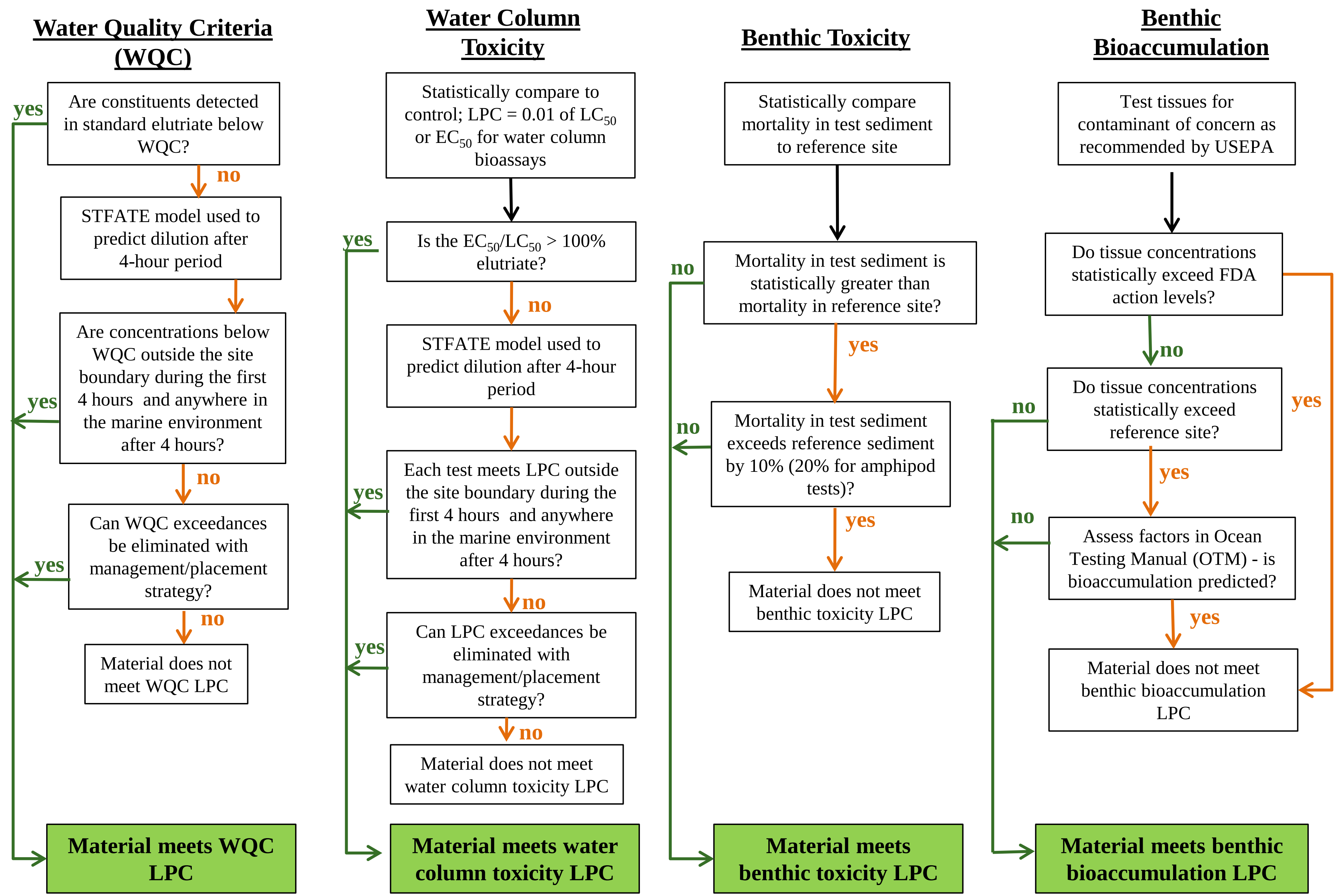


Figure 1-2. Back River Channel Project Area, Reference Locations (WBREF- and OCREF-), Chesapeake Bay Control Site (CBC-), Norfolk Ocean Disposal Site (NODS), and Potential Upland Placement Sites.



*The LPC must be met for each of the four criteria for ocean placement of material.

Figure 1-3. Limiting Permissible Concentration (LPC) Compliance (40 CFR 227.27) Needed for Ocean Placement of Dredged Material.

TABLE 1-1. ANALYTICAL TESTING PROGRAM
JBLE BACK RIVER CHANNEL, HAMPTON, VIRGINIA (DECEMBER 2015)

Physical / Chemical Constituent	Method	Back River Channel Individual Samples	Back River Channel DU Composite Samples	Willoughby Bank Reference	Atlantic Ocean Reference	Chesapeake Bay Control Site	NODS
Metals (ITM List)	SW846 6020	S	S, W, E, T	S, T	S, T	S	W
Mercury	SW846 7471A	S	S, W, E, T	S, T	S, T	S	W
Chlorinated Pesticides	SW846 8081A	S	S, W, E, T	S, T	S, T	S	W
Organophosphorus Pesticides	SW846 8141A	S	S, W, E	S	S	S	W
PCB Congeners	SW846 8082	S	S, W, E, T	S, T	S, T	S	W
Semivolatile Organic Compounds (SVOCs)	SW846 8270C	S	S, W, E	S	S	S	W
Polynuclear Aromatic Hydrocarbons (PAHs)		S	S, W, E, T	S, T	S, T	S	W
Dioxin and Furan Congeners	EPA 1613B	S	S, W, E, T	S, T	S, T	S	W
Butyltins	Unger Method	S	S, W, E	S	S	S	W
Acid Volatile Sulfide (AVS)	EPA Draft 1991	S	S	S	S	S	--
Simultaneously Extracted Metals (SEM)		S	S	S	S	S	--
Ammonia	EPA 350.1	S	S, W, E	S	S	S	W
Total Kjeldahl Nitrogen (TKN)	EPA 351.2	S	S, W, E	S	S	S	W
Nitrate + Nitrite	EPA 353.2	S	S, W, E	S	S	S	W
Total Phosphorous	EPA 365.2	S	S, W, E	S	S	S	W
Total Organic Carbon (TOC)	Lloyd Kahn	S	S, W, E	S	S	S	W
Total Sulfide	SW846 9030B/9034	S	S, W, E	S	S	S	W
Cyanide	SW846 9012A	S	S, W, E	S	S	S	W
Grain Size	ASTM D422	S	S	S	S	S	--
Specific Gravity	ASTM D854	S	S	S	S	S	--
Atterberg Limits	STM D4318	S	S	S	S	S	--
Total Solids	SW846	S	S	S	S	S	--
Lipids	TestAmerica SOP	--	T	T	T	--	--
Upland Parameters							
PCB Aroclors	SW846 8082	S	--	--	--	--	--
Total Petroleum Hydrocarbons-DRO (C10 to C34)	SW846 8015D	S	--	--	--	--	--
Total Petroleum Hydrocarbons-GRO (C6 to C10)		S	--	--	--	--	--
Paint Filter Test	SW846 9095A	S	--	--	--	--	--
Extractable Organic Halides (EOX)	SW846 9023	S	--	--	--	--	--
BTEX	SW846 8260B	S	--	--	--	--	--
TCLP Analysis (Includes Volatiles, Semivolatiles, Pesticides, Herbicides, Metals, Mercury, and TCLP	SW846 1311	S	--	--	--	--	--
pH	9045D	S	--	--	--	--	--
Flashpoint	7.1.2	S	--	--	--	--	--
Weanack LLC							
Potential Acidity	VA Tech method	S	--	--	--	--	--
Neutralization Potential	Neutralization Potential	S	--	--	--	--	--
Acid Base Accounting	Calculation	S	--	--	--	--	--
Calcium Carbonate Equivalence	AOAC 955.01	S	--	--	--	--	--
Pyritic Sulfur (Fizz Rating)	calculation	S	--	--	--	--	--
Saturated Paste pH & Conductivivty	Saturated paste extract	S	--	--	--	--	--

S = bulk sediment
W = site water and receiving water
E = standard elutriate
T = Tissue

TABLE 1-2. SEDIMENT COMPOSITING SCHEME AND ANALYTICAL SAMPLE IDS
JBLE BACK RIVER CHANNEL, HAMPTON, VIRGINIA (DECEMBER 2015)

Dredging Units (DUs)	Station IDs	Sampling Location	Sediment Chemistry ID	Sediment Chemistry Composite Sample ID	Standard Elutriate ID	Site Water Sample ID
Back River Channel						
DU1	06+00 to 09+00	BRC-01	BRC-01-SED	BRC-01/02-SED	BRC-01/02-SET	BRC-WAT
		BRC-02	BRC-02-SED			
DU2	09+00 to 20+00	BRC-03	BRC-03-SED	BRC-03/04-SED	BRC-03/04-SET	
		BRC-04	BRC-04-SED			
DU3	20+00 to 39+00	BRC-05	BRC-05-SED	BRC-05/06-SED	BRC-05/06-SET	
		BRC-06	BRC-06-SED			
DU4	39+00 to 60+00	BRC-07	BRC-07-SED	BRC-07/08-SED	BRC-07/08-SET	
		BRC-08	BRC-08-SED			
DU5	60+00 to 103+00	BRC-09	BRC-09-SED	BRC-09/10-SED	BRC-09/10-SET	
		BRC-10	BRC-10-SED			
DU6	103+00 to 192+64	BRC-11	BRC-11-SED	BRC-11/12-SED	BRC-11/12-SET	
		BRC-12	BRC-12-SED			
Willoughby Bank Reference Site						
--		WBREF1	--	WBREF-SED	--	--
		WBREF2				
		WBREF3				
Atlantic Ocean Reference Area						
--		OCREF1	--	OCREF-SED	--	--
		OCREF2				
		OCREF3				
Chesapeake Bay Control Sediment						
--		CBC1	--	CBCON-SED	--	--
		CBC2				
		CBC3				
Norfolk Ocean Disposal Site						
--		NODS	--	--	--	NODS-WAT

TABLE 1-3. SAMPLE TESTING SCHEME
JBLE BACK RIVER CHANNEL, HAMPTON, VIRGINIA (DECEMBER 2015)

Dredging Units (DUs)	Sampling Location	Bulk Sediment Analysis for Ocean Placement	Bulk Sediment Analysis for Upland Placement	Standard Elutriate Creation	Water Column Bioassays	Whole Sediment Bioassays	Bioaccumulation	Water Chemistry
DU1	BRC-01-SED	√	√					
	BRC-02-SED	√	√					
DU2	BRC-03-SED	√	√					
	BRC-04-SED	√	√					
DU3	BRC-05-SED	√	√					
	BRC-06-SED	√	√					
DU4	BRC-07-SED	√	√					
	BRC-08-SED	√	√					
DU5	BRC-09-SED	√	√					
	BRC-10-SED	√	√					
DU6	BRC-11-SED	√	√					
	BRC-12-SED	√	√					
DU1	BRC-01/02-SED	√		√	√	√	√	
DU2	BRC-03/04-SED	√		√	√	√	√	
DU3	BRC-05/06-SED	√		√	√	√	√	
DU4	BRC-07/08-SED	√		√	√	√	√	
DU5	BRC-09/10-SED	√		√	√	√	√	
DU6	BRC-11/12-SED	√		√	√	√	√	
--	BRC-WAT			√	√			√
Willoughby Bank Reference Site	WBREF-SED	√				√	√	
Atlantic Ocean Reference Area	OCREF-SED	√				√	√	
Chesapeake Bay Control Sediment	CBCON-SED	√				√		
Norfolk Ocean Disposal Site	NODS-WAT							√

TABLE 1-4. SCREENING CRITERIA FOR PLACEMENT AT PORT TOBACCO AT WEANACK

JBLE BACK RIVER CHANNEL, HAMPTON, VIRGINIA (DECEMBER 2015)

	Criteria								
	NJDEP (1997) Residential Soil Cleanup Criteria[3]	EPA Region 3 Screening Levels (EPA, 2014)[4]		EPA Part 503 Biosolids	USGS soil background metals[5]				
PARAMETER		Industrial Soil	Residential Soil	Exceptional Quality	VA background metal levels	Exclusion Criteria[6]	Clean Upland Fill Criteria[7]	VA DEQ 305 (b) Screening Criteria	More stringent of preceding two columns[8]
Metals (mg kg^{-1})									
Aluminum	NA	110,000	7,700			NA	NA		
Antimony	14	47	3			410	14		14
Arsenic	20	3.0	0.67	41	5	41	20	33	20
Barium	700	22,000	1,500		244	19,000	700		700
Beryllium	1	2,300	16		<1	2,000	160		160
Cadmium	39	98	7	39	<0.1	810	39	4.98	4.98
Calcium	NA	NA	NA			NA	NA		
Chromium	NA	NA	NA	0.3	23	1,200	200	111	111
Cobalt	NA	35	2.3			300	NA		
Copper	600	4,700	310	1,500	9	4,300	1,500	149	149
Iron	NA	82,000	5,500			150,000	150,000		150,000
Lead	400	800	400	300	26	800	300	128	128
Magnesium	NA	NA	NA			NA	NA		
Manganese	NA	NA	NA		295	NA	NA		
Mercury	14	12	0.78	17	0.06	100	14	1.06	1.06
Nickel	250	1,100	82	420	9	1,000	250.0	48.6	48.6
Potassium	NA	NA	NA			NA	NA		
Selenium	63	580	39	100		5,100	63		63
Silver	110	580	39			5,100	110	NA	110
Sodium	NA	NA	NA			NA	NA		
Thallium	2	NA	NA		0.5	5	1		1
Vanadium	370	580	39			5,200	370		370
Zinc	1,500	35,000	2,300	2,800	41	7,500	1,500	459	459
PCBS (mg kg^{-1})									
Aroclor 1016	NA	5.2	0.4			21	NA		
Aroclor 1221	NA	0.66	0.15			0.62	NA		
Aroclor 1232	NA	0.66	0.15			0.62	NA		
Aroclor 1242	NA	1.0	0.24			0.74	NA		
Aroclor 1248	NA	1.0	0.24			0.74	NA		
Aroclor 1254	NA	1.0	0.11			0.74	NA		
Aroclor 1260	NA	1.0	0.24			0.74	NA		
Total Aroclor[9]	0	10.5	1.50			25.2	0.49		0.49
Total PCBs, all cogeners	0.49					NA	0.676	0.676	0.676
Pesticides (mg kg^{-1})									
4,4'-DDD	3	9.6	2.2			7.2	3	0.028	0.028
4,4'-DDE	2	6.8	1.6			5.1	2	0.0313	0.0313
4,4'-DDT	2	8.6	1.9			7	2	0.0629	0.0629
DDT, Total								0.5720	*
Aldrin	0.04	0.14	0.031			0.11	0.04		0.04
alpha-Chlordane	NA	NA	NA			NA	NA		
gamma-Chlordane	NA	NA	NA			NA	NA		
Chlordane	NA	8.0	1.8					0.0176	0.0176
Chloropyrifos	NA	82.0	6.2						
delta-BHC	NA	NA	NA			NA	NA		
Diazinon	NA	58	4						
Dieldrin	0.042	0.14	0.03			0.11	0.042	0.0618	0.042
Endosulfan	NA	490	37			3,700	NA		
alpha-Endosulfan	NA	NA	NA			NA	NA		
beta-Endosulfan	NA	NA	NA			NA	NA		
Endosulfan sulfate	NA	NA	NA			NA	NA		
Endrin	17	25	1.8			180	17	0.207	0.207
Endrin aldehyde	NA	NA	NA			NA	NA		
Guthion		250	18						
Endrin ketone	NA	NA	NA			NA	NA		
Heptachlor	0.15	0.51	0.12			0.38	0.15		0.15
Heptachlor epoxide	NA	0.25	0.059			0.19	NA	0.016	0.016
alpha-BHC (Hexachlorocyclhexane)	NA	NA	NA						
beta-BHC (Hexachlorocyclhexane)	NA	NA	NA						
gamma-BHC (Lindane, Hexachlorocyclhexane)	0.52	NA	NA			0.52	0.52	0.00499	0.00499
Kepone	NA	0.23	0.053						
Malathion		1300	120						
Methoxychlor	280	410	31			3,100	280		280
Mirex	NA	0.13	0.03						
Parathion	NA	490	37						
Toxaphene	0.1	2.1	0.48			1.6	0.1		0.1

TABLE 1-4 (CONTINUED)

	Criteria								
	NJDEP (1997) Residential Soil Cleanup Criteria[3]	EPA Region 3 Screening Levels (EPA, 2014)[4]		EPA Part 503 Biosolids	USGS soil background metals[5]				
PARAMETER		Industrial Soil	Residential Soil	Exceptional Quality	VA background metal levels	Exclusion Criteria[6]	Clean Upland Fill Criteria[7]	VA DEQ 305 (b) Screening Criteria	More stringent of preceding two columns[8]
Base Neutral Extractables (mg kg^{-1})									
Acenaphthene	3,400	4,500	350			33,000	3,400	NA	3,400
Acenaphthylene	NA	NA	NA			NA	NA	NA	
Anthracene	10,000	23,000	1,700			170,000	10,000	0.845	0.845
Benzidine	NA	0.01	0.00052			NA	NA		
Benzo(a)anthracene	0.9	2.9	0.15			2.1	0.9	1.05	0.9
Benzo(b)fluoranthene	0.9	2.9	0.15			2.1	0.9		0.9
Benzo(k)fluoranthene	0.9	29	1.5			21	0.9		0.9
Benzo(ghi)perylene	NA	NA	NA			NA	NA		
Benzo(a)pyrene	0.66	0.29	0.015			0.66	0.21	1.45	0.21
bis(2-Chloroethoxy)methane	NA	250	18			1,800	NA		
bis(2-Chloroethyl) ether	0.66	1.0	0.23			0.9	0.66		0.66
2,2'-oxybis(1-Chloropropane) (Bis-2-Chloroisopropyl ether)	2,300	NA	NA			2,300	2,300		2,300
bis(2-Ethylhexyl) phthalate	49	160	38			120	49		49
4-Bromophenyl phenyl ether	NA	NA	NA			NA	NA		
Butyl benzyl phthalate	1,100	1,200	280			1,100	910		910
Carbazole	NA	NA	NA			NA	NA		
4-Chloroaniline	230	NA	NA			230	230		230
2-Chloronaphthalene	NA	NA	NA			NA	NA		
4-Chlorophenyl phenyl ether	NA	NA	NA			NA	NA		
Chrysene	9	290	15			210	9	1.29	1.29
Dibenz(a,h)anthracene	0.66	0.29	0.015			0.66	0.21	NA	0.21
Dibenzofuran	NA	100	7.2			NA	NA		
Di-n-butyl phthalate (dibutyl phthalate)	5,700	NA	NA			5,700	5,700		5,700
1,2-Dichlorobenzene	5,100	930	180			10,000	5,100		5,100
1,3-Dichlorobenzene	5,100	NA	NA			5,100	5,100		5,100
1,4-Dichlorobenzene	570	820	62.0			570	13		13
3,3'-Dichlorobenzidine	2	5.1	1.2			3.8	2		2
Diethyl phthalate	10,000	66,000	4,900			490,000	10,000		10,000
Dimethyl phthalate	10,000	NA	NA			10,000	10,000		10,000
Di-n-octyl phthalate	1,100	820	62			1,100	1,100		1,100
2,4-Dinitrotoluene	NA	7.4	1.7			1,200	NA		
2,6-Dinitrotoluene	1	1.5	0.36			620	61		61
1,2-Diphenylhydrazine	NA	2.9	0.67						
Fluoranthene	2,300	3,000	230			22,000	2,300	2.23	2.23
Fluorene	2,300	3,000	230			22,000	2,300	0.536	0.536
Hexachlorobenzene	0.66	1.4	0.33			1.1	0.66		0.66
Hexachlorobutadiene	1	30	6.2			22	1		1
Hexachlorocyclopentadiene	400	490	37			3,700	400		400
Hexachloroethane	6	58	4.3			120	6		6
Indeno(1,2,3-cd)pyrene	0.9	2.9	0.15			2.1	0.9		0.9
Isophorone	1,100	2,400	560			1,800	1,100		1,100
2-Methylnaphthalene	NA	300	23			4,100	NA	NA	
Naphthalene	230	17	3.8			230	20	0.561	0.561
2-Nitroaniline	NA	NA	NA			NA	NA		
3-Nitroaniline	NA	82	18			82	NA		
4-Nitroaniline	NA	120	25			82	NA		
Nitrobenzene	28	22	5.1			280	28		
2-Nitrophenol	NA	NA	NA						
4-Nitrophenol	NA	NA	NA						
N-Nitroso-dimethylamine	NA	0.045	0.0023						
N-Nitroso-di-N-propylamine	0.66	0.33	0.076			0.66	0.25		0.25
N-Nitrosodiphenylamine	140	470	110			350	140		140
Phenanthrene	NA	NA	NA			NA	NA	1.17	1.17
Pyrene	1,700	2,300	170			17,000	1,700	1.52	1.52
1,2,4-Trichlorobenzene	68	26	5.8			400	68		68

TABLE 1-4 (CONTINUED)

PARAMETER	Criteria: NJDEP (1997) Residential Soil Cleanup Criteria[3]	EPA Region 3 Screening Levels (EPA, 2014)[4]: Industrial Soil	EPA Region 3 Screening Levels (EPA, 2014)[4]: Residential Soil	EPA Part 503 Biosolids: Exceptional Quality	USGS soil background metals[5]: VA background metal levels	Exclusion Criteria[6]	Clean Upland Fill Criteria[7]	VA DEQ 305 (b) Screening Criteria	More stringent of preceding two columns[8]
Acid Extractables (mg kg^{-1})									
4-Chloro-3-methylphenol	10,000	NA	NA			10,000	10,000		10,000
2-Chlorophenol	280	580	39			5,100	280		280
2,4-Dichlorophenol	170	250	18			1,800	170		170
2,4-Dimethylphenol	1,100	1,600	120			12,000	1,100		1,100
2,4-Dinitrophenol	110	160	12			1,200	110		110
4,6-Dinitro-2-methylphenol	NA	NA	NA			NA	NA		
2-Methylphenol	2,800	NA	NA			2,800	2,800		2,800
4-Methylphenol	2,800	NA	NA			2,800	2,800		2,800
Nonylphenol	NA	NA	NA						
Pentachlorophenol	6	4.0	0.99			9	6		6
Phenol	10,000	25,000	1,800			180,000	10,000		10,000
2,4,5-Trichlorophenol	5,600	8,200	620			62,000	5,600		5,600
2,4,6-Trichlorophenol	62	82	6.2			160	62		62
Miscellaneous (mg kg^{-1})									
Ammonia as NH_3-N	NA	NA	NA						
Chloride	NA	NA	NA						
Cyanide, Free									
Cyanide, Total	1,100	20,000	1,600			20,000	1,100		1,100
2,4-Dichlorophenoxy Acetic Acid (2,4-D)	NA	970	69.0						
Fluoride	NA	4,700	310						
Hydrogen sulfide		1,200,000	280,000						
Nitrate (as N)	NA	190,000	13,000						
Nitrite (as N)	NA	12,000	780						
Total PAHs	NA	NA	NA			NA	23		
Total phenols (phenolic compounds)						NA			
Low molecular weight PAHs						NA			
High molecular weight PAHs						NA			
Total PAHS								22.8	22.8
Sulfate									
2-(2,4,5 Trichlorophenoxy) Proprionic acid (Silvex)	NA	660	49			NA	NA		
Dioxin and Furans (ng kg^{-1})									
2,3,7,8-TCDD	NA	22	4.9			18	4.3		4
Tributyltin (mg kg^{-1})									
Tributyltin Compounds	N	25	1.8						
Petroleum (mg kg^{-1})									
Total petroleum hydrocarbons (TPH)									
TPH-DRO							22.8		

TABLE 1-4 (CONTINUED)

PARAMETER	Criteria: NJDEP (1997) Residential Soil Cleanup Criteria[3]	EPA Region 3 Screening Levels (EPA, 2014)[4]: Industrial Soil	EPA Region 3 Screening Levels (EPA, 2014)[4]: Residential Soil	EPA Part 503 Biosolids: Exceptional Quality	USGS soil background metals[5]: VA background metal levels	Exclusion Criteria[6]	Clean Upland Fill Criteria[7]	VA DEQ 305 (b) Screening Criteria	More stringent of preceding two columns[8]

Additional Analyses[10]	Units and Reporting convention	Method	Exclusion Criteria[6]	Clean Fill Criteria[7]
Acid-Base Accounting (all samples > 0.25% total S) or H2O2 Potential Acidity	Tons CCE acid demand per 1000 Tons Material	EPA 600-2-78-054	-10 unless under water table	-5
Pyritic S	% or g kg^{-1}		2.00	0.25
Calcium Carbonate Equivalence	%CCE	AOAC 955.01	NA	NA
Soluble Salts	mmhos cm^{-1} or dS m^{-1}	Saturated paste extract	NA	4.0 after leaching
Total Organic Carbon	% or g kg^{-1}		NA	≤ 5%
Particle Size Analysis (<2 mm)	%Sand	<2 mm samples	NA	NA
	% Silt		NA	NA
	% Clay		NA	NA
Coarse fragments		>2 mm samples	NA	

NA= Indicates that criteria are not available.

1. Enter values for **each discrete or composite sample into a separate column**. Also provide an overall average for all samples in the right-hand data column. For samples <RL, use 50% of RL for data entry column. One-

2. Use **bold highlight** for all individual samples entered in working area and average sample values that exceed the "proposed VA upland fill criteria" in far right column. Highlight all values exceeding proposed VA exclusion criteria in **bold highlight** **red**. Put arbitrary values calculated as 50% the RL in *italics*. Tip: when copying numbers from your lab analytical results spreadsheets to this spreadsheet, samples with a "<" in front of them are typically at the RL and should reported as 50% RL and put in *italics*.

3. New Jersey Department of Environmental Protection, The Management and Regulation of Dredging Activities and Dredged Material in New Jersey's Tidal Waters. 1997. http://www.njstatelib.org/digit/r588/r5881997.html

4. EPA Region 3 SSLs have been merged into a regional document developed with input from Regions III, VI, and IX. Values from May 2014 version. Values listed for: antimony (metallic), arsenic (inorganic), chromium VI (particulates), lead and compounds, manganese and cadmium values are for diet, methyl mercury, nickel refinery dust, vanadium and compounds. Website: http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm

5. Background metal levels specific to the state of Virginia based on Smith, D.B. et al. 2005. Major- and Trace-Element Concentrations in Soils from Two Continental-Scale Transects of the United States and Canada. USGS Open File Report 2005-1253.http://pubs.usgs.gov/of/2005/1253/pdf/OFR1253.pdf

6. The exclusion standards generally represent the higher of EPA RBC Industrial, NJDEP or EPA 503 EQ levels for a given parameter. Values exceeding these limits are questionable for acceptance. Values proposed by Virginia Tech.

7. Clean fill criteria are based primarily on NJDEP residential cleanup criteria and manually adjusted for known issues with agricultural production/bioavailability. Values between the clean fill and exclusion criteria require a variation of the current management strategy. Values proposed by Virginia Tech.

8.More stringent of VA DEQ and clean fill criteria. These values carried forward to Part I.A of draft 2012 permit.

9. Total Aroclor concentrations are reported as sum of seven individual aroclors.

10. Additional analyses for these basic properties are essential for determining the management or acceptance of dredge material.

11.Not needed, give screening levels for DDD, DDE, DDT

Note: Minimum sampling is one composite sample per 50,000 yards of material in situ. A minimum of three samples per material is required regardless of volume. Specific information on sampling procedures should go into the brief descriptions box at the top of the spreadsheet.

2. FIELD SAMPLING AND SAMPLE PROCESSING

The field sampling program was carried out in accordance with the project SAP (EA 2015d) that was reviewed and approved by the USEPA Region 3 and the USACE prior to implementation of the project. Mobilization for the JBLE Back River Channel sampling commenced on 6 December 2015. NODS receiving water and Atlantic Ocean reference sediment were collected on 7 December 2015, Willoughby Bank reference site and control sediment samples were collected on 10 December 2015 (Figure 1-2, Table 2-1). Sediment and site water collection in the JBLE Back River Channel was conducted from 8-10 December 2015 (Figure 1-1, Table 2-1).

Surficial sediments from the reference and control sites were successfully sampled using a stainless steel Van Veen sediment grab. Site water from one sampling location within the project area was collected for chemical analysis and standard elutriate preparation. Sediment in the project area was collected using a vibracore unit at eight locations (BRC-01-08) and a Van Veen sediment grab at 4 locations (BRC-09-12). Coordinates and sample information for each of the sampling locations are summarized in Table 2-1.

A copy of the project logbook with the raw data is located in Appendix A.

2.1 SAMPLING OBJECTIVES

The overall objective of the sampling effort was to obtain and analyze sediment and water samples representative of the area proposed for dredging. Specific objectives of the field sampling and sample processing/testing for the dredged material evaluation were:

- Collect the necessary number of sediment cores or sediment grabs from each of the twelve project locations (Table 1-2) for adequate sample volume to a depth of -15 ft MLLW.
- Collect surficial sediment at the Willoughby Bank reference site, the Atlantic Ocean reference site, and the Chesapeake Bay control sediment site.
- Collect the required volume of site water from one location from within the project footprint for chemical analysis, standard elutriate preparation, and ecotoxicological testing.
- Collect the required volume of receiving water from the NODS for chemical analysis.
- Measure and record water quality information (temperature, salinity, pH, dissolved oxygen [DO], and turbidity) at each sampling location.
- Homogenize sediment to create six composite samples representative of each DU that will be submitted for bulk sediment, standard elutriate preparation, and ecotoxicological testing (See Table 1-2 for testing scheme).

- Submit discrete sediment samples from each of the twelve locations for bulk sediment testing required for ocean placement and placement at upland sites, including landfills and Weanack, LLC.

- Collect and transfer water and sediment to appropriate laboratory-prepared containers and preserve/hold samples for analysis according to protocols that ensure sample integrity.

- Complete appropriate COC documentation.

- Provide chemical and ecotoxicological data for the JBLE Back River Channel project to assess potential impacts related to ocean placement, to document compliance with Section 103 of the MPRSA, and to assess alternate upland placement options.

2.2 SAMPLING LOCATIONS

Coordinates for each sampling location in the JBLE Back River Channel dredging footprint are provided in Table 2-1 (northings and eastings, Virginia State Plane, North American Datum of 1983). Positioning was determined in the field using a digital global positioning system, which uses either the United States Coast Guard Differential Beacon System or the Omnistar® Satellite Differential System to obtain differential accuracy of 3–5 meters.

Coring depths were determined based on tide-corrected water depths in the field. Water depths for DU5 and DU6 were tide corrected based on data obtained from the Chesapeake Bay Bridge Tunnel Station (8638863) tide gauge, maintained by the National Oceanic and Atmospheric Administration (NOAA) National Ocean Service. Water depths for DU1 through DU4 were tide corrected in the field using an USACE tide gauge located at the Poquoson-Messick Boat Launch. Horizontal and vertical control was provided by the USACE-Norfolk District, Operations Branch, Navigation Support and Survey Section, survey vessel "Sea Ark".

2.3 SAMPLE VOLUME REQUIREMENTS

For each discrete sample submitted for analytical testing, a total of approximately two gallons of sediment were collected for bulk sediment analysis for upland and ocean placement. For each composite sample submitted for analytical testing, 2 gallons were collected for bulk sediment analysis for ocean placement, 3 gallons were collected for standard elutriate testing, and 25 gallons were collected for the ecotoxicological testing. Therefore, approximately 240 gallons of sediment were collected from the JBLE Back River Channel. Additional sediment volume was required for analysis of field duplicate samples, and additional volume was collected for MS/MSD analyses. Additional sample volume was also archived at EA to allow re-analysis of physical, chemical, or ecotoxicological testing, if needed. Approximately 30 gallons of sediment were collected from each of the reference sites and control site for physical and chemical analysis and for ecotoxicological testing.

Approximately 110 gallons of site water were collected from one location within the JBLE Back River Channel project footprint for chemical analysis, standard elutriate preparation, and ecotoxicological testing, 6 gallons were collected for chemical analysis and MS/MSD analyses. Approximately 2 gallons of receiving water were collected from the NODS.

2.4 *IN SITU* WATER QUALITY MEASUREMENTS

In situ water quality measurements were recorded using YSI 650 instrumentation. Water temperature, pH, DO, turbidity, and salinity profiles (bottom, mid-depth, and surface increments) were recorded at each sediment sampling location (Table 2-2).

2.5 SAMPLE COLLECTION, STORAGE, TRANSPORT, AND HOLDING TIMES

Sediments representative of maintenance material were collected from each of the 12 locations within the dredging footprint to a depth of -15 ft MLLW using either a vibracore or a Van Veen surface sampler.

The site water/elutriate preparation and receiving water samples were collected using peristaltic pumps with dedicated Tygon tubing. A copy of the project logbook is located in Appendix A.

2.5.1 JBLE Back River Channel Sample Collection

Sediment sampling in the JBLE Back River Channel was conducted from the USACE *M/V Elizabeth*. The Poquoson-Messick Boat Launch served as the staging area for personnel and equipment during the sampling.

Sediment cores were collected from DU1, DU2, DU3, and DU4 to a depth of -15 ft MLLW using a vibracore provided by USACE-Norfolk. The vibracoring system used a stainless steel core barrel capable of holding a core liner with an outside diameter of 3.5 inches. Cellulose acetate butyrate (CAB) core liners with an inner diameter of 3.25 inches were used for sampling. Vibracoring as conducted by placing a clean, CAB liner into the stainless steel barrel. The barrel was lowered to the sediment surface and vibrated to the required depth. After the core penetrated to a sufficient depth, the core barrel was retrieved and brought onto the barge deck. The core liner was removed from the steel barrel, capped at both ends, sealed, and labeled. A summary of the sediment recovery information for cores collected within the JBLE Back River Channel dredging footprint is provided in Table 2-1.

Sediment sampling in DU5 and DU6 was conducted using a Van Veen grab sampler. Multiple grabs were collected from each individual location for adequate analytical volume and composited onboard the sampling platform.

Sediment samples collected during each work day were stored onboard the sampling platform. Cores were transferred to a refrigerated unit (at 4 degrees Celsius [°C]) at the onshore staging area at the end of each workday and samples collected with the Van Veen designated for bulk sediment analysis were shipped directly the Test America from the field.

The refrigeration unit at the staging area was secured with a padlock when unattended. After completion of the coring activities, the sediment cores were transported in a refrigerated truck (at 4°C) to EA in Hunt Valley, Maryland, where they were composited and homogenized for testing. The cores were stored in a secured refrigeration unit at EA (at 4°C) until they were processed.

The sample containers, preservatives, and holding time requirements for sediment samples are provided in Table 2-3. Holding times began when the samples were composited, homogenized, and placed in the appropriate sample containers.

Field Duplicate

A field duplicate is a separate sample collected in the field at the same time and place as a normal sample. Duplicates are utilized to determine the precision of field sampling and laboratory analytical activities. Field duplicates are also indicative of sample homogeneity. For this project, two field duplicates (BRC-09-FD and BRC-10-FD) were submitted for physical and chemical analysis.

2.5.2 Reference Sediment

Surficial sediment was collected at the Willoughby Bank reference site and the Atlantic Ocean reference site using a stainless steel Van Veen grab sampler on 10 and 7 December 2016, respectively, from the USACE *M/V Harrell*. The *M/V Harrell* mobilized from the USACE-Norfolk office on each day of sampling. Three locations were sampled within each reference area. Multiple grabs were collected from each location to obtain the necessary sample volume for bulk sediment and ecotoxicological analyses. Sample composites were created on board the work platform using stainless steel spoons and a pre-cleaned, 55-gallon stainless steel holding container. Because sediments were collected using a grab sampler, holding times for the surface reference sediment samples began at the time of sample collection. Samples designated for ecotoxocological testing were stored in the refrigeration unit staged at Poquoson-Messick Boat Launch and samples designated for bulk sediment analysis were shipped to TestAmerica-Pittsburgh directly from the field. The sample containers, preservatives, and holding time requirements for sediment samples are provided in Table 2-3.

2.5.3 Chesapeake Bay Control Sediment

Surficial sediment was collected from the Chesapeake Bay control site for use in the amphipod whole sediment bioassays using a stainless steel Van Veen grab sampler on 10 December 2015 from the USACE *M/V Harrell.* Three locations were sampled within the control area. Multiple grabs were collected to obtain the necessary sample volume for bulk sediment and ecotoxicological analyses. Sample composites were created on board the work platform using stainless steel spoons and a pre-cleaned, 55-gallon stainless steel holding container. Sample volume designated for ecotoxocological testing was stored in the refrigeration unit staged at Poquoson-Messick Boat Launch. The sample containers, preservatives, and holding time requirements for sediment samples are provided in Table 2-3. Because sediments were collected using a grab sampler, holding times for the control sediment samples began at the time of sample collection.

2.5.4 Site Water/Elutriate Preparation Water/Receiving Water

Site water and elutriate preparation water were collected from one location within the dredging footprint on 8 December 2015 from the USACE *M/V Elizabeth*. Receiving water from the NODS was collected on 10 December 2015 from the USACE *M/V Harrell.* Site water/elutriate preparation water and receiving water was collected from mid-depth of the water column using ISCO pumps with dedicated Tygon tubing.

Site water and receiving water targeted for chemical analysis was shipped to TestAmerica-Pittsburgh on the day of collection. Site water targeted for use in standard elutriate preparation and ecotoxicological testing was stored in 5-gallon high density polyethylene carboys, transported to a refrigeration unit at each staging area at the end of each work day, and hand-delivered to TestAmerica-Pittsburgh and EA's Ecotoxicology Laboratory, respectively.

The sample containers, preservatives, and holding time requirements for site water, receiving water, and elutriate preparation water are provided in Table 2-4. Holding times for the site water samples began when the samples were collected and placed into the appropriate sample containers.

2.5.5 Equipment Blanks

Equipment blanks are collected to determine the extent of contamination, if any, from the sampling equipment used as part of the project. Four equipment blanks were collected: one for the core catcher, one for the core cutter, one for the grab sampler, and one for the peristaltic pump used to collect the site water. Equipment blanks were collected by pouring de-ionized (DI) water, which was provided by EA's Ecotoxicology Laboratory, over sampling equipment that was decontaminated using the procedure outlined in Section 2.7. The rinsate water was placed in laboratory-prepared containers, submitted to the analytical laboratory, and tested for the same chemical parameters as the sediments and site water. Equipment blanks were sent to TestAmerica-Pittsburgh via overnight delivery on the day of collection.

The sample containers, preservatives, and holding time requirements for equipment blanks are provided in Table 2-4. Holding times for the equipment blanks began when the samples were collected and placed into the appropriate sample containers.

2.6 SEDIMENT CORE PROCESSING

Cores were processed in a designated area at EA's warehouse facility. Prior to processing, cores were sorted and checked against the COC form. Sediments were extracted from each core using a stainless steel extrusion rod, composited, and homogenized in certified cleaned, 55-gallon stainless steel holding containers.

Discrete samples from each location consisted of whole core composites. Discrete samples were processed first, and sub-samples of sediment were removed for bulk sediment testing. Any sediment volume remaining after the discrete samples was incorporated into the sediment composites.

Composite sediment samples submitted for testing consisted of a composite of multiple cores from two locations within each DU. Samples were composited and homogenized according to the scheme in Table 1-2. The composited samples were homogenized using a pre-cleaned, 55-gallon stainless steel holding container. Each sample was homogenized until the sediment was thoroughly mixed and of uniform consistency.

Sample processing equipment that came into direct contact with the sediment was decontaminated according to the protocols specified in Section 2.7. When compositing was completed, sub-samples of sediment were removed for bulk chemistry testing, standard elutriate testing, and ecotoxicological testing. Sediment to be used for ecotoxicological testing was sieved through a 1-millimeter mesh screen to remove plant debris, predators, and shell and rock fragments prior to testing.

2.7 EQUIPMENT DECONTAMINATION AND WASTE HANDLING PROCEDURES

Equipment that came into direct contact with sediment during sampling was decontaminated prior to deployment in the field and between each sampling location to minimize cross-contamination. This included the core tubes, the Van Veen grab sampler, the 55-gallon stainless steel holding container, and stainless steel processing equipment (spoons, knives, bowls, etc.). While performing the decontamination procedure, phthalate-free nitrile gloves were worn to prevent phthalate contamination of the sampling equipment or the samples.

The decontamination procedure described below was utilized:

- Rinse with DI water
- Rinse with 10 percent nitric acid
- Rinse with distilled or DI water
- Rinse with methanol followed by hexane
- Rinse with DI water
- Air dry (in area not adjacent to the decontamination area).

Waste liquids were contained during decontamination procedures in 5-gallon buckets with lids and transferred to a 55-gallon drum for characterization and disposal at the end of the field and sample processing effort. Waste liquids were disposed from EA's warehouse facility (Hunt Valley, Maryland) using standard disposal procedures and contractors.

2.8 SAMPLE LABELING, CHAIN-OF-CUSTODY, AND DOCUMENTATION

2.8.1 Field Logbook

A log of sampling activities, sampling locations, water depths, sample IDs, and water quality data was recorded in permanently bound logbooks in indelible ink. Personnel names, local weather conditions, and other information that impacted the field sampling program were also recorded. Each page of the logbook was numbered and dated by the personnel entering information. A full copy of the project logbook is provided in Appendix A.

2.8.2 Numbering System

The sample numbering system was used to communicate sample location and sample type between the field crew, sample processing crew, and the laboratories. Each composite sample ID submitted for physical, chemical, and ecotoxicological testing contained information to indicate which DU the sample was collected from, and the discrete site within each unit.
An example of a sample ID is:

BRC-01/02-SED

where the set of letters denotes the site designation (BRC=Back River Channel, WBREF = Willoughby Bank reference site, CBCON = Chesapeake Bay control site, or OC= Atlantic Ocean reference site). The next two digits describe the individual sediment sampling location(s) included in the sample (01-12). The above example is the composite sample created for DU1 and is comprised of the individual samples 01 and 02 located within the DU. The last three letters of the sample ID indicated the type of sample collected:

SED – sediment sample submitted for chemical and physical analyses
WAT – water submitted for chemical/ecotoxicological analyses
SET – water collected for use in the standard elutriate testing procedure
EQB – equipment blank sample submitted for chemical analysis
FD – field duplicate
MS/MSD – matrix spike/matrix spike duplicate.

2.8.3 Core Labels

Upon collection, each core was capped at either end and secured with duct tape. Each core tube was labeled with the location ID, core tally, date and time, and designated as top (TOP) or bottom (BTM). The core cap was labeled with the DU, location ID, depth of interval of collection, and top or bottom.

An example of a labeled core tube collected from BRC-03 follows:

← TOP	BRC-03 12/8/15	1 of 12 1440	BTM→

2.8.4 Sample Labels

Sample containers for the processed sediment and water samples were labeled with the following information:

Client name
Project number

Sample ID
Sampling location
Date and time of collection
Sampler's initials
Type of analyses required.

2.8.5 Chain-of-Custody Records

Sample processing personnel prepared separate COCs for samples submitted to TestAmerica-Pittsburgh and EA's Ecotoxicology Laboratory. Copies of the COC forms for bulk sediment (project samples and reference/control samples), water (site water, standard elutriates, and equipment blanks), and for the ecotoxicological samples are provided in Appendices C, D, and E, respectively.

TABLE 2-1. SEDIMENT SAMPLING COORDINATES AND NUMBER OF CORES COLLECTED
JBLE BACK RIVER CHANNEL, HAMPTON, VIRGINIA (DECEMBER 2015)

Dredging Units (DUs)	Sampling Location	Actual Sample Coordinates Virginia South State Plane, NAD 83		Tide-Corrected Water Depth (ft MLLW)	Target Core Length (ft)	Date, Time Sampled	Core Recovery (ft)
		Northing (ft)	Easting (ft)				
Norfolk Ocean Disposal Site							
--	NODS	3526616.51	12295441.15	-62	--	12/7/15, 1000	--
Atlantic Ocean and Willoughby Bank Reference Sites							
--	OCREF1	3491368.49	12304188.65	-72	Surface Sediment Collected Only	12/7/15, 1100	Surface Sediment Collected Only
	OCREF2	3491231.20	12303246.58				
	OCREF3	3491548.94	12304744.13				
--	WBREF1	3527690.74	12149395.95	-17.2	Surface Sediment Collected Only	12/10/15, 1315	Surface Sediment Collected Only
	WBREF2	3526218.24	12154948.14				
	WBREF3	3529657.11	12144092.06				
Chesapeake Bay Control Sediment							
--	CBC1	3623356.54	12183033.85	-66.6	Surface Sediment Collected Only	12/10/15, 0930	Surface Sediment Collected Only
	CBC2	3625550.28	12183841.62				
	CBC3	3624968.95	12182706.46				
JBLE Back River Channel Locations							
DU1	BRC-01	3561816.12	12113889.64	-6.4	8.6	12/9/15, 0900	5.3
						12/9/15, 0910	6.2
						12/9/15, 0915	6.2
						12/9/15, 0920	7.9
						12/9/15, 0930	7.2
						12/9/15, 0935	7.7
						12/9/15, 0900	6.4
	BRC-02	3562396.09	12114165.60	-7.3	7.7	12/9/15, 1010	6.9
						12/9/15, 1020	6.1
						12/9/15, 1030	4.9
						12/9/15, 1040	5.1
						12/9/15, 1050	7.2
						12/9/15, 1100	6.8
						12/9/15, 1105	6.9

TABLE 2-1 (CONTINUED)

Dredging Units (DUs)	Sampling Location	Actual Sample Coordinates Virginia South State Plane, NAD 83 Northing (ft)	Easting (ft)	Tide-Corrected Water Depth (ft MLLW)	Target Core Length (ft)	Date, Time Sampled	Core Recovery (ft)
DU2	BRC-03	3562604.70	12114217.66	-9.5	5.5	12/9/15, 1120	5.5
						12/9/15, 1130	5.3
						12/9/15, 1140	5.5
						12/9/15, 1145	5.1
						12/9/15, 1150	5
						12/9/15, 1156	5.6
						12/9/15, 1200	5.3
						12/9/15, 1206	4.6
	BRC-04	3563201.05	12114408.03	-10.6	4.4	12/9/15, 1315	4.2
						12/9/15, 1320	4.9
						12/9/15, 1325	5.1
						12/9/15, 1335	4.7
						12/9/15, 1340	5.8
						12/9/15, 1345	4.2
						12/9/15, 1350	5.4
						12/9/15, 1355	5.5
DU3	BRC-05	3564084.41	12114769.90	-11.1	3.9	12/9/15, 1415	4
						12/9/15, 1420	4.2
						12/9/15, 1425	4
						12/9/15, 1430	4.3
						12/9/15, 1435	4.1
						12/9/15, 1440	4.4
						12/9/15, 1450	4.5
						12/9/15, 1455	3.7
						12/9/15, 1500	4.3
						12/9/15, 1505	4.2
						12/9/15, 1515	3.5
	BRC-06	3564994.37	12115060.14	-11	4	12/10/15, 0820	3.8
						12/10/15, 0824	3
						12/10/15, 0830	2.1
						12/10/15, 0835	4.1
						12/10/15, 0840	2.4
						12/10/15, 0845	3
						12/10/15, 0850	4.1
						12/10/15, 0855	3.8
						12/10/15, 0900	4.3
						12/10/15, 0920	4.1
						12/10/15, 0925	4
						12/10/15, 0935	3.8

TABLE 2-1 (CONTINUED)

Dredging Units (DUs)	Sampling Location	Actual Sample Coordinates Virginia South State Plane, NAD 83		Tide-Corrected Water Depth (ft MLLW)	Target Core Length (ft)	Date, Time Sampled	Core Recovery (ft)
		Northing (ft)	Easting (ft)				
DU4	BRC-07	3565570.97	12115230.80	-11.1	3.9	12/10/15, 1035	4.5
						12/10/15, 1040	4.5
						12/10/15, 1045	3.6
						12/10/15, 1050	2.8
						12/10/15, 1100	4.3
						12/10/15, 1105	4.1
						12/10/15, 1115	4
						12/10/15, 1125	4
						12/10/15, 1130	4.1
						12/10/15, 1140	4.3
						12/10/15, 1145	4
						12/10/15, 1150	4
	BRC-08	3567048.86	12115705.28	-11.4	3.6	12/10/15, 1330	3.3
						12/10/15, 1335	3.5
						12/10/15, 1340	3.4
						12/10/15, 1345	2.7
						12/10/15, 1350	3.2
						12/10/15, 1400	3.2
						12/10/15, 1405	3.5
						12/10/15, 1410	3
						12/10/15, 1415	3.2
						12/10/15, 1420	3.3
						12/10/15, 1425	3.7
						12/10/15, 1430	3.3
						12/10/15, 1435	3.3
						12/10/15, 1440	3.5
DU5	BRC-09*	3568369.70	12116184.52	-12.8	Surface Sediment Collected Only	12/8/15, 1300	Surface Sediment Collected Only
	BRC-10	3568517.69	12117736.07	-14		12/8/15, 1200	
DU6	BRC-11	3569217.19	12121915.38	-13.9	Surface Sediment Collected Only	12/8/15, 1045	Surface Sediment Collected Only
	BRC-12	3569580.64	12123249.00	-13.8		12/8/15, 0950	

* BRC-WAT Collected at BRC-09 on 12/8/15, 1430

TABLE 2-2. *IN SITU* WATER QUALITY PARAMETERS
JBLE BACK RIVER CHANNEL, HAMPTON, VIRGINIA (DECEMBER 2015)

Dredging Unit (DU)	Location	Water Depth (feet MLLW)	Date, Local Time	Water Depth (feet)	Water Temperature (°C)	Salinity (ppt)	pH	Turbidity (NTU)	Dissolved Oxygen (mg/L)
Norfolk Offshore Disposal Site									
--	NODS-WAT	-62	12/9/15, 1000	Surface	14.1	32.8	8.2	0.5	8.7
				30	14.1	32.8	8.2	1.8	8.6
				Bottom (62)	14.0	32.8	8.2	9.2	8.6
Atlantic Ocean and Willoughby Bank Reference Sites									
--	OCREF-SED	-72	12/9/15, 1200	Surface	14.7	33.1	8.2	0.3	8.8
				35	14.7	33.1	9.2	0.2	8.6
				Bottom (72)	14.7	33.1	8.2	1.0	8.5
--	WBREF-SED	-20	12/10/15, 1140	Surface	12.2	12.8	8.0	0.3	10.5
				10	11.9	13.6	8.1	0.4	10.5
				Bottom (20)	12.4	15.5	8.0	3.6	9.5
Chesapeake Bay Control Site									
--	CBCON-SED	-86	12/10/15, 0930	Surface	11.3	14.1	8.1	0.6	10.8
				40	12.1	16.3	8.0	3.6	9.6
				Bottom (86)	11.6	17.7	8.0	14.5	9.9
JBLE Back River Channel Locations									
1	BRC-01	-6.4	12/9/2016, 0855	Surface	9.7	16.4	7.9	5.5	10.7
				3	9.9	16.5	7.9	23.4	10.7
				Bottom (6)	9.9	16.6	7.9	34.2	10.6
	BRC-02	-7.3	12/9/2016, 1012	Surface	10.0	16.3	8.0	8.4	10.7
				5	10.0	16.3	8.0	1.8	10.7
				Bottom (7)	10.0	16.4	8.0	1.7	10.6
2	BRC-03	-9.5	12/9/2016, 1114	Surface	10.3	16.0	8.0	3.4	10.9
				5	10.2	16.6	8.0	4.2	10.9
				Bottom (9)	10.2	16.9	8.0	5.6	10.9
	BRC-04	-10.6	12/9/2016, 1308	Surface	10.2	16.1	8.0	3.1	10.5
				5	10.2	16.4	8.0	4.0	10.7
				Bottom (10)	10.2	16.8	8.0	1.8	10.5
3	BRC-05	-11.1	12/9/2016, 1409	Surface	10.6	16.4	8.0	1.7	10.8
				5	10.6	16.4	8.1	1.2	10.7
				Bottom (11)	10.5	16.8	8.1	0.7	10.4
	BRC-06	-11.0	12/10/2016, 0813	Surface	10.6	22.7	8.0	1.0	10.3
				7	10.5	22.9	8.0	0.8	10.3
				Bottom (14)	10.6	23.0	8.0	1.5	10.3
4	BRC-07	-11.1	12/10/2016, 1035	Surface	11.3	22.6	7.5	0.1	10.4
				7	10.6	22.8	7.5	30.1	10.4
				Bottom (13)	10.6	22.8	7.5	40.2	10.0
	BRC-08	-11.4	12/10/2016, 1325	Surface	11.2	22.6	8.1	0.1	10.5
				6	11.0	22.8	8.1	0.2	10.5
				Bottom (12)	10.9	22.8	8.0	0.9	10.4
5	BRC-09	-12.8	12/8/2016, 1300	Surface	10.3	20.8	8.2	0.7	10.4
				5	10.3	20.8	8.2	0.8	10.4
				10	10.2	20.8	8.2	1.8	10.4
				Bottom (13)	10.1	20.9	8.2	7.8	10.4
	BRC-10	-14	12/8/2016, 1200	Surface	10.2	20.9	8.2	0.7	10.4
				5	10.2	20.9	8.2	0.8	10.4
				10	10.1	21.0	8.3	2.0	10.4
				Bottom (14)	10.2	20.9	8.2	0.7	10.4
6	BRC-11	-13.9	3/19/2015, 1045	Surface	10.1	21.3	8.2	0.4	10.3
				5	10.1	21.3	8.2	0.4	10.3
				10	10.1	21.3	8.2	0.5	10.2
				Bottom (14)	10.1	21.3	8.2	0.6	10.2
	BRC-12	-13.8	3/22/2015, 0945	Surface	10.3	21.4	8.2	0.5	10.1
				5	10.3	21.4	8.2	0.4	10.1
				10	10.3	21.4	8.2	0.5	10.1
				Bottom (15)	10.4	21.4	8.2	0.5	10.3

NOTES: °C = Degrees Celsius; mg/L = Milligram(s) per liter; MLLW = Mean lower low water; NTU = Nephelometric turbidity units; ppt = Part(s) per thousand.

TABLE 2-3. REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES FOR SEDIMENT SAMPLES [(a)]
JBLE BACK RIVER CHANNEL, HAMPTON, VIRGINIA (DECEMBER 2015

Parameter	Volume Required [(b)]	Container[(c)]	Preservative	Holding Time
Inorganics				
Metals (including Mercury)	32 oz.	G	4°C	6 months (28 days for Hg)
Cyanide	(d)	G	4°C	14 days
Ammonia	(d)	G	4°C	28 days
Sulfide	(d)	G	4°C	7 days
Total Solids	(d)	G	4°C	NA
AVS/SEM	4 oz	G	4°C (no headspace)	14 days
Nitrogen (Nitrate, Nitrate)	(d)	G	4°C	28 days after leach
Nitrogen (Total Kjeldahl), Total Phosphorus	4 oz	G	4°C	28 days
Paint Filter	(f)	G	4°C	NA
pH	(f)	G	4°C	7 days
Ignitability	(f)	G	4°C	NA
EOX	(g)	G	4°C	28 days
TCLP metals	32 oz	G	4°C	14 days to TCLP leach then 6 months (28 days for Hg), 14 days, 7 days
Physical Parameters				
Standard Elutriate Test	3x1 gallon	G	4°C	14 days until elutriate creation
Grain Size, Specific Gravity, Atterberg Limits, moisture	32 oz	G	4°C	6 months
Calcium Carbonate Equivalence, Pyritic Sulfur, PPA – Potential Acidity, saturated Paste pH and EC, Neutralization Potential	8 oz	G	4°C	NA
Organics				
Total Organic Carbon	(d)	G	4°C	14 days
BTEX	4 oz	G	4°C (no headspace)	14 days
Pesticides (Organochlorine and Organophosphorus), Semivolatile Organics, and Polynuclear Aromatic Hydrocarbons, PCB Congeners, PCB Aroclors	(d)	G	4°C	14 days until extraction, 40 days after extraction

TABLE 2-3. (CONTINUED)

Parameter	Volume Required [b]	Container[c]	Preservative	Holding Time
Organics (Continued)				
Organotins	(e)	G	4°C	14 days until extraction, 40 days after extraction
Dioxin	4 oz	G	4°C	1 year to analysis
DRO/ORO	4 oz	G	4°C	14 days to extraction, 40 days to analysis
GRO	4 oz	G	4°C (no headspace)	14 days to analysis
TCLP Volatiles	4 oz	G	4°C (no headspace)	14 days to TCLP leach, 14 days to analysis
TCLP (semivolatiles, pesticides, herbicides)	(f)	G	4°C	14 days to TCLP leach, 7 days to extraction then 40 days to analysis

(a) From time of sample collection.
(b) Additional volume will need to be provided for samples designated as MS/MSD/MDs.
(c) G = glass.
(d) Sufficient volume is provided from the 32 oz noted under Metals.
(e) Sufficient volume is provided from the 32 oz. noted under Grain Size.
(f) Sufficient volume is provided from the 32 oz. noted under TCLP metals
(g) Sufficient volume is provided from the 4 oz. noted under Nitrogen (Total Kjeldahl), Total Phosphorus

TABLE 2-4. REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES FOR AQUEOUS SAMPLES [a]

JBLE BACK RIVER CHANNEL, HAMPTON, VIRGINIA (DECEMBER 2015)

Parameter	Volume Required [b]	Container[c]	Preservative	Holding Time
Inorganics				
Metals (including Mercury)	250 milliliters (mL)	P	pH <2 with nitric acid (HNO_3) Cool, 4 degrees Celsius (°C)	6 months (28 days for mercury [Hg])
Cyanide	250 mL	P,G	Sodium hydroxide (NaOH) to pH >12 Cool, 4°C	14 days
Sulfide	250 mL	P,G	NaOH/Zinc Acetate to pH >9 Cool, 4°C	7 days
Ammonia, Nitrogen, Nitrate & Nitrite	250 mL	P,G	H_2SO_4 to pH <2 Cool, 4°C	28 days
Total Phosphorus, Nitrogen (Total Kjeldahl)	500 mL (2x250 mL)	P,G	H_2SO_4 to pH <2 Cool, 4°C	28 days
Elutriate Testing				
Standard Elutriate Test	1x5 gallon cube	P	Cool, 4°C	14 days until elutriate creation
Organics				
Total Organic Carbon	2-40 mL	G, teflon-lined, septa cap	H_2SO_4 to pH <2; Cool, 4°C	28 days
Pesticides (Organochlorine and Organophosphorus), Semivolatile Organics and Polycyclic Aromatic Hydrocarbons, Polychlorinated Biphenyl (PCB) Congeners	6 liters	G, teflon-lined cap	Cool, 4°C	7 days until extraction, 40 days after extraction
Dioxins/Furans	2 liters	G, teflon-lined cap	Cool, 4°C	1 year to analysis
Organotins	2 liters	G, teflon-lined cap	Cool, 4°C	7 days until extraction, 40 days after extraction

(a) From time of sample collection.
(b) Additional volume will need to be provided for samples designated as MS/MSD/MDs.
(c) P = plastic; G = glass.

3. ANALYTICAL TESTING OF BULK SEDIMENTS, SITE WATER, RECEIVING WATER, STANDARD ELUTRIATES, AND TISSUE

Analytical testing of sediment, site water, and standard elutriate, and tissue samples for the JBLE Back River Channel project was conducted primarily by TestAmerica–Pittsburgh, with support from TestAmerica–Burlington (geotechnical testing, grain size, and butyltins), TestAmerica–North Canton (general chemistry), and TestAmerica-Knoxville (dioxin/furan congeners).

Twelve discrete sediment samples and six composite sediment samples from the JBLE Back River Channel, surficial sediment from the Willoughby Bank reference site, surficial sediment from the Atlantic Ocean reference site, and surficial sediment from the Chesapeake Bay control site were analyzed for the following physical parameters (Table 1-1):

- Grain size determination
- Specific gravity
- Unified soil classification system classification
- Moisture content.

In addition, the discrete and composite sediment samples, site water, receiving water, and standard elutriates were tested for the following target compounds (Table 1-1):

- AVS/SEM ratio (sediment only)
- Ammonia (NH_3-N)
- Butyltins
- Chlorinated pesticides
- Cyanide
- Dioxin and furan congeners
- Metals
- Nitritate-nitrite
- Organophosphorus pesticides
- PAHs
- PCB congeners
- TKN
- TOC
- Total phosphorus
- Total sulfide
- SVOCs.

Total PCB congeners, total DDT, total PAHs, high molecular weight PAHs (HPAHs), low molecular weight PAHs (LPAHs), dioxin TEQs, and the SEM/AVS ratio were each calculated.

The twelve discrete sediment samples were also analyzed for the following alternate placement parameters:

- TCLP
- pH
- Flashpoint
- PCB aroclors
- BTEX
- EOX
- The paint filter test
- TPH-GRO
- TPH-DRO
- Potential acidity
- Neutralization potential
- Acid base accounting
- Calcium carbonate equivalence
- Pyritic sulfur (fizz rating)
- Saturated paste pH and conductivity.

Based on the sediment results for the six composite samples and consultation with USEPA Region 3 and USACE Norfolk District, tissues were tested for the following target compounds to determine suitability for ocean placement at the NODS:

- Lipids
- Moisture content
- Metals (including mercury)
- PAHs
- PCBs
- Chlorinated pesticides (DDT series, beta-BHC, dacthal, endrin, endrin aldehyde, methoxychlor, and mirex only)
- Dioxin and furan congeners.

Total PAHs, total PCBs, and the dioxin TEQs were each calculated.

Target analytes, laboratory RLs, method detection limits (MDLs), and recommended TDLs for sediment, aqueous, and tissue samples are presented in Tables 3-2, 3-3, and 3-4, respectively.

Target analytes, TDLs and methodologies, standard elutriate preparation procedures, and sample holding times were derived from the following guidance documents and were consistent with other regional sediment studies (EA 2014a,b,c; EA 2015a,b,c; EA 2016a):

- USEPA/USACE. 1995. *Quality Assurance/Quality Control (QA/QC) Guidance for Sampling and Analysis of Sediments, Water, and Tissues for Dredged Material Evaluations: Chemical Evaluations*. EPA-823-B-95-001.

- USEPA/USACE. 1998. *Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S.-Testing Manual* (Inland Testing Manual). EPA-823-B-98-004.

- USEPA/USACE. 1991. *Evaluation of Dredged Material Proposed for Ocean Disposal, Testing Manual* (commonly called "The Green Book"). EPA-503/8-9/001.

- USEPA Region 3. 2001. *Mid-Atlantic Regional Implementation Manual: Dredged Material Evaluation for Norfolk and Dam Neck Ocean Disposal Sites*.

- USEPA. 2001. *Methods for Collection, Storage, and Manipulation of Sediments for Chemical and Toxicological Analyses: Technical Manual*. EPA-823-B-01-002

The analytical program is described in detail in the Analytical QAPP (Attachment II of the SAP EA 2015d). The QAPP was submitted to USEPA Region 3 and USACE–Norfolk District prior to initiation of the analytical testing program. Analytical testing methods and target analytes were consistent with previous sediment studies conducted in the region (EA 2014abc, 2015abc, 2016ab).

3.1 ANALYTICAL METHODS

Inorganic and organic compounds were determined using the methods listed in Table 3-1, as described in the laboratory's analytical standard operating procedures (SOPs). To meet program-specific regulatory requirements for chemicals of concern, all methods/SOPs were followed as stated with some specific requirements noted below.

3.1.1 Polychlorinated Biphenyl Congeners and Aroclors

PCBs for this project were analyzed and quantified as individual congeners by SW846 Method 8082. Tables 3-2 and 3-3 list the 7 aroclors (sediment only) and 26 congeners that were determined in various matrices. These 26 congeners include all of the "summation" and "highest priority" congeners, specified in Table 5-6 of the Southeast Regional Implementation Manual (SERIM) (USEPA/USACE 2008). Calculations for total PCB congeners are included in this evaluation.

3.1.2 Total Organic Carbon

TOC in sediments was determined using the 1988 USEPA Region 2 combustion oxidation procedure (the Lloyd Kahn procedure).

3.1.3 Polycyclic Aromatic Hydrocarbons

To achieve the TDLs referenced in *QA/QC Guidance for Sampling and Analysis of Sediments, Water, and Tissues for Dredged Material Evaluations — Chemical Evaluations* (USEPA/USACE 823-B-95-001, April 1995), the PAHs were determined utilizing SW846 Method 8270C. For those samples where both semivolatiles by SW846 Method 8270C and PAHs by SW846 Method 8270C were requested, both analyses were performed on the same extract. For those samples, the evaluation of method performance was based on the determined recoveries of surrogates and control analytes (in the LCS and MS/MSDs) from the semivolatiles by 8270C (full scan Gas

Chromatography [GC]/Mass Spectrometry [MS]) analyses because the spiked concentrations exceeded the calibration range for PAHs by GC/MS analyses.

3.1.4 Metals

Because of potential matrix interferences, metals were determined utilizing Inductively Coupled Plasma/MS according to the methodology specified, except for mercury. For mercury, samples were analyzed by Cold Vapor Atomic Absorption method (SW846 7470A [aqueous] or 7471A [sediment]).

3.1.5 Polychlorinated Dioxins/Furans

Dioxin and furan congeners for the sediment samples were reported as 17 individual isomers using method EPA 1613B. The results were reported based on a sample-specific estimated detection limit, which takes into account matrix interferences and provides the most accurate limit of detection for each sample.

3.1.6 Cyanide

Total cyanide was determined by method SW846 9012A. The laboratory RL using this method is higher than the requested TDL; however, this method represents the best available technology for total cyanide determination and, therefore, the lowest possible RL.

3.1.7 Acid Volatile Sulfides and Simultaneously Extracted Metals

The AVS and SEM determinations were performed following the procedures specified in the USEPA April 1991 *Draft Analytical Method for the Determination of Acid Volatile Sulfide in Sediment.* The concentrations of five SEMs—cadmium, copper, lead, nickel, and zinc—were determined, and the reported values for both AVS and SEM were in μmoles/gram.

Using this method, the five metals (cadmium, copper, lead, nickel, and zinc) were extracted, measured, and added together (including any values that are "B" or "J" qualified). If a metal was not detected (ND), it was considered a zero in the calculation. The sum of the concentrations of these five metals was then compared to the amount of AVS detected in the same sediment sample. The total SEM concentration was divided by the AVS concentration, and the resulting value is the SEM/AVS ratio. If AVS was ND in the sample, the SEM/AVS ratio was not calculated.

3.1.8 Standard Elutriate Preparation

SET was used to predict the release of contaminants to the water column resulting from open water/ocean placement of dredged material. The SET was performed following the procedures in the ITM (USEPA/USACE 1998). For the SET, the laboratory created the elutriate based on a sediment-to-water ratio of 1:4, on a volume basis. The sediment and site water volume requirements needed for the SET was dependent on the number and type of analytical tests to be performed on the elutriate.

A sediment/water mixture was thoroughly mixed for 30 minutes. The mixture was then allowed to settle, and the supernatant was siphoned off, filtered to remove particulates, and then analyzed for the dissolved chemical constituents specified in the SAP (EA 2015d). The reported results from the SET included a "dissolved" value for each of the target parameters to be determined. Quantitation limits for the "dissolved" elutriate fraction were the same as aqueous samples (Table 3-3).

3.1.9 Toxicity Characteristic Leaching Procedure

Concentrations of chemical constituents in the TCLP leachate were compared to regulatory limits of contaminants for toxicity characteristics (40 CFR 261.24) to evaluate if the sediment proposed to be dredged from the JBLE Back River Channel could be placed in an upland site. TCLPs, which are routinely required for dredged material placement at landfills and upland locations, are used to identify the potential for toxicity and to determine if the dredged material would be classified as a hazardous waste. The TCLP involves adding a low strength acid (acetic acid) to the sample and analyzing the leachate generated.

The sediments were extracted following the TCLP procedures specified in SW-846 Method 1311 (Table 3-4). If any analyte on the TCLP list (volatiles, SVOCs, metals, chlorinated pesticides, and herbicides) exceeds the regulatory limit, then that sample fails the TCLP and additional delineation of the source material may be warranted to evaluate placement alternatives.

3.1.10 Soil Agricultural Characteristics and Suitability Testing

To evaluate the suitability of the dredged material from the JBLE Back River Channel for placement at the Port Tobacco at Weanack facility permit, testing was conducted to evaluate the suitability of the material to support agricultural use at the facility. Analyses were selected based on the requirements of the Port Tobacco at Weanack facility's screening table (Appendix B). The agricultural suitability testing for the soils included the following tests and methods (Black et al. 1982):

- pH and conductivity by the saturated paste method
- Neutralization Potential by EPA 600/2-78-054/3.2.3
- Potential Acidity by EPA 600/2-78-054/3.2.4
- Pyritic Sulfur by calculation.

3.2 DETECTION LIMITS

The detection limit is a statistical concept that corresponds to the minimum concentration of an analyte above which the net analyte signal can be distinguished with a specified probability from the signal because of the noise inherent in the analytical system. The RL is the limit of detection for a target analyte for an individual sample after adjustments dilutions or percent moisture. Therefore, the RL of any analyte in the testing program can very between samples with the same matrix as a result of different percent moistures (sediments) or if a sample is diluted by the analytical laboratory (sediments and waters).

The MDL was developed by USEPA, and is defined as "the minimum concentration of a substance that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero" (40 CFR 136, Appendix B). Quantitation limits applicable to this project are listed in Tables 3-2 (sediment), 3-3 (aqueous), 3-4 (TCLP), and 3-5 (tissue) samples. This table includes the TDLs referenced in the *QA/QC Guidance for Sampling and Analysis of Sediments, Water, and Tissues for Dredged Material Evaluations – Chemical Evaluations* (USEPA/USACE, 823-B-95-001, April 1995). All analytical parameters for water and sediment, except wet chemistry parameters and dioxin/furan congeners, were quantified to the RL. Detected values greater than or equal to the MDL, but less than the laboratory RL, were qualified as estimated.

RL and MDL values used for sediment analyses are listed in Table 3-2. For sediment analyses, sample weights were adjusted for percent moisture (up to 50 percent moisture), where appropriate, prior to analysis to achieve the lowest possible RLs.

3.3 LABORATORY QUALITY CONTROL SAMPLES

QC samples specified in the ITM were analyzed at the frequency stated in the following table. SRMs were obtained from the National Institute of Standards and Technology or a comparable source, if available.

QC Sample	Frequency
Standard Reference Material	1 per analytical batch of 1-20 samples, where available
Method Blanks	1 per analytical batch of 1-20 samples
Laboratory Control Sample	1 per analytical batch of 1-20 samples
Surrogates	Spiked into all field and QC samples (Organic Analyses)
Sample Duplicates	1 per analytical batch of 1-20 samples (Inorganic Analyses)
Matrix Spike/Matrix Spike Duplicate	1 per analytical batch of 1-20 samples

3.3.1 Standard Reference Material

SRMs represent performance-based QA/QC. An SRM is a soil/solution with a certified concentration that is analyzed as a sample and is used to monitor analytical accuracy.

SRMs were analyzed for the following matrix/fractions:

- **Sediment**: chlorinated pesticides, PCB congeners, metals, PAHs, and SVOCs
- **Water**: chlorinated pesticides, PCB congeners, PAHs, and SVOCs
- **Tissues**: metals, PAHs, and PCB congeners.

Control criteria apply only to those analytes having SRM true values greater than 10 times the MDL established for the method. Results of the SRMs analyses are provided in Appendixes C, D, and E for sediments, site water and standard elutriates, and tissue, respectively.

3.3.2 Method Blanks

The method (reagent) blank is used to monitor laboratory contamination. The method blank is usually a sample of laboratory reagent water processed through the same analytical procedure as the sample (i.e., digested, extracted, distilled). One method blank was analyzed at a frequency of one per every analytical preparation batch of 20 or fewer samples.

3.3.3 Laboratory Control Sample

The LCS is a fortified method blank consisting of reagent water or solid fortified with the analytes of interest for single-analyte methods and selected analytes for multi-analyte methods according to the appropriate analytical method. LCSs were prepared and analyzed with each analytical batch, and analyte recoveries were used to monitor analytical accuracy and precision.

3.3.4 Matrix Spike/Matrix Spike Duplicate

A fortified sample (MS) is an aliquot of a field sample that is fortified with the analyte(s) of interest and analyzed to monitor matrix effects associated with a particular sample. Samples to be spiked were chosen at random. The final spiked concentration of each analyte in the sample was at least 10 times the calculated MDL. A duplicate-fortified sample (MSD) was performed for every batch of 20 or fewer samples.

3.3.5 Sample Duplicates

A sample duplicate is a second aliquot of a field sample that is analyzed to monitor analytical precision associated with that particular sample. Sample duplicates were performed for every batch of 20 or fewer samples for those analytes that did not have MS/MSD analyses.

3.3.6 Surrogates

Surrogates are organic compounds that are similar to analytes of interest in chemical composition, extraction, and chromatography, but are not normally found in environmental samples. These compounds were spiked into all blank, standards, samples, and spiked samples prior to analysis for organic parameters. Generally, surrogates are not used for inorganic analyses. Percent recoveries were calculated for each surrogate. Surrogates were spiked into samples according to the requirements of the reference analytical method (EA 2015d). Surrogate spike recoveries were evaluated against applicable performance limits, such as published method specifications or statistical evaluations of laboratory generated surrogate accuracy data, and were used to assess method performance and sample measurement bias. If sample dilution caused the surrogate concentration to fall below the quantitation limit, surrogate recoveries were not calculated.

TABLE 3-1. ANALYTICAL TESTING METHODS
JBLE BACK RIVER CHANNEL, HAMPTON, VIRGINIA (DECEMBER 2015)

Parameter	Method	Method #	Matrix	Reference
Organics – Extraction Cleanup				
Sulfuric Acid Cleanup	Liquid-liquid Partitioning	3665A	S	EPA 1997
Sulfur Cleanup	Treatment with Cu or Hg or TBA	3660A/B	S	USEPA 1997
Organics				
Total Organic Carbon	Combustion Oxidation	Lloyd Kahn	S,W	USEPA 1988
Organochlorine Pesticides	Gas Chromatography – ECD	8081A	S,W	USEPA 1997
Semivolatile Organics/PAHs, Low Level	Gas Chromatography/Mass Spectrometry	8270C	S,W,T	USEPA 1997
Organophosphorus Pesticides	Gas Chromatography	8041A	S,W	USEPA 1997
Volatile Organic Compounds (BTEX)	Gas Chromatography/Mass Spectrometry	8260B	S	USEPA 1997
PCB Aroclors	Gas Chromatography – ECD	8082	S	USEPA 1997
PCB Congeners	Gas Chromatography – ECD	8082	S,W	USEPA 1997
Total Petroleum Hydrocarbons	Gas Chromatography – FID	8015	S,W	USEPA 1997
Dioxins/Furans	High Resolution Mass Spectrometry	1613B	S,W,T	USEPA 1979
Butyltins	Gas Chromatography – FTD	TA SOP	S,W	VA State Testing Method
Chlorophenoxy Acid Herbicides	Gas Chromatography – ECD	8151A	L	USEPA 1997
Metals				
Aluminum	Atomic Emission – ICP/MS	6020/6010B	S,W	USEPA 1997
Antimony	Atomic Emission – ICP/MS	6020/6010B	S,W,T	USEPA 1997
Arsenic	Atomic Emission – ICP/MS	6020/6010B	S,W,T,L	USEPA 1997
Barium	Atomic Emission – ICP/MS	6020/6010B	S,L	USEPA 1997
Beryllium	Atomic Emission – ICP/MS	6020/6010B	S,W,T	USEPA 1997
Cadmium	Atomic Emission – ICP/MS	6020/6010B	S,W,T,L	USEPA 1997
Calcium	Atomic Emission – ICP/MS	6020/6010B	S,W	USEPA 1997
Chromium	Atomic Emission – ICP/MS	6020/6010B	S,W,T,L	USEPA 1997
Cobalt	Atomic Emission – ICP/MS	6020/6010B	S,W	USEPA 1997
Copper	Atomic Emission – ICP/MS	6020/6010B	S,W,T	USEPA 1997
Iron	Atomic Emission – ICP/MS	6020/6010B	S,W	USEPA 1997
Lead	Atomic Emission – ICP/MS	6020/6010B	S,W,T,L	USEPA 1997
Mercury	Atomic Absorption – Cold Vapor	7470/7471A	S,W,T,L	USEPA 1997
Magnesium	Atomic Emission – ICP/MS	6020/6010B	S,W	USEPA 1997
Manganese	Atomic Emission – ICP/MS	6020/6010B	S,W	USEPA 1997
Nickel	Atomic Emission – ICP/MS	6020/6010B	S,W,T	USEPA 1997
Potassium	Atomic Emission – ICP/MS	6020/6010B	S,W	USEPA 1997
Selenium	Atomic Emission – ICP/MS	6020/6010B	S,W,T,L	USEPA 1997
Silver	Atomic Emission – ICP/MS	6020/6010B	S,W,T,L	USEPA 1997

TABLE 3-1 (continued).

Sodium	Atomic Emission – ICP/MS	6020/6010B	S,W	USEPA 1997
Thallium	Atomic Emission – ICP/MS	6020/6010B	S,W,T	USEPA 1997
Tin	Atomic Emission – ICP/MS	6020/6010B	S,W	USEPA 1997
Vanadium	Atomic Emission – ICP/MS	6020/6010B	S,W	USEPA 1997
Zinc	Atomic Emission – ICP/MS	6020/6010B	S,W,T	USEPA 1997
Inorganic Nonmetals				
Extractable Organic Halides	Pyrolysis/Microcoulometry	9023	S	USEPA 1997
Paint Filter Test	Filtration	9095A	S	USEPA 1997
Cyanide, Total	Colorimetric – Automated	9012A	S	USEPA 1997
Sulfide, Total	Distallation / Titrimetric	9030B/9034	S	USEPA 1997
Grain Size (sieve and hydrometer)	------	D422	S	ASTM 1995
Specific Gravity	------	D854	S	USEPA 1979
Total Solids	Gravimetric	2540B	S	APHA 1998

Matrix codes: S=sediment; W=water; T=Tissues; L=TCLP

References:

APHA, 1998 American Public Health Association. 1998. Standard Methods for the Examination of Water and Wastewater, 20th Edition. APHA, Washington, DC.

ASTM 1995 American Society for Testing and Materials, 1995. Annual Book of ASTM Standards. Volume 4.08. ASTM, Philadelphia, PA.

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USEPA, 1988 Kahn, Lloyd. 1988. Determination of Total Organic Carbon in Sediment. U.S. USEPA Region II. Edison, N.J.

USEPA, 1991 Allen, H.E. and F. Gongmin et al. 1991. Determination of Acid Volatile Sulfide and Simultaneously Extractable Metals in Sediment, April, 1991. (Draft Analytical Method for the Determination of Acid Volatile Sulfide in Sediment, U.S. USEPA Office of Water and Office of Science and Technology, Health and Ecological Criteria Division, Washington, D.C., August 1991).

USEPA, 1997 United States Environmental Protection Agency. June 1997. Test Methods for Evaluating Solid Waste. Physical/Chemical Methods. USEPA SW-846, 3rd Edition, including Final Update III. U.S. USEPA, Washington, D.C.

TABLE 3-2. PROJECT LIMITS FOR SEDIMENT SAMPLES
JBLE BACK RIVER CHANNEL, HAMPTON, VIRGINIA (DECEMBER 2015)

Parameter	Units	Laboratory RL[(a)]	Laboratory MDL[(a)]	Recommended TDL[(b)]
Metals - Cold Vapor (SW846 7471A) (based on solid MDLs)				
Mercury	mg/kg	0.033	0.0109	0.01
Metals - Atomic Emission Inductively Coupled Plasma / Mass Spectrometry (SW846 6020) (based on solid MDLs)				
Aluminum	mg/kg	3	0.2849	50
Antimony	mg/kg	0.2	0.0026	2.5
Arsenic	mg/kg	0.1	0.0181	5
Barium	mg/kg	1.0	0.0107	--
Beryllium	mg/kg	0.1	0.0075	2.5
Cadmium	mg/kg	0.1	0.007	0.3
Calcium	mg/kg	10	1.3260	--
Chromium	mg/kg	0.2	0.0061	5
Cobalt	mg/kg	0.05	0.0015	0.1
Copper	mg/kg	0.2	0.033	5
Iron	mg/kg	5	0.3539	50
Lead	mg/kg	0.1	0.0038	5
Magnesium	mg/kg	10	0.1870	--
Manganese	mg/kg	0.05	0.0103	5
Mercury	mg/kg	0.033	0.0109	0.2
Nickel	mg/kg	0.1	0.0113	5
Potassium	mg/kg	10	1.3583	--
Selenium	mg/kg	0.5	0.0502	1
Silver	mg/kg	0.1	0.0039	0.2
Sodium	mg/kg	10	1.3690	--
Thallium	mg/kg	0.1	0.002	0.2
Tin	mg/kg	0.5	0.0593	0.5
Vanadium	mg/kg	0.1	0.0079	--
Zinc	mg/kg	0.5	0.0648	15
Dioxins/Furans- High Resolution Mass Spectrometry (HRMS) - (USEPA 1613B)				
2,3,7,8-TCDD	pg/g	1	--	1
2,3,7,8-TCDF	pg/g	1	--	1
1,2,3,7,8-PeCDD	pg/g	5	--	2.5
1,2,3,7,8-PeCDF	pg/g	5	--	2.5
2,3,4,7,8-PeCDF	pg/g	5	--	2.5
1,2,3,4,7,8-HxCDD	pg/g	5	--	5
1,2,3,6,7,8-HxCDD	pg/g	5	--	5
1,2,3,7,8,9-HxCDD	pg/g	5	--	5
1,2,3,4,7,8-HxCDF	pg/g	5	--	5
1,2,3,6,7,8-HxCDF	pg/g	5	--	5
2,3,4,6,7,8-HxCDF	pg/g	5	--	5
1,2,3,7,8,9-HxCDF	pg/g	5	--	5
1,2,3,4,6,7,8-HpCDD	pg/g	5	--	5
1,2,3,4,6,7,8-HpCDF	pg/g	5	--	5
1,2,3,4,7,8,9-HpCDF	pg/g	5	--	5
OCDD	pg/g	10	--	10
OCDF	pg/g	10	--	10
Polycyclic Aromatic Hydrocarbons (PAHs) and Semivolatile Organic Compounds (SVOCs) – Gas Chromatography/Mass Spectrometry - (SW846 8270C)				
Acenaphthene	ug/kg	6.7	0.6408	20
Acenaphthylene	ug/kg	6.7	0.7641	20

(a) RL=Reporting Limit, MDL = Method Detection Limit. Values ≥ MDL and < RL will be qualified as estimated. MDLs are required to be updated periodically, and are subject to change; dioxin and furan congeners are quantified to a sample-specific EDL, calculated based on the instrument noise for each sample at the time it is analyzed

(b) Target Detection Limit (TDL) from the QA/QC Guidance Document (USEPA/USACE, April 1995).

TABLE 3-2. (continued)

Parameter	Units	Laboratory RL[(a)]	Laboratory MDL[(a)]	Recommended TDL[(b)]
Anthracene	ug/kg	6.7	0.6527	20
Benzidine	ug/kg	670	139.7924	--
Benzo(a)anthracene	ug/kg	6.7	0.836	20
Benzo(b)fluoranthene	ug/kg	6.7	1.0488	20
Benzo(k)fluoranthene	ug/kg	6.7	1.3486	20
Benzoic acid	ug/kg	170	13.8385	100
Benzo(ghi)perylene	ug/kg	6.7	0.6637	20
Benzo(a)pyrene	ug/kg	6.7	0.6675	20
Benzyl alcohol	ug/kg	33	4.0337	50
bis(2-Chloroethoxy)methane	ug/kg	33	2.1959	--
bis(2-Chloroethyl) ether	ug/kg	6.7	0.8954	--
bis(2-Chloroisopropyl) ether	ug/kg	6.7	0.7201	--
bis(2-Ethylhexyl) phthalate	ug/kg	66.7	5.3906	50
4-Bromophenyl phenyl ether	ug/kg	33	2.9028	--
Butyl benzyl phthalate	ug/kg	33	4.5589	50
4-Chloro-3-methylphenol	ug/kg	33	3.0707	--
2-Chloronaphthalene	ug/kg	6.7	0.6962	--
2-Chlorophenol	ug/kg	33	2.7275	--
4-Chlorophenyl phenyl ether	ug/kg	33	3.7077	--
Chrysene	ug/kg	6.7	0.7943	20
Dibenzo(a,h)anthracene	ug/kg	6.7	0.7421	20
Dibenzofuran	ug/kg	33	3.282	50
Di-n-butyl phthalate	ug/kg	33	4.1799	50
1,2-Dichlorobenzene	ug/kg	33	3.4976	20
1,3-Dichlorobenzene	ug/kg	33	2.5959	20
1,4-Dichlorobenzene	ug/kg	33	2.3861	20
3,3'-Dichlorobenzidine	ug/kg	33	3.5266	--
2,4-Dichlorophenol	ug/kg	6.7	0.6693	--
Diethyl phthalate	ug/kg	33	3.6431	50
2,4-Dimethylphenol	ug/kg	33	5.2171	20
Dimethyl phthalate	ug/kg	33	3.6347	50
4,6-Dinitro-2-methylphenol	ug/kg	170	13.4068	--
2,4-Dinitrophenol	ug/kg	170	39.717	--
2,4-Dinitrotoluene	ug/kg	33	2.6927	--
2,6-Dinitrotoluene	ug/kg	33	3.4416	--
Di-n-octyl phthalate	ug/kg	33	3.5151	50
1,2-Diphenylhydrazine	ug/kg	33	4.2709	--
Fluoranthene	ug/kg	6.7	0.7134	20
Fluorene	ug/kg	6.7	0.8793	20
Hexachlorobenzene	ug/kg	6.7	0.7107	10
Hexachlorobutadiene	ug/kg	6.7	0.7465	20
Hexachlorocyclopentadiene	ug/kg	33	3.5973	--
Hexachloroethane	ug/kg	33	2.3986	100
Indeno(1,2,3-cd)pyrene	ug/kg	6.7	0.6874	20
Isophorone	ug/kg	33	2.5145	--
2-Methylnaphthalene	ug/kg	6.7	0.5999	20
1-Methylnaphthalene	ug/kg	6.7	0.7119	20
2-Methylphenol	ug/kg	33	2.331	50
4-Methylphenol	ug/kg	33	3.2652	100
Naphthalene	ug/kg	6.7	0.575	20
Nitrobenzene	ug/kg	66.7	2.7772	--
2-Nitrophenol	ug/kg	33	3.6772	--
4-Nitrophenol	ug/kg	170	11.379	--
N-Nitrosodimethylamine	ug/kg	33	2.8604	--

(a) RL=Reporting Limit, MDL = Method Detection Limit. Values ≥ MDL and < RL will be qualified as estimated. MDLs are required to be updated periodically, and are subject to change; dioxin and furan congeners are quantified to a sample-specific EDL, calculated based on the instrument noise for each sample at the time it is analyzed

(b) Target Detection Limit (TDL) from the QA/QC Guidance Document (USEPA/USACE, April 1995).

TABLE 3-2. (continued)

Parameter	Units	Laboratory RL[a]	Laboratory MDL[a]	Recommended TDL[b]
N-Nitrosodiphenylamine	ug/kg	33	3.088	20
N-Nitrosodi-n-propylamine	ug/kg	6.7	0.7824	--
2,2'-oxybis(1-Chloropropane)	ug/kg	6.7	0.7201	--
Pentachlorophenol	ug/kg	33	2.9832	100
Phenanthrene	ug/kg	6.7	1.0612	20
Phenol	ug/kg	6.7	0.7883	100
Pyrene	ug/kg	6.7	0.6746	20
1,2,4-Trichlorobenzene	ug/kg	33	1.8452	10
2,4,6-Trichlorophenol	ug/kg	33	4.9941	--
Organochlorine Pesticides - Gas Chromatography/Electron Capture Detector - (SW846 8081A)				
Aldrin	ug/kg	1.7	0.2981	10
alpha-BHC	ug/kg	1.7	0.2712	--
beta-BHC	ug/kg	1.7	0.4325	--
delta-BHC	ug/kg	1.7	0.2552	--
gamma-BHC (Lindane)	ug/kg	1.7	0.2928	10
Chlordane (technical)	ug/kg	17	0.7347	10
alpha-chlordane	ug/kg	1.7	0.3308	--
gamma-chlordane	ug/kg	1.7	0.3289	--
Chlorobenside	ug/kg	3.3	0.8691	2
DCPA	ug/kg	3.3	0.4518	2
2,4'-DDD	ug/kg	1.7	0.2182	10
4,4'-DDD	ug/kg	1.7	0.2182	10
2,4'-DDE	ug/kg	1.7	0.2518	10
4,4'-DDE	ug/kg	1.7	0.2518	10
2,4'-DDT	ug/kg	1.7	0.2492	10
4,4'-DDT	ug/kg	1.7	0.2492	10
Dieldrin	ug/kg	1.7	0.2777	10
Endosulfan I	ug/kg	1.7	0.3134	10
Endosulfan II	ug/kg	1.7	0.2944	10
Endosulfan sulfate	ug/kg	1.7	0.1739	10
Endrin	ug/kg	1.7	0.3232	5
Endrin aldehyde	ug/kg	1.7	0.3237	5
Endrin ketone	ug/kg	1.7	0.2593	--
Heptachlor	ug/kg	1.7	0.3708	10
Heptachlor epoxide	ug/kg	1.7	0.3248	10
Methoxychlor	ug/kg	3.3	0.3476	10
Mirex	ug/kg	1.7	0.1537	--
Toxaphene	ug/kg	67	11.1273	50
PCB Aroclors - Gas Chromatography/Electron Capture Detector (SW846 8082)				
Aroclor 1016	ug/kg	16.667	2.47904	--
Aroclor 1221	ug/kg	16.667	3.18026	--
Aroclor 1232	ug/kg	16.667	2.85338	--
Aroclor 1242	ug/kg	16.667	2.7151	--
Aroclor 1248	ug/kg	16.667	1.57616	--
Aroclor 1254	ug/kg	16.667	2.37056	--
Aroclor 1260	ug/kg	16.667	2.36946	--
PCB Congeners - Gas Chromatography/Electron Capture Detector (SW846 8082)				
PCB 209 (BZ)	ug/kg	0.17	0.03587	1
PCB 8 (BZ)	ug/kg	0.17	0.03472	1
PCB 187 (BZ)	ug/kg	0.17	0.03539	1
PCB 184 (BZ)	ug/kg	0.17	0.02881	1
PCB 183 (BZ)	ug/kg	0.17	0.03331	1
PCB 170 (BZ)	ug/kg	0.17	0.03439	1
PCB 180 (BZ)	ug/kg	0.17	0.03415	1
PCB 128 (BZ)	ug/kg	0.17	0.03434	1

(a) RL=Reporting Limit, MDL = Method Detection Limit. Values ≥ MDL and < RL will be qualified as estimated. MDLs are required to be updated periodically, and are subject to change; dioxin and furan congeners are quantified to a sample-specific EDL, calculated based on the instrument noise for each sample at the time it is analyzed

(b) Target Detection Limit (TDL) from the QA/QC Guidance Document (USEPA/USACE, April 1995).

TABLE 3-2. (continued)

Parameter	Units	Laboratory RL[(a)]	Laboratory MDL[(a)]	Recommended TDL[(b)]
PCB 138 (BZ)	ug/kg	0.17	0.0359	1
PCB 156 (BZ)	ug/kg	0.17	0.03393	1
PCB 169 (BZ)	ug/kg	0.17	0.03292	1
PCB 153 (BZ)	ug/kg	0.17	0.03475	1
PCB 206 (BZ)	ug/kg	0.17	0.03347	1
PCB 195 (BZ)	ug/kg	0.17	0.03384	1
PCB 101 (BZ)	ug/kg	0.17	0.03371	1
PCB 87 (BZ)	ug/kg	0.17	0.03119	1
PCB 90 (BZ)	ug/kg	0.17	0.02556	1
PCB 105 (BZ)	ug/kg	0.17	0.03498	1
PCB 118 (BZ)	ug/kg	0.17	0.03414	1
PCB 126 (BZ)	ug/kg	0.17	0.0439	1
PCB 44 (BZ)	ug/kg	0.17	0.03442	1
PCB 66 (BZ)	ug/kg	0.17	0.02735	1
PCB 52 (BZ)	ug/kg	0.17	0.03325	1
PCB 49 (BZ)	ug/kg	0.17	0.03529	1
PCB 77 (BZ)	ug/kg	0.17	0.03654	1
PCB 18 (BZ)	ug/kg	0.17	0.02293	1
PCB 28 (BZ)	ug/kg	0.17	0.03747	1
Wet Chemistry Parameters				
Ammonia	mg/kg	5.0	0.67	--
Total Cyanide (SW846 9012A)	mg/kg	0.5	0.0968	--
Total Sulfide (SW846 9030B/9034)	mg/kg	30	6.0001	0.1
TOC (Lloyd Kahn)	mg/kg	1000	272.35	--
Soil Parameters				
Calcium Carbonate Equivalents	%	0.2	--	--
Potential Acidity (PPA)	ppt	0.2	--	--
pH (saturated paste)	--	0.02	--	--
Electrical Conductivity (EC)	mmhos/cm	0.05	--	--
Total Petroleum Hydrocarbons (TPH) - Gas Chromatography/Flame Ionization Detector (SW846 8015B)				
Diesel Range Organics (DRO)	mg/kg	10	0.24	--
Gas Range Organics (GRO)	µg/kg	100	28	--
Volatile Organic Compounds (BTEX) - Gas Chromatography/Mass Spectrometry (SW846 8060)				
Benzene	µg/kg	5	--	10
Toluene	µg/kg	5	--	10
Ethylbenze	µg/kg	5	--	10
Xylene	µg/kg	5	--	10
Organophosphorus Pesticides - Gas				
Azinphos-methyl	µg/kg	33	6.36	10
Demeton (total)	µg/kg	33	3.45	10
Malathion	µg/kg	33	2.99	10
Methyl parathion	µg/kg	33	2.95	10
Ethyl parathion	µg/kg	3	5.31	10
Organotins (TA SOP)				
Monobutyltin	µg/kg	0.5	2.5	10
Dibutyltin	µg/kg	0.039	1.7	10
Tributyltin	µg/kg	0.045	1.5	10

(a) RL=Reporting Limit, MDL = Method Detection Limit. Values ≥ MDL and < RL will be qualified as estimated. MDLs are required to be updated periodically, and are subject to change; dioxin and furan congeners are quantified to a sample-specific EDL, calculated based on the instrument noise for each sample at the time it is analyzed

(b) Target Detection Limit (TDL) from the QA/QC Guidance Document (USEPA/USACE, April 1995).

TABLE 3-3. PROJECT LIMITS FOR AQUEOUS SAMPLES
JBLE BACK RIVER CHANNEL, HAMPTON, VIRGINIA (DECEMBER 2015)

Parameter	Units	Laboratory RL (MDL)[(a)]	Recommended TDL [(b)]
Organochlorine Pesticides - Gas Chromatography/Electron Capture Detector - (SW846 8081A)			
Aldrin	ug/L	0.05 (0.0333)	0.04
alpha-BHC	ug/L	0.05 (0.0266)	--
beta-BHC	ug/L	0.05 (0.001)	--
delta-BHC	ug/L	0.05 (0.0175)	--
gamma-BHC (Lindane)	ug/L	0.05 (0.0321)	0.002
Chlorobenside	ug/L	0.01 (0.0591)	--
Chlordane (Technical)	ug/L	0.05 (0.0658)	0.17
Dacthal	ug/L	0.0025 (0.00034)	--
DCPA	ug/L	0.1(0.0135)	0.03
1,2,4-Trichlorobenzene	ug/L	1(0.0712)	10
2,4,6-Trichlorophenol	ug/L	1(0.175)	--
2,4'-DDD	ug/L	0.05(0.0269)	0.01
2,4'-DDE	ug/L	0.05(0.0317)	0.01
2,4'-DDT	ug/L	0.05(0.0297)	0.01
4,4'-DDD	ug/L	0.0013 (0.00067)	0.1
4,4'-DDE	ug/L	0.0013 (0.00079)	0.1
4,4'-DDT	ug/L	0.0013 (0.00074)	0.1
Dieldrin	ug/L	0.05 (0.0328)	0.02
Endosulfan I	ug/L	0.05 (0.0376)	0.1
Endosulfan II	ug/L	0.05(0.0391)	0.1
Endosulfan sulfate	ug/L	0.05(0.0228)	0.1
Endrin	ug/L	0.05(0.0385)	0.1
Endrin aldehyde	ug/L	0.05 (0.0359)	0.1
Heptachlor	ug/L	0.05 (0.0397)	0.1
Heptachlor epoxide	ug/L	0.05 (0.0388)	0.1
Methoxychlor	ug/L	0.1 (0.0365)	0.5
Mirex	ug/L	0.05 (0.019)	--
Toxaphene	ug/L	4 (0.745)	0.5
Polycyclic Aromatic Hydrocarbons (PAHs) – Gas Chromatography/Mass Spectrometry/Selected Ion Monitoring - (SW846 8270C)			
Acenaphthene	ug/L	0.2(0.144)	10
Acenaphthylene	ug/L	0.2(0.0152)	10
Anthracene	ug/L	0.2(0.0154)	10
Benzo(a)anthracene	ug/L	0.2(0.0147)	10
Benzo(b)fluoranthene	ug/L	0.2(0.0157)	10
Benzo(k)fluoranthene	ug/L	0.2(0.0547)	10
Benzo(ghi)perylene	ug/L	0.2(0.0151)	10
Benzo(a)pyrene	ug/L	0.2(0.0134)	10
Chrysene	ug/L	0.2(0.014)	10
Dibenzo(a,h)anthracene	ug/L	0.2(0.0155)	10
Fluoranthene	ug/L	0.2(0.0162)	10
Fluroene	ug/L	0.2(0.0216)	10
Indeno(1,2,3-cd)pyrene	ug/L	0.2(0.0199)	--
2-Methylnaphthalene	ug/L	0.2(0.0122)	--
1-Methylnaphthalene	ug/L	0.2(0.0138)	--
Naphthalene	ug/L	0.2(0.014)	10
Phenanthrene	ug/L	0.2(0.0427)	10
Pyrene	ug/L	0.2 (0.0157)	10

(a) RL=Reporting Limit, MDL = Method Detection Limit. MDLs are provided if RL is > TDL. Values ≥ MDL and < RL will be qualified as estimated, except wet chemistry parameters, dioxin/furan congeners, and butyltins. MDLs are required to be updated periodically, and are subject to change.

(b) (b) Target Detection Limit (TDL) from *QA/QC Guidance for Sampling and Analysis of Sediments, Water, and Tissues for Dredged Material Evaluations* (USEPA/USACE 1995).

TABLE 3-3. (continued)

Parameter	Units	Laboratory RL (MDL)[(a)]	Recommended TDL [(b)]
PCB Congeners - Gas Chromatography/Electron Capture Detector - (SW846 8082)			
2,4'-Dichlorobiphenyl (BZ # 8)	ng/L	1.0 (0.441)	10
2,2',5-Trichlorobiphenyl (BZ # 18)	ng/L	1.0 (0.480)	10
2,4,4'-Trichlorobiphenyl (BZ # 28)	ng/L	1.0 (0.432)	10
2,2',3,5'-Tetrachlorobiphenyl (BZ # 44)	ng/L	1.0 (0.436)	10
2,2',4,5'-Tetrachlorobiphenyl (BZ # 49)	ng/L	1.0 (0.449)	10
2,2',5,5'-Tetrachlorobiphenyl (BZ # 52)	ng/L	1.0 (0.431)	10
2,3',4,4'-Tetrachlorobiphenyl (BZ # 66)	ng/L	1.0 (0.505)	10
3,3',4,4'-Tetrachlorobiphenyl (BZ # 77)	ng/L	1.0 (0.441)	10
2,2',3,4,5'-Pentachlorobiphenyl (BZ # 87)	ng/L	1.0 (0.407)	10
2,2',3,4',5-Pentachlorobiphenyl (BZ # 90)	ng/L	1.0 (0.776)	10
2,2',4,5,5'-Pentachlorobiphenyl (BZ # 101)	ng/L	1.0 (0.413)	10
2,3,3',4,4'-Pentachlorobiphenyl (BZ # 105)	ng/L	1.0 (0.383)	10
2,3',4,4',5-Pentachlorobiphenyl (BZ # 118)	ng/L	1.0 (0.532)	10
3,3',4,4',5-Pentachlorobiphenyl (BZ # 126)	ng/L	1.0 (0.393)	10
2,2',3,3',4,4'-Hexachlorobiphenyl (BZ # 128)	ng/L	1.0 (0.356)	10
2,2',3,4,4',5'-Hexachlorobiphenyl (BZ # 138)	ng/L	1.0 (0.338)	10
2,2',4,4',5,5'-Hexachlorobiphenyl (BZ # 153)	ng/L	1.0 (0.392)	10
2,3,3',4,4',5-Hexachlorobiphenyl (BZ # 156)	ng/L	1.0 (0.374)	10
3,3',4,4',5,5'-Hexachlorobiphenyl (BZ # 169)	ng/L	1.0 (0.429)	10
2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ # 170)	ng/L	1.0 (0.368)	10
2,2',3,4,4',5,5'-Heptachlorobiphenyl (BZ # 180)	ng/L	1.0 (0.364)	10
2,2',3,4,4',5',6-Heptachlorobiphenyl (BZ # 183)	ng/L	1.0 (0.372)	10
2,2',3,4,4',6,6'-Heptachlorobiphenyl (BZ # 184)	ng/L	1.0 (0.423)	10
2,2',3,4',5,5',6-Heptachlorobiphenyl (BZ # 187)	ng/L	1.0 (0.394)	10
2,2',3,3',4,4',5,6-Octachlorobiphenyl (BZ # 195)	ng/L	1.0 (0.393)	10
2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (BZ # 206)	ng/L	1.0 (0.383)	10
2,2',3,3',4,4',5,5',6,6'-Decachlorobiphenyl (BZ # 209)	ng/L	1.0 (0.438)	10
Metals – Atomic Emission Inductively Coupled Plasma/Mass Spectrometry - (SW846 6020)			
Aluminum	ug/L	30 (2.57)	40
Antimony	ug/L	2.0 (0.0187)	3
Arsenic	ug/L	1.0 (0.291)	1
Beryllium	ug/L	1.0 (0.0367)	0.2
Cadmium	ug/L	1.0 (0.114)	1
Chromium	ug/L	2.0 (0.543)	1
Cobalt	ug/L	0.5 (0.0263)	4
Copper	ug/L	2.0 (0.244)	1
Iron	ug/L	50 (6.09)	10
Lead	ug/L	1.0 (0.0192)	1
Manganese	ug/L	0.5 (0.0389)	1
Nickel	ug/L	1.0 (0.175)	1
Selenium	ug/L	5(0.422)	1
Silver	ug/L	1.0 (0.0362)	1
Thallium	ug/L	1.0 (0.0152)	1
Tin	ug/L	5.0 (1.51)	5
Zinc	ug/L	5.0 (0.961)	1
Metals - Cold Vapor (SW846 7470A)			
Mercury	ug/L	0.2 (0.0384)	0.2

(a) RL=Reporting Limit, MDL = Method Detection Limit. MDLs are provided if RL is > TDL. Values ≥ MDL and < RL will be qualified as estimated, except wet chemistry parameters, dioxin/furan congeners, and butyltins. MDLs are required to be updated periodically, and are subject to change.

(b) (b) Target Detection Limit (TDL) from *QA/QC Guidance for Sampling and Analysis of Sediments, Water, and Tissues for Dredged Material Evaluations* (USEPA/USACE 1995).

TABLE 3-3. (continued)

Parameter	Units	Laboratory RL (MDL)[(a)]	Recommended TDL [(b)]
Semivolatile Organics - Gas Chromatography/Mass Spectrometry - (SW846 8270C)			
Benzoic acid	ug/L	5.0 (0.562)	50
Benzyl alcohol	ug/L	1.0 (0.215)	50
Bis(2-chloroethyl) ether	ug/L	0.2 (0.0251)	10
Bis(2-chloroethoxy)methane	ug/L	1.0 (0.0581)	--
Bis(2-ethylhexyl) phthalate	ug/L	2.0 (0.797)	--
4-Bromophenyl phenyl ether	ug/L	1.0 (0.0635)	--
Butylbenzylphthalate	ug/L	1.0 (0.142)	10
4-Chloro-3-methylphenol	ug/L	1.0 (0.0754)	--
2-Chloronaphthalene	ug/L	0.2 (0.0151)	--
2-Chlorophenol	ug/L	1.0 (0.165)	--
4-Chlorophenyl phenyl ether	ug/L	1.0 (0.0503)	--
Dibenzofuran	ug/L	1.0 (0.0617)	10
Di-n-butyl phthalate	ug/L	1.0 (0.125)	10
3,3'-Dichlorobenzidine	ug/L	1.0 (0.112)	--
2,4-Dichlorophenol	ug/L	0.2 (0.0334)	--
Diethyl phthalate	ug/L	1.0 (0.146)	10
4,6-Dinitro-2-Methylphenol	ug/L	5.0 (0.220)	--
2,4-Dimethylphenol	ug/L	1.0 (0.0852)	10
Dimethyl phthalate	ug/L	1.0 (0.0765)	10
2,4-Dinitrophenol	ug/L	5.0 (0.613)	--
2,4-Dinitrotoluene	ug/L	1.0 (0.0536)	--
2,6-Dinitrotoluene	ug/L	1.0 (0.0797)	--
Di-n-octyl phthalate	ug/L	1.0 (0.207)	--
1,2-Diphenylhydrazine	ug/L	0.2 (0.066)	--
Hexachlorobenzene	ug/L	0.2 (0.0183)	--
Hexachlorobutadiene	ug/L	0.2 (0.0166)	--
Hexachloroethane	ug/L	1.0 (0.0628)	--
Hexachlorocyclopentadiene	ug/L	1.0 (0.0518)	--
Isophorone	ug/L	1.0 (0.0644)	--
2-Methylphenol	ug/L	1.0 (0.0862)	--
4-Methylphenol	ug/L	1.0 (0.0902)	--
Nitrobenzene	ug/L	0.2 (0.0843)	--
2-Nitrophenol	ug/L	1.0 (0.171)	--
4-Nitrophenol	ug/L	5.0 (0.605)	--
N-Nitrosodiphenylamine	ug/L	0.2 (0.0853)	--
N-Nitrosodimethylamine	ug/L	0.2 (0.0735)	--
N-Nitroso-di-n-propylamine	ug/L	0.2 (0.0308)	--
2,2’-oxybis(1-Chloropropane	ug/L	1.0(0.0197)	--
Pentachlorophenol	ug/L	1.0 (0.0663)	50
Phenanthrene	ug/L	0.2(0.0427)	10
Phenol	ug/L	0.2 (0.0581)	10
1,2,4-Trichlorobenzene	ug/L	0.2 (0.0461)	--
2,4,6-Trichlorophenol	ug/L	1.0 (0.0091)	--
Butyltins - Gas Chromatography/Flame Photometric Detector - (TA-Burlington SOP)			
Monobutyltins	ug/L	0.5 (0.16)	10
Dibutyltins	ug/L	0.039 (0.02)	10
Tributyltins	ug/L	0.045 (0.023)	10
Tetrabutyltins	ug/L	0.05 (0.03)	--

(a) RL=Reporting Limit, MDL = Method Detection Limit. MDLs are provided if RL is > TDL. Values ≥ MDL and < RL will be qualified as estimated, except wet chemistry parameters, dioxin/furan congeners, and butyltins. MDLs are required to be updated periodically, and are subject to change.

(b) (b) Target Detection Limit (TDL) from *QA/QC Guidance for Sampling and Analysis of Sediments, Water, and Tissues for Dredged Material Evaluations* (USEPA/USACE 1995).

TABLE 3-3. (continued)

Parameter	Units	Laboratory RL (MDL)[(a)]	Recommended TDL [(b)]
Wet Chemistry Parameters			
Total Organic Carbon (EPA 415.1)	mg/L	1.0 (0.189)	0.1
Cyanide (SW846 9012A)	µg/L	10 (1.5)	5000
Nitrogen, ammonia (EPA 350.1M)	mg/L	0.10 (0.041)	0.03
Nitrogen, nitrate (EPA 353.2M)	mg/L	0.10 (0.014)	--
Nitrogen, nitrite (EPA 353.2M)	mg/L	0.10 (0.014)	--
Nitrogen, total Kjeldahl (EPA 351.3M)	mg/L	3.0 (2.0)	--
Sulfide (SW846 9030B/9034)	mg/L	3.0 (0.590)	0.1
Total Phosphorus (EPA 365.2M)	mg/L	0.10 (0.03)	--
Dioxins/Furan Congeners - High Resolution Mass Spectrometry (USEPA 1613B)			
2,3,7,8-TCDD	pg/L	10	10
1,2,3,7,8-PeCDD	pg/L	50	25
1,2,3,4,7,8-HxCDD	pg/L	50	50
1,2,3,6,7,8-HxCDD	pg/L	50	50
1,2,3,7,8,9-HxCDD	pg/L	50	50
1,2,3,4,6,7,8-HpCDD	pg/L	50	50
OCDD	pg/L	100	100
2,3,7,8-TCDF	pg/L	10	10
1,2,3,7,8-PeCDF	pg/L	50	25
2,3,4,7,8-PeCDF	pg/L	50	25
1,2,3,4,7,8-HxCDF	pg/L	50	50
1,2,3,6,7,8-HxCDF	pg/L	50	50
2,3,4,6,7,8-HxCDF	pg/L	50	50
1,2,3,7,8,9-HxCDF	pg/L	50	50
1,2,3,4,6,7,8-HpCDF	pg/L	50	50
1,2,3,4,7,8,9-HpCDF	pg/L	50	50
OCDF	pg/L	100	100

(a) RL=Reporting Limit, MDL = Method Detection Limit. MDLs are provided if RL is > TDL. Values ≥ MDL and < RL will be qualified as estimated, except wet chemistry parameters, dioxin/furan congeners, and butyltins. MDLs are required to be updated periodically, and are subject to change.

(b) (b) Target Detection Limit (TDL) from *QA/QC Guidance for Sampling and Analysis of Sediments, Water, and Tissues for Dredged Material Evaluations* (USEPA/USACE 1995).

TABLE 3-4. PROJECT LIMITS FOR TCLP SAMPLES
JBLE BACK RIVER CHANNEL, HAMPTON, VIRGINIA (DECEMBER 2015)

Parameter	Units	Laboratory RL (MDL) [(a)]	Recommended TDL[(b)]
Metals - Cold Vapor (SW846 1311/7470A)			
Mercury	mg/L	0.0002	0.2
Metals - Atomic Emission Inductively Coupled Plasma/Mass Spectrometry - (SW846 1311/6010B)			
Arsenic	mg/L	0.50	5.0
Barium	mg/L	10	100
Cadmium	mg/L	0.10	1.0
Chromium	mg/L	0.50	5.0
Lead	mg/L	0.5	5.0
Silver	mg/L	0.25	5.0
Selenium	mg/L	0.25	1.0
Volatile Organics - Gas Chromatography/Mass Spectrometry - (SW846 1311/8260B)			
Benzene	mg/L	0.050	0.50
2-Butanone (Methyl Ethyl Ketone)	mg/L	0.050	200
Carbon tetrachloride	mg/L	0.050	0.50
Chlorobenzene	mg/L	0.050	100
Chloroform	mg/L	0.050	6.0
1,2-Dichloroethane	mg/L	0.050	0.50
1,1-Dichloroethene	mg/L	0.050	0.70
Tetrachloroethene	mg/L	0.050	0.50
Trichloroethene	mg/L	0.050	0.70
Vinyl Chloride	mg/L	0.050	0.20
Semivolatile Organics - Gas Chromatography/Mass Spectrometry - (SW846 1311/8270C)			
Cresols (total)	mg/L	0.050	200
1,4-Dichlorobenzene	mg/L	0.010	7.5
2,4-Dinitrotoluene	mg/L	0.050	0.13
Hexachlorobenzene	mg/L	0.010	0.13
Hexachlorobutadiene	mg/L	0.01	0.50
Hexachloroethane	mg/L	0.050	3.0
Nitrobenzene	mg/L	0.01	2.0
Pentachlorophenol	mg/L	0.05	100
Pyridine	mg/L	0.05	5.0
2,4,5-Trichlorophenol	mg/L	0.050	400
2,4,6-Trichlorophenol	mg/L	0.050	2.0
Organochlorine Pesticides - Gas Chromatography/ Electron Capture Detector - (SW846 1311/8081A) (2 ml final extract volume)			
Gamma-BHC (Lindane)	mg/L	0.0005	0.40
Chlordane (technical)	mg/L	0.005	0.030
Endrin	mg/L	0.0005	0.020
Heptachlor	mg/L	0.0005	0.0080
Heptachlor epoxide	mg/L	0.0005	0.0080
Methoxychlor	mg/L	0.001	10
Toxaphene	mg/L	0.02	0.50
Chlorophenoxy Acid Herbicides - Gas Chromatography/ Electron Capture Detector - (SW846 1311/8151A)			
2,4-D	mg/L	0.04	10
2,4,5-TP (Silvex)	mg/L	0.01	1.0

(a) RL=Reporting Limit, MDL= Method Detection Limit. MDLs are provided if RL is >TDL. Values $\geq$ MDL and < RL will be qualified as estimated. MDLs are required to be updated periodically, and are subject to change.

(b) Target Detection Limit (TDL) from the QA/QC Guidance Document (USEPA/USACE, April 1995). The TDL for TCLP parameters are the Toxicity Characteristic Rule's Regulatory Level (40 CFR 261.24)

TABLE 3-5. PROJECT LIMITS FOR TISSUE SAMPLES
JBLE BACK RIVER CHANNEL, HAMPTON, VIRGINIA (DECEMBER 2015)

Parameter	Units	Laboratory RL[(a)]	Laboratory MDL[(a)]	Recommended TDL[(b)]
Metals - Cold Vapor (SW846 6020/7471A) (based on solid MDLs)				
Mercury	mg/kg	0.033	0.0109	0.02
Metals - Inductively Coupled Plasma / Mass Spectrometry (SW846 6020/7471A) (based on solid MDLs)				
Aluminum	mg/kg	3	0.2849	--
Antimony	mg/kg	0.2	0.0026	--
Arsenic	mg/kg	0.1	0.0181	0.2
Beryllium	mg/kg	0.1	0.0075	--
Cadmium	mg/kg	0.1	0.007	0.1
Chromium	mg/kg	0.2	0.0061	1
Cobalt	mg/kg	0.05	0.0015	--
Copper	mg/kg	0.2	0.033	1
Iron	mg/kg	5	0.3539	--
Lead	mg/kg	0.1	0.0038	0.2
Manganese	mg/kg	0.5	0.0103	--
Mercury	mg/kg	0.033	0.0109	0.02
Nickel	mg/kg	0.1	0.0113	1
Selenium	mg/kg	0.5	0.0502	--
Silver	mg/kg	0.1	0.0039	0.2
Thallium	mg/kg	0.1	0.002	--
Tin	mg/kg	0.5	0.0593	--
Zinc	mg/kg	0.5	0.0648	1
Lipids	%	0.1	0.0296	0.1
Dioxins/Furan Congeners- High Resolution Mass Spectrometry (HRMS) - (USEPA 1613B)				
2,3,7,8-TCDD	ng/kg	1	0.38	1
1,2,3,7,8-PeCDD	ng/kg	5	0.43	1
1,2,3,4,7,8-HxCDD	ng/kg	5	0.49	2.5
1,2,3,6,7,8-HxCDD	ng/kg	5	0.45	2.5
1,2,3,7,8,9-HxCDD	ng/kg	5	0.30	2.5
1,2,3,4,6,7,8-HpCDD	ng/kg	5	0.57	5
OCDD	ng/kg	10	5.2	5
2,3,7,8-TCDF	ng/kg	1	0.59	5
1,2,3,7,8-PeCDF	ng/kg	5	0.74	5
2,3,4,7,8-PeCDF	ng/kg	5	0.39	5
1,2,3,4,7,8-HxCDF	ng/kg	5	0.59	5
1,2,3,6,7,8-HxCDF	ng/kg	5	0.54	5
2,3,4,6,7,8-HxCDF	ng/kg	5	0.79	5
1,2,3,7,8,9-HxCDF	ng/kg	5	0.46	5
1,2,3,4,6,7,8-HpCDF	ng/kg	5	0.52	5
1,2,3,4,7,8,9-HpCDF	ng/kg	5	0.39	10
OCDF	ng/kg	10	1.2	10
Organochlorine Pesticides - Gas Chromatography/Electron Capture Detector - (SW846 8081A)				
4,4'-DDD	ug/kg	0.0833	0.0109	2
4,4'-DDE	ug/kg	0.0833	0.0126	2
4,4'-DDT	ug/kg	0.0833	0.0125	2
Beta-BHC	ug/kg	0.0833	0.0216	--
DCPA	ug/kg	0.0833	0.0127	--
Endrin	ug/kg	0.0833	0.0162	2

(a) RL=Reporting Limit, MDL = Method Detection Limit. Values ≥ MDL and < RL will be qualified as estimated. MDLs are required to be updated periodically, and are subject to change

(b) Target Detection Limit (TDL) from the Southeast Regional Implementation Manual (SERIM) (USEPA/USACE 2008).
mg/kg – milligrams per kilogram; µg/kg – micrograms per kilogram

TABLE 3-5. (continued)

Parameter	Units	Laboratory RL[(a)]	Laboratory MDL[(a)]	Recommended TDL[(b)]
Endrin Aldehyde	ug/kg	0.0833	0.0162	2
Methoxychlor	ug/kg	0.167	0.0174	2
Mirex	ug/kg	0.0833	0.00770	--
PCB Congeners – Gas Chromatography/Electron Capture Detector – (SW846 8082)				
2,4'-Dichlorobiphenyl (BZ # 8)	ug/kg	1	0.0882	1
2,2',5-Trichlorobiphenyl (BZ # 18)	ug/kg	1	0.0752	1
2,4,4'-Trichlorobiphenyl (BZ # 28)	ug/kg	1	0.1071	1
2,2',3,5'-Tetrachlorobiphenyl (BZ # 44)	ug/kg	1	0.0658	1
2,2',4,5'-Tetrachlorobiphenyl (BZ # 49)	ug/kg	1	0.0734	1
2,2',5,5'-Tetrachlorobiphenyl (BZ # 52)	ug/kg	1	0.1636	1
2,3',4,4'-Tetrachlorobiphenyl (BZ # 66)	ug/kg	1	0.1702	1
3,3',4,4'-Tetrachlorobiphenyl (BZ # 77)	ug/kg	1	0.2004	1
2,2',3,4,5'-Pentachlorobiphenyl (BZ # 87)	ug/kg	1	0.0626	1
2,2',4,5,5'-Pentachlorobiphenyl (BZ # 101)	ug/kg	1	0.062	1
2,3,3',4,4'-Pentachlorobiphenyl (BZ # 105)	ug/kg	1	0.1789	1
2,3',4,4',5-Pentachlorobiphenyl (BZ # 118)	ug/kg	1	0.1494	1
3,3',4,4',5-Pentachlorobiphenyl (BZ # 126)	ug/kg	1	0.1868	1
2,2',3,3',4,4'-Hexachlorobiphenyl (BZ # 128)	ug/kg	1	0.0724	1
2,2',3,4,4',5'-Hexachlorobiphenyl (BZ # 138)	ug/kg	1	0.0907	1
2,2',4,4',5,5'-Hexachlorobiphenyl (BZ # 153)	ug/kg	1	0.139	1
2,3,3',4,4',5-Hexachlorobiphenyl (BZ # 156)	ug/kg	1	0.1477	1
3,3',4,4',5,5'-Hexachlorobiphenyl (BZ # 169)	ug/kg	1	0.127	1
2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ # 170)	ug/kg	1	0.139	1
2,2',3,4,4',5,5'-Heptachlorobiphenyl (BZ # 180)	ug/kg	1	0.1536	1
2,2',3,4,4',5',6-Heptachlorobiphenyl (BZ # 183)	ug/kg	1	0.1049	1
2,2',3,4,4',6,6'-Heptachlorobiphenyl (BZ # 184)	ug/kg	1	0.0961	1
2,2',3,4',5,5',6-Heptachlorobiphenyl (BZ # 187)	ug/kg	1	0.0921	1
2,2',3,3',4,4',5,6-Octachlorobiphenyl (BZ # 195)	ug/kg	1	0.1186	1
2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (BZ # 206)	ug/kg	1	0.0664	1
2,2',3,3',4,4',5,5',6,6'-Decachlorobiphenyl (BZ # 209)	ug/kg	1	0.1472	1
Polycyclic Aromatic Hydrocarbons (PAHs)) – Gas Chromatography/Mass Spectrometry - (SW846 8270C)				
Acenaphthene	ug/kg	6.7	0.6408	20
Acenaphthylene	ug/kg	6.7	0.7641	20
Anthracene	ug/kg	6.7	0.6527	20
Benzo[a]anthracene	ug/kg	6.7	0.836	20
Benzo[b]fluoranthene	ug/kg	6.7	1.0488	20
Benzo[k]fluoranthene	ug/kg	6.7	1.3486	20
Benzo[g,h,i]perylene	ug/kg	6.7	0.6637	20
Benzo[a]pyrene	ug/kg	6.7	0.6675	20
Chrysene	ug/kg	6.7	0.7943	20
Dibenz(a,h)anthracene	ug/kg	6.7	0.7421	20
Fluoranthene	ug/kg	6.7	0.7134	20
Fluorene	ug/kg	6.7	0.8793	20
Indeno[1,2,3-cd]pyrene	ug/kg	6.7	0.6874	20
Naphthalene	ug/kg	6.7	0.575	20
Phenanthrene	ug/kg	6.7	1.0612	20
Pyrene	ug/kg	6.7	0.6746	20

(a) RL=Reporting Limit, MDL = Method Detection Limit. Values ≥ MDL and < RL will be qualified as estimated. MDLs are required to be updated periodically, and are subject to change; dioxin and furan congeners are quantified to a sample-specific EDL, calculated based on the instrument noise for each sample at the time it is analyzed

(b) Target Detection Limit (TDL) from USEPA 1995.

4. BULK SEDIMENT CHEMISTRY

The physical and chemical characteristics of twelve discrete samples, six composites, and two duplicate samples from locations in the JBLE Back River Channel (Figure 1-1) were determined to assess the sediment quality of the material proposed for dredging. Additionally, surficial sediment from the Willoughby Bank reference site and the Atlantic Ocean reference site was analyzed. This chapter presents the results of the bulk sediment chemical analyses and comparisons of detected chemical constituents to SQGs and to Port Tobacco at Weanack screening criteria, TCLP criteria, and Commonwealth of Virginia disposal criteria as per 9VAC 20-81-660.

4.1 DATA ANALYSIS

4.1.1 Calculation of Total Polychlorinated Biphenyl Congeners, Total Polychlorinated Biphenyl Aroclors, and Total Polycyclic Aromatic Hydrocarbons

For each individual sediment sample, two total PCB concentrations were determined. Total NOAA PCBs and Total USEPA Region 4 PCBs were calculated by summing the concentrations of the congeners in each list (as specified in Table 5-6 of the *SERIM*) and multiplying the total by a factor of 2. Multiplying by a factor of 2 estimated the total PCB concentrations and accounted for additional congeners that were not tested as part of this program. These determinations were based upon testing of specific congeners recommended in the *SERIM* (USEPA/USACE 2008) and the NOAA (1993) approach for total PCB determinations. The total PCB aroclor concentration was determined by summing the concentrations of the 7 aroclors.

PAHs were also summed because PAHs are usually found in mixtures containing two or more compounds (Agency for Toxic Substances and Disease Registry [ATSDR] 1995). Total PAH concentrations were determined for each sample by summing the concentrations of the individual PAHs. In addition, total PAHs were determined as total LPAHs (2 or 3 carbon rings) and total HPAHs (4, 5, or 6 carbon rings). HPAHs and LPAHs have different sources as well as act differently in marine environments. LPAHs are often associated with petroleum, while HPAHs are associated with combustion products (NOAA 1989).

- LPAHs included in the total LPAH (as per USEPA/USACE 2008): 1-methylnaphthalene, 2-methylnaphthalene, anthracene, acenaphthene, fluorene, naphthalene, and phenanthrene.

- HPAHs included in the total HPAH (as per USEPA/USACE 2008): benzo(a)anthracene, benzo(a)pyrene, chrysene, dibenzo(a,h)anthracene, fluoranthene, and pyrene.

Three values were reported for total PCBs and total PAHs, representing the following method for treating concentrations below the analytical detection limit:

- Non-detects = 0 (ND=0)
- Non-detects = one-half of the reporting limit (ND=½RL)
- Non-detects = the reporting limit (ND=RL)

Substituting 0 (ND=0), ½ the reporting limit (ND=½RL), and the reporting limit (ND=RL) for each non-detect provides a range of conservative estimates for the concentrations. Substituting ND=RL is the most conservative and produces results that are biased high, especially in data sets where the majority of samples are non-detects. This overestimation is important to consider when comparing the calculated total values to criteria values.

4.1.2 Calculation of Dioxin Toxicity Equivalency Quotients

The TEQs for dioxin and furan congeners were calculated following the approach recommended by the World Health Organization (WHO) (Van den Berg et al. 2006). Each congener was multiplied by a WHO recommended Toxicity Equivalency Factor (TEF) for human health (Van den Berg et al. 2006) and then the congener concentrations were summed. Concentrations that were flagged with a “B” (detected in blank) or “Q” (estimated maximum possible concentration) were not included in the TEQ calculation as per the USEPA dioxin validation guidance (USEPA 2005). The dioxin TEQs were calculated using ND=0, ND=½RL, and ND=RL. Substituting the reporting limit (ND=RL) for each non-detect provides a conservative estimate of the concentration. This method, however, tends to produce results that are biased high, especially in data sets where the majority of congeners are below the RL.

4.1.3 Calculation of Total DDTs

For each sample, total DDT concentrations were determined by summing the concentrations of 4’4’-DDT, 4’4’-dichlorodiphenyldichloroethylene (DDE), and 4’4’-dichlorodiphenyldichloroethane (DDD). If one of the DDT components was not detected (“U” qualified), the RL was utilized in the calculation. As noted for PCB congeners and PAHs, this results in a conservative estimate of total DDTs.

4.1.4 Simultaneously Extracted Metals/Acid Volatile Sulfide Ratio

The bioavailability of divalent metals to aquatic organisms is influenced by the ratio of SEM/AVS. In low oxygenated environments, metals may precipitate with sulfides, making them unavailable for uptake by aquatic organisms. Using this method, five metals (cadmium, copper, lead, nickel, and zinc) were extracted, measured, and added together (including any values that are “B” or “J” qualified; Table 4-2). If a metal was not detected, it was considered a zero in the calculation. The sum of the concentrations of these five metals was then compared to the amount of AVS detected in the same sediment sample. If AVS was not detected in the sample, the SEM/AVS ratio was not calculated.

4.1.5 Comparison of Bulk Sediment Data to Sediment Quality Guidelines

SQGs are numerical chemical concentrations intended to either be protective of biological resources, or predictive of adverse effects to those resources, or both (Wenning and Ingersoll 2002). USACE’s guidance on using SQGs in dredged material management acknowledges the limitations of each approach used to derive SQGs to date, but concludes that SQGs are still useful as initial screening values. If, based on the initial screening using established SQGs, there is a “reason to believe” that the material is not contaminated, no further chemical or toxicological testing would be necessary as indicated by the ITM (USACE–Waterways Experiment Station [WES] 1998).

The SQGs were developed as informal (non-regulatory) guidelines for use in interpreting chemical data from analyses of sediments. Several biological-effects approaches have been used to assess marine/estuarine sediment quality relative to the potential for adverse effects on benthic organisms, including the Threshold Effects Level (TEL)/Effects Level (PEL) (MacDonald et al. 1996) approach. The TEL and PEL values were derived using concentrations with both effects and no observed effects (Long and MacDonald 1998). TELs typically represent concentrations below which adverse biological effects were rarely observed, while PELs typically represent concentrations in the middle of the effects range and above which effects were more frequently observed (Long and MacDonald 1998). Concentrations that are between the TEL and PEL represent the concentrations at which adverse biological effects occasionally occur.

The heptachlor epoxide PEL value was developed for the CCME (2001). The Canadian heptachlor epoxide PEL value was initially developed for freshwater sediment through a modification of the approach used by the National Status and Trends Program. Because of data gaps in toxicity data for heptachlor epoxide in marine sediments, CCME provisionally adopted the freshwater heptachlor epoxide PEL value for marine sediments (CCME 2001).

Concentrations of detected analytes in sediment samples from the Thimble Shoal Channel were compared to SQGs (MacDonald et al. 1996) for marine sediments to assess the sediment quality of the material proposed for dredging. SQGs were used to identify potential adverse biological effects associated with contaminated sediments. TEL and PEL values for marine/estuarine sediments are provided in Table 4-1.

Evaluations of large chemical and toxicity data sets (O'Connor et al. 1998; O'Connor and Paul 1999) have indicated that TEL/PEL screening is not a reliable method for predicting sample toxicity or for screening samples out as non-toxic. The studies indicate that:

- Not exceeding a TEL should reliably predict the absence of whole-sediment toxicity
- Exceeding a PEL (much less a TEL) does not reliably indicate toxicity
- Many, perhaps even most, sediments that exceed one or more PELs are not toxic.

Since TELs/PELs are widely used despite their recently demonstrated over-sensitivity in predicting toxicity, the concentrations of contaminants in the sediments sampled in this project were compared to the TEL and PEL values for all chemical constituents for which TEL/PEL values have been developed. For dredged material evaluations, SQGs are used as a tool to assist with identification of constituents of potential concern and to provide additional weight of evidence in the evaluation (USACE–WES 1998).

4.1.6 Comparison to Port Tobacco at Weanack Requirements

The physical and chemical qualities of the sediments from the JBLE Back River Channel were also analyzed to determine suitability for upland placement at the Port Tobacco at Weanack facility based on the requirements specified in the facility permit (VDEQ 2014). Data are presented in summary tables (Tables 4-5 through 4-16) and are also presented in the screening table format requested by representatives from Port Tobacco at Weanack (Appendix B).

In addition to the chemical analyses, the Weanack facility requests that the several agricultural-based properties of the soils be determined (Tables B-1 through B-6). The acid-base accounting value was used to evaluate the suitability of the material to support agricultural or vegetative growth, based on the requirements at the Weanack facility. The acid-base accounting for each sample was calculated by subtracting the potential acidity from the neutralization potential of each sample (Jambor at al. 2006).

- If the acid-base accounting value is positive (greater than 0), the material is considered suitable for placement at the Weanack facility and could support agricultural growth as is, without the addition of any soil amendments.

- If the acid-base accounting value is between 0 and -15, the material would need to be amended using lime before the material would be suitable for placement at the Weanack facility.

- If the acid-base accounting value is less than -15, the material is so acidic that the amount of lime addition and management required could preclude the material from placement at the Weanack facility.

4.1.7 Testing to Support Other Upland Placement Options

Based on the requirements of local landfill operators, each discrete sediment sample was also tested for the following chemical analyses to determine if the sediment would be suitable for other upland disposal options: TCLP (volatiles, SVOCs, metals, chlorinated pesticides, and herbicides), ICR, paint filter test, TPH, EOX, and BTEX.

Concentrations of chemical constituents in the TCLP leachate were compared to maximum concentrations of contaminants for toxicity characteristics (Table 4-2) (40 CFR 261.24) to evaluate if the sediment proposed to be dredged could be placed in an upland site. TCLPs, which are routinely required for dredged material placement at landfills and upland locations, are used to identify the potential for toxicity and to determine if the dredged material would be classified as a hazardous waste. Sediment that fails the TCLP test must be managed in accordance with the Virginia Hazardous Waste Management Regulations (9VAC20-60).

As per 9VAC20-81-660, soils contaminated with petroleum products (including BTEX, EOX and TPH) must be handled in the following way:

- If EOX concentrations are >100 milligrams per kilogram (mg/kg), separate approval from the VDEQ must be granted.

- If BTEX concentrations are greater than 10 mg/kg or TPH is greater than 500 mg/kg, the soil cannot be disposed of in any landfill unless the facility permit expressly allows such disposal.

- If the concentration of TPH is >50 mg/kg and less than 500 mg/kg, and total BTEX is less than 10 mg/kg, the disposal of the contaminated soil may be approved for permitted landfills equipped with liners and leachate collection systems.

- If soil contains <50 mg/kg TPH and total BTEX is<10 mg/kg, the soil may be used as fill material. However, the soil may not be disposed of closer than 100 ft to any regularly flowing surface water body or river; 500 ft to any well, spring or other groundwater source of drinking water; and 200 ft from any residence, school, hospital, nursing home, or recreational park area.

4.2 BULK SEDIMENT RESULTS

Results of the bulk sediment chemistry analyses of the JBLE Back River Channel sediments collected in December 2015 are presented in the following sub-sections. Results of the sediment analyses were compared to the concentrations at the reference sites, SQGs, and the Virginia Exclusion Criteria and are presented in Tables 4-6 through 4-16.

Bulk sediments were analyzed for target analytes identified in the approved project SAP (EA 2015d). Project-specific analytical methods and detection limits for sediment samples are provided in Tables 3-1 and 3-2, respectively. Sample weights were adjusted for percent moisture (up to 50 percent moisture) prior to analysis to achieve the lowest possible detection limits. Analytical results are reported on a dry weight basis.

Definitions of inorganic, organic, and dioxin data qualifiers are presented in Tables 4-3 through 4-5, respectively. Values for detected chemical constituents are in bold on the data tables, and RLs are presented for non-detected chemical constituents. Shaded cells indicate that detected concentrations exceed the applicable SQGs or the Virginia Exclusion Criteria.

Analytical narratives that include an evaluation of laboratory QA/QC results and copies of final raw data sheets (Form Is) are provided in Appendix C. TestAmerica will retain and archive the results of these analyses for 7 years from the date of issuance of the final results.

4.2.1 Physical Analyses

Results of the grain size and physical analyses for each discrete and composite sample are provided in Table 4-6 and Figure 4-1. The sediments from locations BRC-01 through BRC-09 in the JBLE Back River Channel were predominantly comprised of fine-grained material, ranging from 69 to 97.2 percent silt+clay. Sediments from BRC-10 through BRC-12 were predominantly comprised of sand, ranging from 61.3 to 95 percent sand. The DU composites indicated that DU1, DU2, DU3, and DU4 were predominantly comprised of fine-grained clays with some sand, DU 5 was predominantly sand with some silt/clay, and DU6 was predominantly sand. The Willoughby Bank reference site and the Atlantic Ocean reference site were each predominantly comprised of fine sand (77.5 and 84.7 percent, respectively) (Table 4-6).

4.2.2 General Chemistry Parameters

The results of the nutrient and general chemistry analyses for the JBLE Back River Channel sediments are presented in Table 4-7. TOC concentrations ranged from 0.26 (BRC-12) to 3.3 (BRC-05) percent in the JBLE Back River Channel sediments, and TOC concentrations were 0.52 and 0.11 percent at the Willoughby Bank reference site and Atlantic Ocean reference site, respectively. TOC typically bonds to silts and clays in the sediments; therefore, samples with higher proportions of silt+clay tend to have higher TOC concentrations. Ammonia-nitrogen concentrations ranged from 6.2 (BRC-10) to 200 (BRC-05) mg/kg in the JBLE Back River Channel sediments. Ammonia-nitrogen was not detected in either of the reference sediment samples. Total sulfide concentrations ranged from 26 (BRC-02) to 1100 (BRC-05/06) mg/kg in the JBLE Back River Channel sediments. Total sulfide concentrations were estimated below the laboratory RL in each of the reference site samples. Cyanide concentrations were estimated below the laboratory RL and ranged from 0.055 (BRC-11) to 0.18 (BRC-09-FD) mg/kg in the JBLE Back River Channel sediments. Cyanide in the Willoughby Bank reference sample was estimated below the laboratory RL and was not detected in the Atlantic Ocean reference sample.

4.2.3 Metals

The results of the metals analyses for the JBLE Back River Channel are presented in Table 4-8. Of the 22 tested metals, 9 of them—arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc—have TEL and PEL values. With the exception of mercury in the discrete and composite samples in DU6, each of the tested metals were detected in each discrete and composite sediment sample, however, none of the concentrations exceeded the PEL values, or the Virginia Exclusion Criteria (Table 4-8).

The results of metals analyses and comparison to SQGs and Virginia Exclusion Criteria are presented in the following subsections.

Arsenic

Arsenic in sediment at the JBLE Back River Channel was detected in each of the discrete and composite samples. Concentrations ranged from 0.76 (BRC-11/12) to 11 mg/kg (BRC-04). The arsenic concentration at the Willoughby Bank reference site was 3.4 mg/kg and the Atlantic Ocean reference site had an arsenic concentration of 2.2 mg/kg. The arsenic concentration was between the TEL (7.24 mg/kg) and the PEL (41.6 mg/kg) in nine samples. None of the detected arsenic concentrations exceeded the PEL (Table 4-8).

Cadmium

Concentrations of cadmium ranged from 0.031 (BRC-11/12) to 0.34 (BRC-03) mg/kg, and were below the TEL value in each sample (Table 4-8). The cadmium concentrations at the Willoughby Bank reference site and Atlantic Ocean reference site were each estimated below the laboratory RL.

Chromium
Chromium concentrations ranged from 3.3 (BRC-11/12) to 38 mg/kg (BRC-04), and did not exceed the TEL value (Table 4-8). The chromium concentrations at the Willoughby Bank reference site and the Atlantic Ocean reference site were 11 and 8.5 mg/kg, respectively. Chromium was detected in the laboratory method blank for each sample but was estimated at concentrations below the laboratory RL.

Copper
Copper concentrations ranged from 0.97 (BRC-11/12) to 18 mg/kg (BRC-03) in sediments at the JBLE Back River Channel and did not exceed the TEL value (Table 4-8). The copper concentration at the Willoughby Bank reference site sample was 4.3 mg/kg and the concentration in the Atlantic Ocean reference sample was 1.6 mg/kg.

Lead
Concentrations of lead ranged from 1.6 (BRC-11/12) to 28 mg/kg (BRC-03), and none exceeded the TEL value (Table 4-8). The lead concentrations in the Willoughby Bank reference site and Atlantic Ocean reference site samples were 5.6 and 2.3 mg/kg, respectively.

Mercury
Mercury concentrations ranged from <0.020 (not detected, BRC-11) to 0.14 mg/kg (BRC-04). The mercury concentration at BRC-04 exceeded the TEL value (Table 4-8). The mercury concentration at the Willoughby Bank reference site was 0.039 mg/kg; mercury was not detected in the Atlantic Ocean reference site sample.

Nickel
Concentrations of nickel ranged from 1.1 (BRC-11/12) to 17 mg/kg (BRC-04). The nickel concentration in the Willoughby Bank reference site sample was 6.3 mg/kg and the nickel concentration in the Atlantic Ocean reference site sample was 5.1 mg/kg. Concentrations of nickel were between the TEL and PEL values in two samples (BRC-04 [17 mg/kg] and BRC-05 [16 mg/kg]). None of the samples had nickel concentrations that exceeded PEL values (Table 4-8).

Silver
Silver concentrations were estimated below the laboratory RL in each sample from BRC-11, BRC-12, BRC-11/12, BRC-10, BRC-10-FD, BRC-06, and both of the reference locations. Detected concentrations of silver ranged from 0.1 (BRC-09/10) to 0.44 mg/kg (BRC-01/02), and none of them exceeded the TEL value (Table 4-8).

Zinc
Zinc concentrations ranged from 5.9 (BRC-11/12) to 93 mg/kg (BRC-03), and none of the concentrations exceeded the TEL value (Table 4-8). The zinc concentrations in the Willoughby Bank reference site and Atlantic Ocean reference site samples were 32 and 20 mg/kg, respectively.

Butyltins
Results of the butyltin analyses are presented in Table 4-8. Butyltins were not detected in the JBLE Back River Channel samples or reference samples.

SEM/AVS Ratio

In addition to comparing sediment results to sediment quality guidelines, an additional analysis was performed to assess the bioavailability of metals in the sediment. The SEM/AVS ratio was calculated to assess the bioavailability of the five SEMs included in the analysis (cadmium, copper, lead, nickel, and zinc). An SEM/AVS ratio less than 1 indicates a high degree of probability that the metals are bound to organic material and not bioavailable to aquatic organisms. If the SEM/AVS ratio is greater than 1, then the metals in sediment exceed the sulfide binding ability and have a higher probability of being bioavailable to aquatic organisms. Results from the SEM/AVS analysis ranged from 0.04 (BRC-09) to 2.5 (BRC-01) in the sediment from the JBLE Back River Channel, and are presented in Table 4-8. Five samples had a ratio that was greater than 1: BRC-01, BRC-02, BRC-01/02, BRC-10, and BRC-11. Because the SEM/AVS ratio was greater than 1 for these samples, the five SEMs included in the analysis may be bioavailable to aquatic organisms.

Metals without TEL and PEL Values

Manganese concentrations ranged from 12 (BRC-11/12) to 160 mg/kg (BRC-03 and -04) in sediments at the JBLE Back River Channel area, and were 94 and 87 mg/kg in the Willoughby Bank reference and Atlantic Ocean reference samples, respectively (Table 4-8). Manganese is a highly mobile metal in shallow sediments because the reactivity of manganese is predominantly controlled by the availability of oxygen, and the transition between oxic/anoxic conditions occurs throughout the shallow sediment layers. Even though manganese is highly exchangeable in surface sediments, manganese does not tend to bioaccumulate or biomagnify in organism tissues. The detected concentrations of manganese are most likely not of ecological significance in the sediment.

Aluminum concentrations ranged from 950 (BRC-11/12) to 19,000 mg/kg (BRC-04), and were 3,800 and 2,600 mg/kg in the Willoughby Bank reference and Atlantic Ocean reference samples, respectively. Cobalt concentrations ranged from 0.48 (BRC-11/12) to 6.9 mg/kg (BRC-04), and the cobalt concentrations in the Willoughby Bank reference and Atlantic Ocean reference samples were 3.4 and 2.9 mg/kg, respectively (Table 4-8).

Antimony concentrations were estimated below the laboratory RL in each of the JBLE Back River Channel samples as well as in each of the reference site samples (Table 4-8). Beryllium concentrations ranged from 0.049 (BRC-11/12) to 1 mg/kg (BRC-04) and the concentrations of beryllium in the Willoughby Bank reference and Atlantic Ocean reference samples were 0.21 and 0.13 mg/kg, respectively (Table 4-8). Selenium concentrations ranged from 0.065 (BRC-11/12) to 0.76 (BRC-04) mg/kg, and concentrations were estimated below the laboratory RL in each of the reference samples. Thallium concentrations ranged from 0.03 (BRC-11/12) to 0.2 (BRC-04) mg/kg and concentrations were estimated below the laboratory RL in each of the reference samples. Vanadium concentrations ranged from 3.2 (BRC-11/12) to 40 mg/kg (BRC-04 and -05) and concentrations in the Willoughby Bank reference site and Atlantic Ocean reference sites were 14 and 8.5 mg/kg, respectively (Table 4-8).

Metals Summary

Metal concentrations in sediments from the JBLE Back River Channel, Willoughby Bank reference site, and Atlantic Ocean reference site were compared to TEL/PEL values and Virginia Exclusion Criteria. None of the analyzed metals exceeded respective PEL concentrations or the Virginia Exclusion Criteria. Arsenic, nickel, and mercury were detected at concentrations between the TEL and PEL in one or more samples from the JBLE Back River Channel. The reference site samples frequently had lower metal concentrations than sediment from the JBLE Back River Channel samples and the metal concentrations did not exceed any TEL or PEL values.

4.2.4 Polycyclic Aromatic Hydrocarbons

Results of the PAH analyses are presented in Table 4-9. Of the 18 tested individual PAHs, 13 have TEL and PEL values. In addition to the individual PAHs, the total PAH concentration also has TEL/PEL values. Fifteen PAHs were detected in one or more of the sediment samples. The majority of detected concentrations were estimated below the laboratory RL. Although each concentration was estimated below the laboratory RL, the following PAHs had concentrations that were between the TEL and PEL: acenaphthene (the Atlantic Ocean reference site), acenaphthylene (BRC-03/04 and the Atlantic Ocean reference site), and dibenzo(a,h)anthracene (BRC-01, BRC-02, BRC-01/02, BRC-03, BRC-04, BRC-03/04, BRC-05, BRC-06, BRC-07, BRC-08, and BRC-07/08). None of the detected PAH concentrations exceeded the PEL values (Table 4-9).

Total PAH concentrations (ND=RL) in sediments from the JBLE Back River Channel ranged from 326 (BRC-02) to 635 (BRC-09-FD) micrograms per kilogram (µg/kg). None of the total PAH concentrations exceeded the TEL value. In the Willoughby Bank reference site and Atlantic Ocean reference site, none of the individual PAHs or total PAHs exceeded TEL or PEL values; total PAH concentrations (ND=RL) were 384 and 364 µg/kg, respectively.

4.2.5 Polychlorinated Biphenyl Congeners and Aroclors

Results of the PCB congener analyses are presented in Table 4-10. None of the 26 tested individual PCB congeners have TEL or PEL values; however there are TEL and PEL values for total PCB concentrations (Table 4-1).

Fifteen of the 26 tested PCB congeners were detected in one or more of the sediment samples collected from the JBLE Back River Channel and reference sites and the majority of concentrations were estimated below the laboratory RL. Total NOAA PCB concentrations (ND=RL) ranged from 18.6 (BRC-02) to 33.5 (BRC-09-FD) µg/kg, and, with the exception of BRC-02, each was between the TEL (21.6 µg/kg) and PEL (189 µg/kg). The total NOAA PCB concentration (ND=RL) in the Willoughby Bank reference site sample was 19.8 µg/kg and in the Atlantic Ocean reference site sample it was 25.9 µg/kg, slightly exceeding the TEL value. None of the total NOAA PCB concentrations (ND=RL) exceeded the PEL value (Table 4-10).

Total USEPA Region 4 PCB concentrations (ND=RL) ranged from 32.2 (BRC-02) to 51.3 (BRC-09-FD) µg/kg, and each sample was between the TEL (21.6 µg/kg) and PEL (189 µg/kg). The total USEPA Region 4 PCB concentration (ND=RL) in the Willoughby Bank reference site sample was 29.9 µg/kg and in the Atlantic Ocean reference site sample it was 36.2 µg/kg, both exceeding the TEL value. None of the total USEPA Region 4 PCB concentrations (ND=RL) exceeded the PEL value (Table 4-10).

Results of the PCB aroclor analyses are presented in Table 4-11. Only one aroclor was detected in one project sample. Aroclor 1254 was detected at a concentration estimated below the laboratory RL in BRC-10 (Table 4-11). None of the aroclor concentrations exceeded the Virginia Exclusion Criteria.

4.2.6 Dioxin and Furan Congeners

Results of the dioxin and furan congener analyses are provided in Table 4-12. There are no TEL or PEL values for dioxin and furan congeners. Sixteen of the 17 analyzed congeners were detected in one or more sediment samples. The most toxic dioxin congener, 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD), was detected in four samples (BRC-03/04, -09, -09-FD, and -09/10) at concentrations estimated below the laboratory RL. The detected concentrations of 2,3,7,8-TCDD did not exceed the Virginia Exclusion Criteria. In the JBLE Back River Channel sediments, dioxin TEQs (ND=RL) ranged from 0.7 (BRC-09-FD) to 16.5 nanograms per kilogram ([ng/kg], parts per trillion [pptr]) (BRC-01). The dioxin TEQ (ND=RL) values from the Willoughby Bank reference site and Atlantic Ocean reference site samples (2.4 and 1.5 ng/kg, respectively) were within the range of the JBLE Back River Channel dioxin TEQs.

4.2.7 Chlorinated and Organophosphorus Pesticides, and Semivolatile Organic Compounds

Results of the chlorinated pesticide analyses are presented in Table 4-13. Six of the 22 tested chlorinated pesticides have TEL and PEL values. The pesticides 2,4'-DDD, 2,4'-DDE, 2,4'-DDT,4'-DDD, 4,4'-DDE, and 4,4'-DDT were detected in at least one sediment sample and the Willoughby Bank reference site sample. Total DDT (ND=RL) concentrations ranged from 0.3 (BRC-01) to 10.3 µg/kg (BRC-09-FD) in the JBLE Back River Channel sediment samples and were 0.75 and 0.90 µg/kg in the Willoughby Bank reference site and Atlantic Ocean reference site samples, respectively. 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT concentrations exceeded respective TEL values in at least one sample, and the 4,4'-DDT concentration in BRC-09-FD exceeded the PEL (4.77 µg/kg). DDT was historically used as a pesticide, but the manufacture and use of DDT is now banned in the United States (ATSDR 2002). DDD and DDE are breakdown products of DDT (ATSDR 2002).

With the exception of chlordane, chlorobenside, heptachlor, and toxaphene, each of the analyzed chlorinated pesticides was detected in one or more sediment samples from the JBLE Back River Channel (Table 4-13). The majority of detected concentrations were estimated at concentrations below the laboratory RL. No pesticides were detected in the Atlantic Ocean reference site sediment, and five pesticides (including four from the DDT series) were detected in the Willoughby Bank reference site sediment. None of the chlorinated pesticide concentrations exceeded the Virginia Exclusion Criteria.

Results of the organophosphorus pesticide analyses are presented in Table 4-13. None of the seven organophosphorus pesticides were detected in sediments from the JBLE Back River Channel or the reference sites.

The results of the SVOC analyses are presented in Table 4-14. Of the 52 tested SVOCs, 1 (butyl benzyl phthalate) was detected in 11 samples at concentrations estimated below the laboratory RL in the JBLE Back River Channel sediment. It does not have a TEL or PEL value. None of the 52 SVOCs was detected in the Willoughby Bank reference or Atlantic Ocean reference sample.

4.2.8 Bulk Sediment Results – Additional Analyses for Upland Placement Options

None of the tested constituents (metals, PAHs, PCBs, pesticides, or SVOCs) exceeded the Virginia Exclusion Criteria (Tables 4-8, 4-9, 4-11, 4-13, and 4-14). Results of acid-base accounting (potential acidity minus neutralization potential) and soil suitability testing for the Weanack facility are provided in Table 4-15. The soil suitability testing indicted that the potential acidity in DU1 through DU4 ranged from 17.6 to 24.3 tons cce/kT, and the neutralization potential ranged from <2.6 to 19.7 tons cce/kT (Table 4-15). Based on these values, the acid-base accounting values in DU1 through DU4 ranged from 1.8 to >18.6 tons cce/kT in the discrete sediment samples from JBLE Back River Channel project (Table 4-15). These acid-base accounting values indicate the material is considered suitable for placement at the Weanack facility and could support agricultural growth as is, without the addition of any soil amendments. The soil suitability testing indicted that the potential acidity in DU5 and DU6 ranged from <0.05 to 1.54 tons cce/kT, and the neutralization potential ranged from 5.9 to 10.6 tons cce/kT (Table 4-15). Based on these values, the acid-base accounting values in DU5 and DU6 ranged from < -5.85 to -9.06 tons cce/kT in the discrete sediment samples from JBLE Back River Channel project (Table 4-15). These acid-base accounting values indicate that the material would require additional soil amendment (lime) to meet agricultural use requirements at the Weanack facility. Additional coordination with the Weanack facility would be required to determine material acceptability.

Additional analytical testing, including the paint filter test, EOX, BTEX, and TCLP (Tables 4-15 and 4-16) was conducted to evaluate the feasibility of other upland placement options. Results indicated that five samples passed through the paint filter (BRC-08 through -12 contained free liquid), that none of the samples were flammable, and that sediment pH was near neutral (ranging from 6.26 to 8.12). EOX was not detected, and BTEX constituents were either not detected or estimated below the laboratory RL. In addition, TPH-GRO were not detected, and TPH-DRO concentrations ranged from 9.6 (BRC-12) to 230 (BRC-04) mg/kg. There was method blank contamination from DU1, DU2, DU3, and DU4, however, the concentration in the method blank was estimated below the laboratory RL.

For TCLP, of the 38 chemical constituents tested, only 5— arsenic, barium, cadmium, lead, and selenium—were detected at low concentrations and were each estimated below the laboratory RL in the JBLE Back River Channel leachate (Table 4-16). The concentrations of the detected chemical constituents were compared to the limiting concentration of contaminants for toxicity characteristics (40 CFR 261.24). Concentrations of detected constituents were well below the toxicity characteristic criteria. The results also indicate that the materials were not corrosive or ignitable (Table 4-15). Therefore, the sediments from JBLE Back River Channel would not be considered a hazardous waste per USEPA criteria and would not require management in accordance with Virginia Hazardous Waste Management regulations (9VAC20-60).

With the exception of BRC-04, TPH concentrations were less than 50 mg/kg and BTEX was less than 10 mg/kg, indicating that the material may be used as fill material as per 9VAC20-81-660 specifications. Based on the TPH-DRO concentration, material from BRC-04 would not be suitable as fill material, but could be approved for permitted landfills equipped with liners and leachate collection systems.

4.3 SUMMARY OF RESULTS

The physical and chemical characteristics of twelve discrete sediment samples were determined to assess the quality of material proposed for ocean placement and placement at Port Tobacco at Weanack and other upland placement facilities, and characteristics of six DU composite samples were determined to assess the quality of the material proposed for ocean placement. Results indicated that:

- Three metals (arsenic, mercury, and nickel), three individual PAHs (acenaphthene, acenaphthylene, and naphthalene); total NOAA and USEPA Region 4 PCBs (ND=RL); and three chlorinated pesticides (4’4-DDD, 4’4-DDE, and 4’4-DDT) were detected in at least one sample at concentrations between the TEL and PEL. One sample, the field duplicate for BRC-09, had a 4’4-DDT concentration that exceeded the PEL.

- In the twelve discrete samples, concentrations of detected constituents did not exceed the Virginia Exclusion Criteria and were well below the TCLP screening values. In addition, the materials were not corrosive or ignitable. Therefore, the sediments from JBLE Back River Channel would not be considered characteristic of a hazardous waste per USEPA criteria and would not require management in accordance with Virginia Hazardous Waste Management regulations (9VAC20-60).

- With the exception of BRC-04, TPH concentrations were less than 50 mg/kg and BTEX was less than 10 mg/kg, indicating that the material may be used as fill material as per 9VAC20-81-660 specifications. Based on the TPH-DRO concentration, material from BRC-04 would not be suitable as fill material, but could be approved for permitted landfills equipped with liners and leachate collection systems.

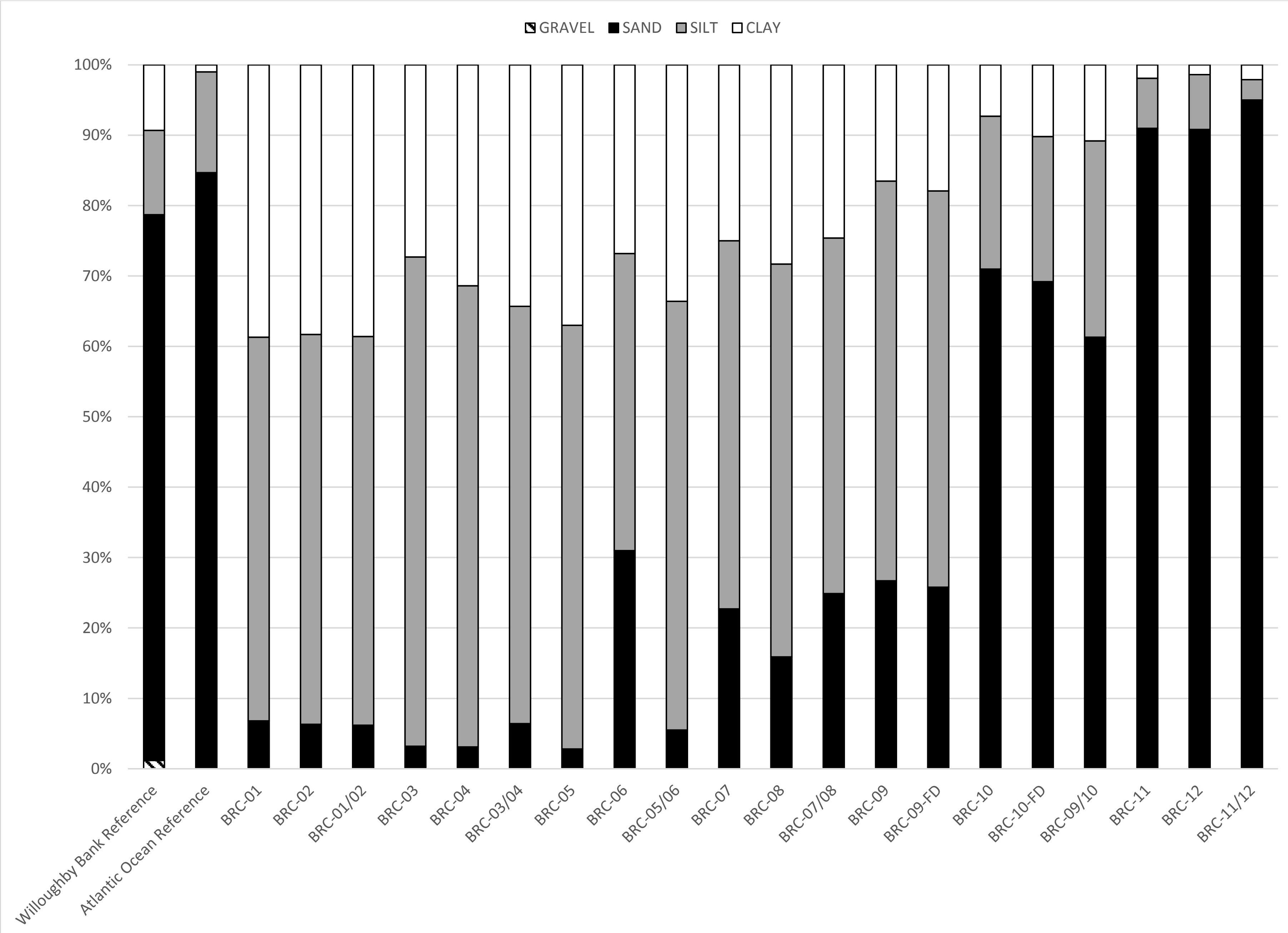

Figure 4.1. Grain size distribution for the JBLE Back River Channel sediment samples and reference sites.

TABLE 4-1. MARINE SEDIMENT QUALITY GUIDELINES (SQGs)
JBLE BACK RIVER CHANNEL, HAMPTON, VIRGINIA (DECEMBER 2015)

Chemical Name	Units	Threshold Effects Level (TEL)	Probable Effects Level (PEL)
METALS			
ARSENIC	MG/KG	7.24	41.6
CADMIUM	MG/KG	0.68	4.21
CHROMIUM	MG/KG	52.3	160
COPPER	MG/KG	18.7	108
LEAD	MG/KG	30.24	112
MERCURY	MG/KG	0.13	0.7
NICKEL	MG/KG	15.9	42.8
SILVER	MG/KG	0.73	1.77
ZINC	MG/KG	124	271
CHLORINATED PESTICIDES			
CHLORDANE	UG/KG	2.26	4.79
4,4-DDD	UG/KG	1.22	7.81
4,4-DDE	UG/KG	2.07	374
4,4-DDT	UG/KG	1.19	4.77
DIELDRIN	UG/KG	0.72	4.3
GAMMA-BHC	UG/KG	0.32	0.99
HEPTACHLOR EPOXIDE	UG/KG	--	2.74*
POLYCYCLIC AROMATIC HYDROCARBONS (PAHs)			
2-METHYLNAPHTHALENE	UG/KG	20.2	201
ACENAPHTHENE	UG/KG	6.71	88.9
ACENAPHTHYLENE	UG/KG	5.87	128
ANTHRACENE	UG/KG	46.9	245
BENZO(A)PYRENE	UG/KG	88.8	763
BENZO[A]ANTHRACENE	UG/KG	74.8	693
CHRYSENE	UG/KG	108	846
DIBENZ(A,H)ANTHRACENE	UG/KG	6.22	135
FLUORANTHENE	UG/KG	113	1,494
FLUORENE	UG/KG	21.2	144
NAPHTHALENE	UG/KG	34.6	391
PHENANTHRENE	UG/KG	86.7	544
PYRENE	UG/KG	153	1,398
PAHs, TOTAL	UG/KG	1,684	16,770
POLYCHLORINATED BIPHENYL (PCB) CONGENERS			
PCBs, TOTAL	UG/KG	21.6	189
SEMIVOLATILE ORGANIC COMPOUNDS			
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG	182	2,647

Source : MacDonald et al. 1996. Ecotoxicology 5: 253-278.

**Source* : CCME 2001. Canadian Sediment Quality Guidelines for the Protection of Aquatic Life.

TABLE 4-2. TCLP REGULATORY GUIDELINES
JBLE BACK RIVER CHANNEL, HAMPTON, VIRGINIA (DECEMBER 2015)

(Maximum Concentration of Contaminants for Toxicity Characteristics)

CHEMICAL NAME	REGULATORY LEVEL (MG/L)
METALS	
ARSENIC	5
BARIUM	100
CADMIUM	1
CHROMIUM	5
LEAD	5
MERCURY	0.2
SELENIUM	1
SILVER	5
PESTICIDES AND HERBICIDES	
2, 4, 5-TP (SILVEX)	1
2, 4-D	10
CHLORDANE	0.03
ENDRIN	0.02
HEPTACHLOR (AND ITS EPOXIDE)	0.008
GAMMA-BHC	0.4
METHOXYCHLOR	10
TOXAPHENE	0.5
SEMIVOLATILE ORGANIC COMPOUNDS (SVOCs)	
o-CRESOL*	200
m-CRESOL*	200
p-CRESOL*	200
CRESOL	200
1, 4 DICHLOROBENZENE	7.5
2,4 DINITROTOLUENE	0.13
HEXACHLOROBENZENE	0.13
HEXACHLOROBUTADIENE	0.5
HEXACHLOROETHANE	3
NITROBENZENE	2
PENTACHLOROPHENOL	100

TABLE 4-2. (continued)

2, 4, 5-TRICHOROPHENOL	400
2, 4, 6-TRICHOROPHENOL	2
PYRIDINE	5
VOLATILE ORGANIC COMPOUNDS (VOCs)	
BENZENE	0.5
CARBON TETRACHLORIDE	0.5
CHLOROBENZENE	100
CHLOROFORM	6
1, 2 DICHOROETHANE	0.5
1, 1 DICHLOROETHYLENE	0.7
2-BUTANONE	200
TETRACHLOROETHYLENE	0.7
TRICHLOROETHYLENE	0.5
VINYL CHLORIDE	0.2

*If o-, m-, p-Cresol concentration cannot be differentiated, the total cresol concentration is used. The regulatory level of total cresol is 200 mg/L.
Source: 40 CFR 261.24 (1993)

TABLE 4-3. INORGANIC DATA QUALIFIERS

C ***<u>(Concentration) qualifiers:</u>***

- **J** Estimated result; reported value is less than the project-specified Reporting Limit (RL), but greater than the method-specified Instrument Detection Limit (IDL) or Method Detection Limit (MDL).
- **U** Analyte analyzed for but not detected (concentration is less than the method-specified Instrument Detection Limit (IDL) or MDL.

Q ***<u>(Quality control) qualifiers:</u>***

- **E** Matrix interference; the serial dilution was outside of the percent difference control limits.
- **B** Method blank contamination. This qualifier is used when the analyte is found in the associated method blank as well as in the sample. It indicates possible/probable blank contamination. For Gas Chromatography/ Mass Spectrometry (GC/MS) analyses, this qualifier is used for a Tentatively Identified Compound (TIC), as well as, for a positively identified target compound.
- **M** Duplicate injection precision not met.
- **N** Spiked sample recovery is not within control limits.
- **S** Reported value is determined by the method of standard additions (MSA).
- **W** Postdigestion spike for furnace Atomic Absorption Spectrophotometric (AAS) AAS analysis is out of control limits (85-115%) and sample absorbance is less than 50% of spike absorbance.
- ***** Duplicate analyses and/or relative percent difference (RPD) is not within control limits.
- **+** Correlation coefficient for MSA is less than 0.995.

TABLE 4-4. ORGANIC DATA QUALIFIERS

C ***(Concentration) qualifiers:***

COL There was more than 40% difference between initial and confirmation results. The lower result was reported. (PCBs only)

EST PCB congeners flagged with "EST" indicate that the value is estimated because of coelution with another PCB congener

G Elevated reporting limit, reporting limit elevated because of matrix interference.

I Matrix interference

J Estimated result; reported value is less than the project-specified Reporting Limit (RL), but greater than the method-specified Instrument Detection Limit (IDL) or Method Detection Limit (MDL).

P Compound was detected, but the percent difference between the original and confirmation analyses between the two GC columns is greater than 40%. The highest value is presented

Q Compound was detected, but as an estimated maximum possible concentration (EMPC).

U Analyte analyzed but not detected (concentration is less than the method-specified Instrument Detection Limit (IDL) or MDL.

Q ***(Quality control) qualifiers:***

A Tentatively identified compound is a suspected aldol condensation

B Method blank contamination. This qualifier is used when the analyte is found in the associated method blank as well as in the sample. It indicates possible/probable blank contamination

D Compound analyzed at a secondary dilution factor

E Compound was over the calibration range

M Duplicate injection precision not met.

N Identification of tentatively identified compound is based on a mass spectral library search

***** Duplicate analysis is not within control limits.

+ Correlation coefficient for MSA is less than 0.995.

TABLE 4-5. DIOXIN AND FURAN DATA QUALIFIERS

B	The analyte is reported in the associated method blank at a reportable level
C	"Coeluting Isomer" – The isomer is known to coelute with another member of its homologue group, or the peak shape is shouldered, indicating the likelihood of a coeluting isomer.
E	The amount reported is above the upper calibration limit in the method, therefore the reported result is an estimate
J	The amount reported is below the lowest calibration standard, therefore the reported result is an estimate
Q	Reported value is estimated maximum possible concentration. This qualifier is used when chromatographic data does not meet all positive identification criteria, such as ion ratios, retention time, co-maximization criteria and polychlorinated dibenzofuran purity.
S	"Ion suppression event" – Signal is deflected when analyte is measured, possibly because of matrix-borne interference.
U	Compound was analyzed, but not detected.
X	Other. See explanation for specific definition.

TABLE 4-6. GRAIN SIZE RESULTS FOR SEDIMENT

JBLE BACK RIVER CHANNEL, HAMPTON, VIRGINIA (DECEMBER 2015)

		Reference Sites		Dredging Unit 1			Dredging Unit 2			Dredging Unit 3			Dredging Unit 4			Dredging Unit 5					Dredging Unit 6		
	UNITS	Willoughby Bank Reference	Atlantic Ocean Reference	BRC-01	BRC-02	BRC-01/02	BRC-03	BRC-04	BRC-03/04	BRC-05	BRC-06	BRC-05/06	BRC-07	BRC-08	BRC-07/08	BRC-09	BRC-09-FD	BRC-10	BRC-10-FD	BRC-09/10	BRC-11	BRC-12	BRC-11/12
GRAVEL	%	1.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SAND	%	77.5	84.7	6.8	6.3	6.2	3.2	3.1	6.4	2.8	31	5.5	22.7	15.9	24.9	26.7	25.8	71	69.2	61.3	91	90.9	95
Coarse Sand	%	2.1	0.1	0	0	0.8	0	0	1.4	0	0	0	1.8	0	1.7	0	0	0	0	0	0	0	0
Medium Sand	%	11.7	0.1	0.3	0.2	0.1	0.6	0.9	0.8	0	0.4	0	0.7	0	0.5	0.4	0.6	0	0	0.2	0.1	0.1	0
Fine Sand	%	63.7	84.5	6.5	6.1	5.3	2.6	2.2	4.2	2.8	30.6	5.5	20.2	15.9	22.7	26.3	25.2	71	69.2	61.1	90.9	90.8	95
SILT	%	12	14.3	54.5	55.4	55.2	69.5	65.5	59.3	60.2	42.2	60.9	52.3	55.8	50.5	56.8	56.3	21.7	20.6	27.9	7.1	7.8	2.9
CLAY	%	9.3	1	38.7	38.3	38.6	27.3	31.4	34.3	37	26.8	33.6	25	28.3	24.6	16.5	17.9	7.3	10.2	10.8	1.9	1.4	2.1
SILT+CLAY	%	21.3	15.3	93.2	93.7	93.8	96.8	96.9	93.6	97.2	69	94.5	77.3	84.1	75.1	73.3	74.2	29	30.8	38.7	9	9.2	5
USCS SYMBOL	--	SM	SM	CH	CH	CH	CH	CH	CH	CH	CH	CH	CH	CH	CH	CH	CH	SM	SM	SC	SP-SM	SP-SM	SP-SM
USCS CLASSIFICATION	--	SI-SAND	SI-SAND	FAT-CLAY	FAT-CLAY	FAT-CLAY	FAT-CLAY	FAT-CLAY	FAT-CLAY	FAT-CLAY	SN-FAT-CLAY	FAT-CLAY	FAT-CLAY-W-SAND	FAT-CLAY-W-SAND	FAT-CLAY-W-SAND	FAT-CLAY-W-SAND	FAT-CLAY-W-SAND	SI-SAND	SI-SAND	CL-SAND	PG-SAND-W-SILT	PG-SAND-W-SILT	PG-SAND-W-SILT
LIQUID LIMIT	%	0	0	84	64	64	92	97	85	78	66	86	57	68	64	80	77	28	0	36	0	0	0
PLASTIC LIMIT	%	0	0	31	25	25	32	32	30	29	24	31	22	25	25	28	28	27	0	25	0	0	0
PLASTICITY INDEX	%	--	--	52	39	39	60	65	56	49	42	55	35	43	39	52	49	1	--	11	--	--	--
PERCENT MOISTURE	%	28	32	50.1	43.7	46.7	54.8	55.3	53.6	58	41.2	54.1	47.4	47.5	47.6	56.5	55.3	32.3	33.7	41.5	29.5	29.2	29

CL = Clayey
PG = Poorly Graded
SI = Silty
SN=Sandy
W = With

TABLE 4-7. GENERAL CHEMISTY RESULTS FOR SEDIMENT
JBLE BACK RIVER CHANNEL, HAMPTON, VIRGINIA (DECEMBER 2015)

ANALYTE	UNITS	Average RL	Reference Sites		Dredging Unit 1			Dredging Unit 2			Dredging Unit 3		
			Willoughby Bank Reference	Atlantic Ocean Reference	BRC-01	BRC-02	BRC-01/02	BRC-03	BRC-04	BRC-03/04	BRC-05	BRC-06	BRC-05/06
AMMONIA AS NITROGEN	MG/KG	9.45	6.7 U	7.4 U	**110**	**42**	**69**	**160**	**190**	**170**	**200**	**81**	**160**
NITRATE-NITRITE	MG/KG	1.90	**0.97 J**	**0.46 J**	**1.1 J**	**1.5 J**	**1.1 J**	**0.34 J**	**0.64 J**	**0.58 J**	**0.58 J**	**0.65 J**	**0.43 J**
TOTAL KJELDAHL NITROGEN	MG/KG	275	**470 B**	**260 B**	**1500 B**	**1600 B**	**1700 B**	**1900 B**	**1600 B**	**1800 B**	**1500 B**	**1800 B**	**2100 B**
TOTAL ORGANIC CARBON	%	0.19	**0.52**	**0.11 J**	**1.9**	**1.4**	**1.5**	**2.2**	**2.5**	**2.3**	**3.3**	**1.8**	**2.2**
TOTAL PHOSPHORUS	MG/KG	87.1	**250**	**420**	**350**	**310**	**340**	**480**	**360**	**390**	**560**	**360**	**480**
TOTAL SULFIDE	MG/KG	57.2	**30 J**	**29 J**	**65**	**26 J**	**70**	**670**	**890**	**530**	**410**	**300**	**1100**
TOTAL CYANIDE	MG/KG	0.468	**0.051 J**	0.35 U	**0.11 J**	0.43 U	**0.11 J**	**0.092 J**	0.6 U	0.54 U	**0.088 J**	**0.084 J**	0.56 U

ANALYTE	Dredging Unit 4			Dredging Unit 5					Dredging Unit 6		
	BRC-07	BRC-08	BRC-07/08	BRC-09	BRC-09-FD	BRC-10	BRC-10-FD	BRC-09/10	BRC-11	BRC-12	BRC-11/12
AMMONIA AS NITROGEN	**74**	**84**	**92**	**40**	**42**	**6.2 J**	**6.9 J**	**45**	**13**	7.2 U	**8.8**
NITRATE-NITRITE	**0.9 J**	**0.52 J**	**0.82 J**	**1.2 J**	**1.3 J**	**1.3 J**	**1.4 J**	**1.9 J**	**0.45 J**	**0.79 J**	**0.75 J**
TOTAL KJELDAHL NITROGEN	**1400 B**	**1200 B**	**1100 B**	**1700 B**	**1600 B**	**560 B**	**680 B**	**1000 B**	**280 B**	**260 B**	**280 B**
TOTAL ORGANIC CARBON	**1.7**	**1.5**	**1.6**	**2.6**	**2.2**	**0.88**	**0.74**	**1.5**	**0.28**	**0.26**	**0.27**
TOTAL PHOSPHORUS	**350**	**340**	**360**	**370**	**370**	**110**	**110**	**180**	**58**	**75**	**57**
TOTAL SULFIDE	**610**	**600**	**390**	**550**	**81**	**62**	**91**	**400**	39 U	43 U	39 U
TOTAL CYANIDE	**0.095 J**	**0.089 J**	0.47 U	0.6 U	**0.18 J**	0.38 U	0.38 U	0.5 U	**0.055 J**	**0.082 J**	0.32 U

There are no sediment quality guidelines for the general chemistry parameters

NOTES: Bold values represent detected concentrations

RL is reported for non-detected constituents

RL = average reporting limit

B = compound was detected in the laboratory method blank

J = compound was detected, but below the reporting limit (value is estimated)

U = compound was analyzed, but not detected

TABLE 4-8. METAL (MG/KG), BUTYLTIN (UG/KG), AND AVS/SEM IN SEDIMENT
JBLE BACK RIVER CHANNEL, HAMPTON, VIRGINIA (DECEMBER 2015)

ANALYTE	UNITS	Average RL	TEL*	PEL*	VA Exclusion Criteria**	Reference Sites		Dredging Unit 1			Dredging Unit 2		
						Willoughby Bank Reference	Atlantic Ocean Reference	BRC-01	BRC-02	BRC-01/02	BRC-03	BRC-04	BRC-03/04
ALUMINUM	MG/KG	2.78	NSL	NSL	NSL	**3800**	**2600**	**14000**	**15000**	**16000**	**16000**	**19000**	**17000**
ANTIMONY	MG/KG	0.19	NSL	NSL	410	**0.037 J**	**0.017 J**	**0.082 J**	**0.098 J**	**0.099 J**	**0.12 J**	**0.13 J**	**0.11 J**
ARSENIC	MG/KG	0.09	7.24	41.6	41	**3.4**	**2.2**	**8.2**	**9.4**	**8.8**	**8.8**	**11**	**8.8**
BARIUM	MG/KG	0.93	NSL	NSL	19,000	**8.7**	**4**	**24**	**26**	**29**	**33**	**36**	**33**
BERYLLIUM	MG/KG	0.09	NSL	NSL	2,000	**0.21**	**0.13**	**0.79**	**0.8**	**0.91**	**0.87**	**1**	**0.9**
CADMIUM	MG/KG	0.09	0.676	4.210	810	**0.06 J**	**0.019 J**	**0.18**	**0.22**	**0.23**	**0.34**	**0.31**	**0.28**
CALCIUM	MG/KG	46.57	NSL	NSL	NSL	**3100**	**6800**	**2000**	**4200**	**2000**	**2300**	**2300**	**2800**
CHROMIUM	MG/KG	0.19	52.3	160.4	1,200	**11 B**	**8.5 B**	**28 B**	**31 B**	**33 B**	**37 B**	**38 B**	**36 B**
COBALT	MG/KG	0.05	NSL	NSL	300	**3.4**	**2.9**	**5.4**	**6**	**6**	**5.7**	**6.9**	**6**
COPPER	MG/KG	0.19	18.7	108	4,300	**4.3**	**1.6**	**9.5**	**11**	**12**	**18**	**17**	**15**
IRON	MG/KG	4.66	NSL	NSL	150,000	**10000**	**6800**	**20000**	**20000**	**22000**	**21000**	**24000**	**22000**
LEAD	MG/KG	0.09	30.24	112	800	**5.6**	**2.3**	**16**	**19**	**20**	**28**	**26**	**23**
MAGNESIUM	MG/KG	46.57	NSL	NSL	NSL	**2300**	**3000**	**4800**	**5400**	**5700**	**5600**	**6500**	**5700**
MANGANESE	MG/KG	0.47	NSL	NSL	NSL	**94**	**87**	**120**	**140**	**140**	**160**	**160**	**150**
MERCURY	MG/KG	0.03	0.1	1	100	**0.039**	0.021 U	**0.04**	**0.061**	**0.049**	**0.081**	**0.14**	**0.061**
NICKEL	MG/KG	0.09	15.9	42.8	1,000	**6.3**	**5.1**	**13**	**14**	**15**	**14**	**17**	**15**
POTASSIUM	MG/KG	46.57	NSL	NSL	NSL	**880**	**590**	**2600**	**3000**	**3100**	**3000**	**3600**	**3200**
SELENIUM	MG/KG	0.47	NSL	NSL	5,100	**0.19 J**	**0.15 J**	**0.51**	**0.57**	**0.59**	**0.68**	**0.76**	**0.63**
SILVER	MG/KG	0.09	0.73	1.77	5,100	**0.035 J**	**0.012 J**	**0.19**	**0.36**	**0.44**	**0.5**	**0.43**	**0.41**
THALLIUM	MG/KG	0.09	NSL	NSL	10	**0.048 J**	**0.058 J**	**0.15 B**	**0.16 B**	**0.17 B**	**0.18 B**	**0.2 B**	**0.18 B**
VANADIUM	MG/KG	0.09	NSL	NSL	5,200	**14**	**8.5**	**29**	**33**	**35**	**39**	**40**	**37**
ZINC	MG/KG	0.47	124	271	7,500	**32**	**20**	**49**	**59**	**61**	**93**	**87**	**81**
SEM/AVS	NA	NA	NSL	NSL	NSL	**NC**	**0.31**	**2.50**	**1.40**	**1.20**	**0.15**	**0.26**	**0.16**
BUTYLTINS													
MONOBUTYLTIN	UG/KG	38.91	NSL	NSL	NSL	28 U	29 U	38 U	36 U	41 U	47 U	50 U	46 U
DIBUTYLTIN	UG/KG	2.45	NSL	NSL	NSL	1.7 U	1.8 U	2.4 U	2.3 U	2.6 U	3 U	3.1 U	2.9 U
TRIBUTYLTIN	UG/KG	2.81	NSL	NSL	NSL	2 U	2.1 U	2.7 U	2.6 U	2.9 U	3.4 U	3.6 U	3.3 U
TETRABUTYLTIN	UG/KG	3.20	NSL	NSL	NSL	2.3 U	2.4 U	3.1 U	3 U	3.3 U	3.9 U	4.1 U	3.8 U

ANALYTE	Dredging Unit 3			Dredging Unit 4			Dredging Unit 5					Dredging Unit 6		
	BRC-05	BRC-06	BRC-05/06	BRC-07	BRC-08	BRC-07/08	BRC-09	BRC-09-FD	BRC-10	BRC-10-FD	BRC-09/10	BRC-11	BRC-12	BRC-11/12
ALUMINUM	**18000**	**12000**	**16000**	**13000**	**13000**	**13000**	**11000**	**9300**	**3900**	**3700**	**7000**	**1200**	**1000**	**950**
ANTIMONY	**0.12 J**	**0.057 J**	**0.099 J**	**0.1 J**	**0.093 J**	**0.098 J**	**0.057 J**	**0.04 J**	**0.032 J**	**0.038 J**	**0.034 J**	**0.012 J**	**0.015 J**	**0.01 J**
ARSENIC	**9.9**	**7.2**	**8.4**	**8.1**	**7.2**	**6.9**	**6.4**	**5.7**	**2.6**	**2.5**	**4.2**	**0.86**	**0.88**	**0.76**
BARIUM	**37**	**21**	**33**	**28**	**29**	**27**	**29**	**25**	**10**	**9.7**	**18**	**3.4**	**3.2**	**2.7**
BERYLLIUM	**0.92**	**0.68**	**0.83**	**0.65**	**0.67**	**0.62**	**0.54**	**0.48**	**0.22**	**0.18**	**0.34**	**0.065**	**0.052 J**	**0.049 J**
CADMIUM	**0.31**	**0.08 J**	**0.29**	**0.21**	**0.25**	**0.22**	**0.2**	**0.19**	**0.11**	**0.11**	**0.15**	**0.036 J**	**0.028 J**	**0.031 J**
CALCIUM	**2200**	**1500**	**2300**	**2700**	**9600**	**1900**	**1800**	**1600**	**590**	**510**	**1200**	**350**	**250**	**340**
CHROMIUM	**37 B**	**24 B**	**33 B**	**28 B**	**27 B**	**26 B**	**27 B**	**22 B**	**11 B**	**10 B**	**19 B**	**4.2 B**	**3.7 B**	**3.3 B**
COBALT	**6.4**	**5.3**	**5.4**	**4.3**	**4.5**	**4.2**	**4.4**	**3.8**	**1.8**	**1.7**	**2.9**	**0.59**	**0.56**	**0.48**
COPPER	**17**	**6.7**	**15**	**11**	**12**	**11**	**13**	**11**	**4.8**	**6.6**	**7.8**	**1.2**	**1**	**0.97**
IRON	**23000**	**17000**	**20000**	**17000**	**17000**	**16000**	**17000**	**14000**	**6300**	**5800**	**11000**	**1800**	**1800**	**1500**
LEAD	**26**	**10**	**22**	**16**	**16**	**16**	**13**	**12**	**5.7**	**5.1**	**8.7**	**2**	**1.8**	**1.6**
MAGNESIUM	**6100**	**4900**	**5400**	**4000**	**4700**	**4200**	**3900**	**3500**	**1500**	**1400**	**2500**	**560**	**550**	**480**
MANGANESE	**150**	**110**	**140**	**110**	**130**	**110**	**110**	**93**	**36**	**32**	**69**	**13**	**14**	**12**
MERCURY	**0.094**	**0.065**	**0.063**	**0.054**	**0.053**	**0.05**	**0.058**	**0.045**	**0.029**	**0.033**	**0.039**	0.02 U	0.022 U	0.021 U
NICKEL	**16**	**12**	**13**	**11**	**11**	**11**	**12**	**10**	**4.6**	**4.7**	**8.3**	**1.5**	**1.2**	**1.1**
POTASSIUM	**3400**	**2700**	**3100**	**2300**	**2500**	**2400**	**2200**	**1900**	**870**	**800**	**1400**	**320**	**300**	**270**
SELENIUM	**0.75**	**0.36 J**	**0.66**	**0.5**	**0.57**	**0.53**	**0.53 J**	**0.48 J**	**0.21 J**	**0.21 J**	**0.34 J**	**0.072 J**	**0.077 J**	**0.065 J**
SILVER	**0.41**	**0.077 J**	**0.33**	**0.21**	**0.22**	**0.22**	**0.15**	**0.14**	**0.063 J**	**0.058 J**	**0.1**	**0.015 J**	**0.011 J**	**0.012 J**
THALLIUM	**0.19 B**	**0.12 B**	**0.18 B**	**0.15 B**	**0.16 B**	**0.15 B**	**0.13**	**0.12**	**0.065 J**	**0.063 J**	**0.096 J**	**0.034 J**	**0.036 J**	**0.03 J**
VANADIUM	**40**	**24**	**35**	**31**	**29**	**28**	**28**	**24**	**11**	**10**	**18**	**3.7**	**3.8**	**3.2**
ZINC	**89**	**41**	**79**	**59**	**60**	**56**	**61**	**53**	**28**	**26**	**40**	**7.7**	**6.6**	**5.9**
SEM/AVS	**0.13**	**0.17**	**0.13**	**0.09**	**0.70**	**0.18**	**0.04**	**0.06**	**2.30**	**0.16**	**0.31**	**1.10**	**NC**	**0.56**
BUTYLTINS														
MONOBUTYLTIN	49 U	42 U	47 U	41 U	42 U	40 U	48 U	47 U	31 U	30 U	41 U	27 U	29 U	27 U
DIBUTYLTIN	3.1 U	2.6 U	2.9 U	2.6 U	2.7 U	2.5 U	3 U	2.9 U	2 U	1.9 U	2.6 U	1.7 U	1.8 U	1.7 U
TRIBUTYLTIN	3.6 U	3 U	3.4 U	3 U	3.1 U	2.9 U	3.5 U	3.4 U	2.3 U	2.2 U	2.9 U	2 U	2.1 U	1.9 U
TETRABUTYLTIN	4.1 U	3.4 U	3.8 U	3.4 U	3.5 U	3.3 U	3.9 U	3.8 U	2.6 U	2.5 U	3.3 U	2.2 U	2.4 U	2.2 U

**Source*: MacDonald et al. 1996. *Ecotoxicology* 5: 253-278.

**Proposed Virginia exclusion criteria for placement of dredged material at Weanack.

NOTES: Bold values represent detected concentrations. Shaded concentrations exceed sediment quality guidelines.

RL is reported for non-detected metals and butyltins.

RL = average method detection limit

TEL = threshold effects level

PEL = probable effects level

NA = no value available

NC = Not calculated because AVS not detected

NSL = no screening level

B = compound was detected in the laboratory method blank

J = compound was detected, but below the reporting limit (value is estimated)

U = compound was analyzed, but not detected

exceeds TEL value

exceeds PEL value

TABLE 4-9. PAH CONCENTRATIONS (UG/KG) IN SEDIMENT
JBLE BACK RIVER CHANNEL, HAMPTON, VIRGINIA (DECEMBER 2015)

						Reference Sites		Dredging Unit 1			Dredging Unit 2			Dredging Unit 3			Dredging Unit 4			Dredging Unit 5					Dredging Unit 6		
ANALYTE	UNITS	Average RL	TEL*	PEL*	VA Exclusion Criteria**	Willoughby Bank Reference	Atlantic Ocean Reference	BRC-01	BRC-02	BRC-01/02	BRC-03	BRC-04	BRC-03/04	BRC-05	BRC-06	BRC-05/06	BRC-07	BRC-08	BRC-07/08	BRC-09	BRC-09-FD	BRC-10	BRC-10-FD	BRC-09/10	BRC-11	BRC-12	BRC-11/12
LOW MOLECULAR WEIGHT PAHs (LPAHs)																											
1-METHYLNAPHTHALENE	UG/KG	41.8	NSL	NSL	NA	23 U	24 U	31 U	30 U	33 U	38 U	42 U	37 U	41 U	34 U	38 U	34 U	35 U	33 U	40 U	38 U	26 U	25 U	33 U	22 U	24 U	22 U
2-METHYLNAPHTHALENE	UG/KG	41.8	20.2	201	4,100,000	23 U	24 U	31 U	30 U	33 U	38 U	42 U	37 U	41 U	34 U	38 U	34 U	35 U	33 U	40 U	38 U	26 U	25 U	33 U	22 U	24 U	22 U
ACENAPHTHENE	UG/KG	41.8	6.71	88.9	33,000,000	23 U	**7.2 J**	31 U	30 U	33 U	38 U	42 U	37 U	41 U	34 U	38 U	34 U	35 U	33 U	40 U	38 U	26 U	25 U	33 U	22 U	24 U	22 U
ACENAPHTHYLENE	UG/KG	41.8	5.87	128	NA	23 U	**14 J**	**4.3 J**	30 U	**4 J**	**4.6 J**	42 U	**5.9 J**	**5.2 J**	34 U	**4.3 J**	34 U	35 U	**3.7 J**	40 U	38 U	26 U	25 U	33 U	22 U	24 U	22 U
ANTHRACENE	UG/KG	41.8	46.9	245	170,000,000	23 U	**11 J**	**6.3 J**	**4.2 J**	**5.5 J**	**6.8 J**	**6.3 J**	**7.6 J**	**6.8 J**	**4.9 J**	**5.6 J**	**3.7 J**	**6.1 J**	**4.7 J**	40 U	38 U	26 U	25 U	33 U	22 U	24 U	22 U
FLUORENE	UG/KG	41.8	21.2	144	22,000,000	23 U	24 U	31 U	30 U	33 U	38 U	42 U	37 U	41 U	34 U	38 U	34 U	35 U	33 U	40 U	38 U	26 U	25 U	33 U	22 U	24 U	22 U
NAPHTHALENE	UG/KG	41.8	34.6	391	230,000	23 U	24 U	**5.7 J**	**3.9 J**	**4.8 J**	**5.9 J**	**6 J**	**6.2 J**	**6 J**	**4.2 J**	38 U	**4 J**	**5.7 J**	**4.8 J**	40 U	38 U	26 U	25 U	33 U	22 U	24 U	22 U
PHENANTHRENE	UG/KG	41.8	86.7	544	NA	**11 J**	**12 J**	**18 J**	**12 J**	**16 J**	**18 J**	**21 J**	**21 J**	**20 J**	**14 J**	**18 J**	**11 J**	**19 J**	**15 J**	**9.4 J**	38 U	26 U	25 U	33 U	22 U	24 U	22 U
HIGH MOLECULAR WEIGHT PAHs (HPAHs)																											
BENZO(A)ANTHRACENE	UG/KG	41.8	74.8	693	2,100	23 U	24 U	**22 J B**	**13 J B**	**19 J B**	**27 J B**	**29 J B**	**27 J B**	**27 J B**	**16 J B**	**24 J B**	**14 J B**	**24 J B**	**19 J B**	**18 J**	38 U	**11 J**	25 U	33 U	22 U	24 U	22 U
BENZO(A)PYRENE	UG/KG	41.8	88.8	763	660	23 U	24 U	**21 J**	**10 J**	**19 J**	**30 J**	**29 J**	**33 J**	**27 J**	**19 J**	**24 J**	**14 J**	**26 J**	**20 J**	**22 J**	38 U	26 U	25 U	33 U	22 U	24 U	22 U
BENZO(B)FLUORANTHENE	UG/KG	41.8	NSL	NSL	2,100	23 U	24 U	**44 B**	**28 J B**	**41 B**	**61 B**	**61 B**	**61 B**	**56 B**	**41 B**	**55 B**	**32 J B**	**49 B**	**46 B**	**34 J**	38 U	**12 J**	25 U	**10 J**	22 U	24 U	22 U
BENZO(GHI)PERYLENE	UG/KG	41.8	NSL	NSL		23 U	24 U	**17 J**	**8.5 J**	**17 J**	**25 J**	**25 J**	**29 J**	**22 J**	**15 J**	**24 J**	**13 J**	**22 J**	**16 J**	**24 J**	38 U	26 U	25 U	33 U	22 U	24 U	22 U
BENZO(K)FLUORANTHENE	UG/KG	41.8	NSL	NSL	21,000	23 U	24 U	**15 J**	**8.5 J**	**11 J**	**18 J**	**18 J**	**25 J**	**17 J**	**8.9 J**	**10 J**	**10 J**	**18 J**	**8.4 J**	**12 J**	38 U	26 U	25 U	33 U	22 U	24 U	22 U
CHRYSENE	UG/KG	41.8	108	846	210,000	23 U	24 U	**27 J B**	**16 J B**	**22 J B**	**37 J B**	**37 J B**	**38 B**	**30 J B**	**21 J B**	**29 J B**	**16 J B**	**29 J B**	**24 J B**	**22 J**	38 U	**12 J**	25 U	33 U	22 U	24 U	22 U
DIBENZO(A,H)ANTHRACENE	UG/KG	41.8	6.22	135	660	23 U	24 U	**12 J**	**10 J**	**12 J**	**14 J**	**16 J**	**16 J**	**14 J**	**13 J**	38 U	**11 J**	**13 J**	**13 J**	40 U	38 U	26 U	25 U	33 U	22 U	24 U	22 U
FLUORANTHENE	UG/KG	41.8	113	1,494	22,000,000	**17 J**	**21 J**	**45 B**	**20 J B**	**33 B**	**50 B**	**52 B**	**55 B**	**47 B**	**32 J B**	**41 B**	**23 J B**	**49 B**	**31 J B**	**43**	**15 J**	**17 J**	**9.4 J**	**11 J**	**6.7 J**	24 U	22 U
INDENO(1,2,3-CD)PYRENE	UG/KG	41.8	NSL	NSL	22,000,000	23 U	24 U	**25 J**	**17 J**	**22 J**	**31 J**	**32 J**	**34 J**	**32 J**	**23 J**	**30 J**	**21 J**	**27 J**	**24 J**	**18 J**	38 U	26 U	25 U	33 U	22 U	24 U	22 U
PYRENE	UG/KG	41.8	153	1,398	17,000,000	**11 J**	**11 J**	**42**	**25 J**	**38**	**51**	**53**	**56**	**47**	**33 J**	**44**	**26 J**	**51**	**39**	**34 J**	**12 J**	**16 J**	**11 J**	**12 J**	**8.2 J**	24 U	22 U
TOTAL PAHs																											
TOTAL PAHs (ND=0)	UG/KG	NA	1,684	16,770	NA	**39.0**	**76**	**304.3**	**176**	**264**	**379.3**	**385**	**415**	**357**	**245.0**	**309**	**199**	**338.8**	**269**	**236.4**	**27.0**	**68.0**	**20.4**	**33**	**14.9**	**0.0**	**0.0**
TOTAL PAHs (ND=1/2RL)	UG/KG	NA	1,684	16,770	NA	**211.5**	**220**	**366.3**	**251**	**330**	**455.3**	**490**	**489**	**439**	**330.0**	**423**	**284**	**426.3**	**335**	**396.4**	**331.0**	**237.0**	**220.4**	**281**	**190.9**	**216.0**	**198.0**
TOTAL PAHs (ND=RL)	UG/KG	NA	1,684	16,770	NA	**384.0**	**364**	**428**	**326**	**396**	**531.3**	**595**	**563**	**521**	**415.0**	**537**	**369**	**513.8**	**401**	**556.4**	**635.0**	**406.0**	**420.4**	**528**	**366.9**	**432.0**	**396.0**

**Source*: MacDonald et al. 1996. *Ecotoxicology* 5: 253-278.

** Proposed Virginia exclusion criteria for placement of dredged material at Weanack.

NOTES: Bold values represent detected concentrations. Shaded concentrations exceed sediment quality guidelines.

RL is reported for non-detected constituents.

RL = reporting limit

TEL = threshold effects level

PEL = probable effects level

NA = no value available

NSL = no screening level

LPAH = low molecular weight PAHs

HPAH = high molecular weight PAHs

B = compound was detected in the laboratory method blank

J = compound was detected, but below the reporting limit (value is estimated)

U = compound was analyzed, but not detected

exceeds TEL value

exceeds PEL value

TABLE 4-10. PCB CONGENER CONCENTRATIONS (UG/KG) IN SEDIMENT

JBLE BACK RIVER CHANNEL, HAMPTON, VIRGINIA (DECEMBER 2015)

ANALYTE	UNITS	Average RL	TEL***	PEL***	Reference Sites		Dredging Unit 1			Dredging Unit 2			Dredging Unit 3			Dredging Unit 4			Dredging Unit 5					Dredging Unit 6		
					Willoughby Bank Reference	Atlantic Ocean Reference	BRC-01	BRC-02	BRC-01/02	BRC-03	BRC-04	BRC-03/04	BRC-05	BRC-06	BRC-05/06	BRC-07	BRC-08	BRC-07/08	BRC-09	BRC-09-FD	BRC-10	BRC-10-FD	BRC-09/10	BRC-11	BRC-12	BRC-11/12
PCB 8 (BZ)*	UG/KG	11.77	NSL	NSL	0.68 U	0.72 U	0.9 U	0.85 U	0.96 U	1.1 U	1.2 U	1.1 U	1.2 U	0.99 U	1.1 U	1 U	1 U	0.96 U	1.2 U	1.2 U	0.79 U	0.75 U	1 U	0.66 U	0.71 U	0.65 U
PCB 18 (BZ)*	UG/KG	11.77	NSL	NSL	0.68 U	0.72 U	0.9 U	0.85 U	0.96 U	1.1 U	1.2 U	1.1 U	1.2 U	0.99 U	1.1 U	1 U	1 U	0.96 U	1.2 U	1.2 U	0.79 U	0.75 U	1 U	0.66 U	0.71 U	0.65 U
PCB 28 (BZ)*	UG/KG	11.77	NSL	NSL	**0.11 J P**	0.72 U	**0.25 J P**	**0.48 J P**	**0.84 J P**	**0.7 J P**	**0.41 J P**	**0.66 J P**	**0.42 J P**	**0.31 J P**	**0.51 J P**	**0.34 J P**	**0.35 J P**	**0.34 J P**	**0.42 J P**	**0.22 J P**	**0.21 J P**	**0.16 J P**	**0.19 J P**	0.66 U	0.71 U	0.65 U
PCB 44 (BZ)*	UG/KG	3.07	NSL	NSL	0.68 U	0.72 U	0.9 U	**0.13 J**	**0.28 J**	**0.25 J**	1.2 U	**0.26 J**	**0.19 J**	0.99 U	**0.15 J**	1 U	1 U	**0.24 J**	1.2 U	1.2 U	0.79 U	0.75 U	1 U	0.66 U	0.71 U	0.65 U
PCB 49 (BZ)	UG/KG	11.77	NSL	NSL	0.68 U	0.72 U	0.9 U	0.85 U	0.96 U	1.1 U	1.2 U	1.1 U	1.2 U	0.99 U	1.1 U	1 U	1 U	0.96 U	1.2 U	1.2 U	0.79 U	0.75 U	1 U	0.66 U	0.71 U	0.65 U
PCB 52 (BZ)*	UG/KG	11.77	NSL	NSL	0.68 U	0.72 U	0.9 U	0.85 U	0.96 U	1.1 U	1.2 U	**0.37 J P**	**0.27 J P**	0.99 U	1.1 U	1 U	1 U	0.96 U	1.2 U	1.2 U	0.79 U	0.75 U	1 U	0.66 U	0.71 U	0.65 U
PCB 66 (BZ)*	UG/KG	3.07	NSL	NSL	**0.099 J P**	0.72 U	0.9 U	**0.19 J P**	**0.39 J P**	**0.37 J P**	**0.22 J P**	**0.4 J P**	1.2 U	0.99 U	**0.23 J P**	1 U	**0.18 J P**	0.96 U	**0.28 J P**	**0.26 J P**	**0.11 J P**	**0.12 J P**	**0.12 J P**	0.66 U	0.71 U	0.65 U
PCB 77 (BZ)*	UG/KG	3.07	NSL	NSL	**0.3 J P**	**0.099 J P**	**0.62 J**	0.85 U	**1.9**	**1.4**	1.2 U	**1.6**	1.2 U	0.99 U	1.1 U	1 U	**0.54 J**	0.96 U	**0.55 J**	**0.49 J P**	**0.24 J**	**0.23 J**	**0.47 J**	0.66 U	0.71 U	0.65 U
PCB 87 (BZ)	UG/KG	3.07	NSL	NSL	0.68 U	0.72 U	0.9 U	0.85 U	0.96 U	**0.14 J P**	1.2 U	**0.19 J P**	1.2 U	**0.11 J P**	1.1 U	1 U	1 U	**0.13 J P**	1.2 U	1.2 U	0.79 U	0.75 U	1 U	0.66 U	0.71 U	0.65 U
PCB 101 (BZ)*	UG/KG	3.07	NSL	NSL	0.68 U	0.72 U	**0.21 J P**	**0.19 J P**	**0.35 J P**	**0.44 J P**	**0.28 J P**	**0.42 J P**	**0.33 J P**	**0.24 J P**	**0.22 J P**	1 U	**0.12 J P**	**0.36 J P**	**0.38 J**	**0.37 J**	**0.15 J P**	0.75 U	**0.15 J P**	0.66 U	0.71 U	0.65 U
PCB 105 (BZ)*	UG/KG	3.07	NSL	NSL	0.68 U	0.72 U	0.9 U	**0.13 J**	**0.086 J P**	**0.095 J P**	1.2 U	**0.091 J P**	1.2 U	**0.17 J**	1.1 U	1 U	**0.12 J**	**0.12 J P**	1.2 U	1.2 U	0.79 U	0.75 U	1 U	0.66 U	0.71 U	0.65 U
PCB 118 (BZ)*	UG/KG	3.07	NSL	NSL	0.68 U	0.72 U	0.9 U	0.85 U	0.96 U	1.1 U	1.2 U	1.1 U	1.2 U	0.99 U	1.1 U	1 U	1 U	0.96 U	1.2 U	1.2 U	0.79 U	0.75 U	1 U	0.66 U	0.71 U	0.65 U
PCB 126 (BZ)*	UG/KG	3.07	NSL	NSL	0.68 U	0.72 U	0.9 U	0.85 U	0.96 U	1.1 U	1.2 U	1.1 U	1.2 U	0.99 U	1.1 U	1 U	1 U	0.96 U	1.2 U	1.2 U	0.79 U	0.75 U	1 U	0.66 U	0.71 U	0.65 U
PCB 128 (BZ)*	UG/KG	3.07	NSL	NSL	0.68 U	0.72 U	0.9 U	**0.13 J**	**0.28 J**	**0.18 J**	1.2 U	**0.21 J**	1.2 U	**0.14 J**	**0.17 J**	1 U	1 U	**0.18 J**	1.2 U	1.2 U	0.79 U	0.75 U	1 U	0.66 U	0.71 U	0.65 U
PCB 138 (BZ)*	UG/KG	3.07	NSL	NSL	0.68 U	0.72 U	0.9 U	0.85 U	0.96 U	1.1 U	**0.11 J P**	1.1 U	1.2 U	**0.19 J P**	1.1 U	1 U	1 U	**0.24 J P**	**0.13 J**	**0.14 J**	0.79 U	0.75 U	1 U	0.66 U	0.71 U	0.65 U
PCB 153 (BZ)*	UG/KG	3.07	NSL	NSL	**0.087 J P**	0.72 U	**0.32 J**	**0.53 J**	**1.2**	**0.9 J**	**0.57 J**	**0.93 J**	**0.77 J**	**0.57 J**	1.1 U	1 U	**0.33 J**	**0.57 J**	**0.37 J**	**0.18 J P**	**0.15 J**	**0.12 J**	**0.16 J P**	0.66 U	0.71 U	0.65 U
PCB 156 (BZ)	UG/KG	3.07	NSL	NSL	0.68 U	0.72 U	0.9 U	0.85 U	0.96 U	1.1 U	1.2 U	1.1 U	1.2 U	0.99 U	1.1 U	1 U	1 U	0.96 U	1.2 U	1.2 U	0.79 U	0.75 U	1 U	0.66 U	0.71 U	0.65 U
PCB 169 (BZ)*	UG/KG	3.07	NSL	NSL	0.68 U	0.72 U	0.9 U	0.85 U	0.96 U	1.1 U	1.2 U	1.1 U	1.2 U	0.99 U	1.1 U	1 U	1 U	0.96 U	1.2 U	1.2 U	0.79 U	0.75 U	1 U	0.66 U	0.71 U	0.65 U
PCB 170 (BZ)*	UG/KG	3.07	NSL	NSL	0.68 U	0.72 U	0.9 U	0.85 U	0.96 U	1.1 U	1.2 U	1.1 U	1.2 U	0.99 U	1.1 U	1 U	1 U	0.96 U	1.2 U	1.2 U	0.79 U	0.75 U	1 U	0.66 U	0.71 U	0.65 U
PCB 180 (BZ)*	UG/KG	3.07	NSL	NSL	0.68 U	0.72 U	0.9 U	**0.23 J**	**0.67 J**	**0.24 J P**	**0.11 J P**	**0.27 J P**	**0.3 J**	**0.27 J**	**0.21 J P**	1 U	1 U	**0.3 J**	**0.18 J**	1.2 U	0.79 U	0.75 U	1 U	0.66 U	0.71 U	0.65 U
PCB 183 (BZ)	UG/KG	3.07	NSL	NSL	0.68 U	0.72 U	0.9 U	0.85 U	0.96 U	1.1 U	1.2 U	1.1 U	1.2 U	0.99 U	1.1 U	1 U	1 U	0.96 U	1.2 U	1.2 U	0.79 U	0.75 U	1 U	0.66 U	0.71 U	0.65 U
PCB 184 (BZ)	UG/KG	3.07	NSL	NSL	0.68 U	0.72 U	0.9 U	0.85 U	0.96 U	1.1 U	1.2 U	1.1 U	1.2 U	0.99 U	1.1 U	1 U	1 U	0.96 U	1.2 U	1.2 U	0.79 U	0.75 U	1 U	0.66 U	0.71 U	0.65 U
PCB 187 (BZ)*	UG/KG	3.07	NSL	NSL	0.68 U	0.72 U	**0.17 J**	**0.24 J**	**0.55 J**	**0.34 J**	**0.16 J P**	**0.31 J**	**0.24 J**	**0.24 J**	**0.25 J**	**0.16 J**	1 U	**0.19 J**	1.2 U	1.2 U	0.79 U	0.75 U	1 U	0.66 U	0.71 U	0.65 U
PCB 195 (BZ)	UG/KG	3.07	NSL	NSL	0.68 U	0.72 U	0.9 U	0.85 U	0.96 U	1.1 U	1.2 U	1.1 U	1.2 U	0.99 U	1.1 U	1 U	1 U	0.96 U	1.2 U	1.2 U	0.79 U	0.75 U	1 U	0.66 U	0.71 U	0.65 U
PCB 206 (BZ)	UG/KG	3.07	NSL	NSL	0.68 U	0.72 U	0.9 U	0.85 U	0.96 U	1.1 U	1.2 U	1.1 U	1.2 U	0.99 U	1.1 U	**0.56 J**	1 U	0.96 U	1.2 U	1.2 U	0.79 U	0.75 U	1 U	0.66 U	0.71 U	0.65 U
PCB 209 (BZ)	UG/KG	3.07	NSL	NSL	**0.06 J**	0.72 U	0.9 U	0.85 U	0.96 U	1.1 U	1.2 U	1.1 U	1.2 U	0.99 U	1.1 U	1 U	1 U	0.96 U	1.2 U	1.2 U	0.79 U	0.75 U	1 U	0.66 U	0.71 U	0.65 U
TOTAL NOAA PCBs (ND=0)	UG/KG	--	21.6	188.8	**0.7**	**0.0**	**1.9**	**5.0**	**9.3**	**7.0**	**3.7**	**7.8**	**5.0**	**4.3**	**3.5**	**2.1**	**2.2**	**5.1**	**3.5**	**2.3**	**1.2**	**0.8**	**1.2**	**0.0**	**0.0**	**0.0**
TOTAL NOAA PCBs (ND=1/2RL)	UG/KG	--	21.6	188.8	**10.2**	**13.0**	**14.5**	**11.8**	**17.9**	**16.9**	**16.9**	**16.6**	**18.2**	**14.2**	**15.6**	**17.1**	**15.2**	**13.7**	**17.9**	**17.9**	**12.3**	**12.1**	**15.2**	**11.9**	**12.8**	**11.7**
TOTAL NOAA PCBs (ND=RL)	UG/KG	--	21.6	188.8	**19.8**	**25.9**	**27.1**	**18.6**	**26.6**	**26.8**	**30.1**	**25.4**	**31.4**	**24.1**	**27.7**	**32.1**	**28.2**	**22.4**	**32.3**	**33.5**	**23.4**	**23.3**	**29.2**	**23.8**	**25.6**	**23.4**
TOTAL REGION 4 PCBs (ND=0)**	UG/KG	--	21.6	188.8	**1.3**	**0.2**	**3.1**	**5.0**	**13.1**	**10.1**	**3.7**	**11.4**	**5.0**	**4.5**	**3.5**	**2.1**	**3.3**	**5.3**	**4.6**	**3.3**	**1.7**	**1.3**	**2.2**	**0.0**	**0.0**	**0.0**
TOTAL REGION 4 PCBs (ND=1/2RL)**	UG/KG	--	21.6	188.8	**15.6**	**18.2**	**22.0**	**18.6**	**28.5**	**26.6**	**26.5**	**26.8**	**27.8**	**21.3**	**24.4**	**25.1**	**23.3**	**20.7**	**27.4**	**27.3**	**18.3**	**17.8**	**23.2**	**17.2**	**18.5**	**16.9**
TOTAL REGION 4 PCBs (ND=RL)**	UG/KG	--	21.6	188.8	**29.9**	**36.2**	**40.9**	**32.2**	**43.8**	**43.1**	**49.3**	**42.2**	**50.6**	**38.1**	**45.3**	**48.1**	**43.3**	**36.1**	**50.2**	**51.3**	**34.9**	**34.3**	**44.2**	**34.3**	**36.9**	**33.8**

*PCB congeners used for Total NOAA PCB summation (SERIM 2008)

** Total Region 4 PCBs represents the sum of all PCBs in table 6-7 (SERIM2008)

****Source*: MacDonald et al. 1996. *Ecotoxicology* 5: 253-278.

NOTES: Bold values represent detected concentrations. Shaded concentrations exceed sediment quality guidelines.

RL is reported for non-detected constituents.

RL = average detection limit

TEL = threshold effects level — **exceeds TEL value**

PEL = probable effects level — **exceeds PEL value**

J = compound was detected, but below the reporting limit (value is estimated)

P = the percent difference between the original and confirmation analysis is greater than 40%

U = compound was analyzed, but not detected

TABLE 4-11. PCB AROCLOR CONCENTRATIONS (UG/KG) IN SEDIMENT

JBLE BACK RIVER CHANNEL, HAMPTON, VIRGINIA (DECEMBER 2015)

				Reference Sites		Dredging Unit 1			Dredging Unit 2			Dredging Unit 3			Dredging Unit 4			Dredging Unit 5					Dredging Unit 6		
ANALYTE	UNITS	Average RL	VA Exclusion Criteria*	Willoughby Bank Reference	Atlantic Ocean Reference	BRC-01	BRC-02	BRC-01/02	BRC-03	BRC-04	BRC-03/04	BRC-05	BRC-06	BRC-05/06	BRC-07	BRC-08	BRC-07/08	BRC-09	BRC-09-FD	BRC-10	BRC-10-FD	BRC-09/10	BRC-11	BRC-12	BRC-11/12
AROCLOR 1016	UG/KG	6.55	21,000	NA	NA	7.7 U	7.4 U	NA	9.4 U	10 U	NA	10 U	8.4 U	NA	8.5 U	8.6 U	NA	4.9 U	4.8 U	3.2 U	3.1 U	NA	2.7 U	3 U	NA
AROCLOR 1221	UG/KG	6.55	620	NA	NA	7.7 U	7.4 U	NA	9.4 U	10 U	NA	10 U	8.4 U	NA	8.5 U	8.6 U	NA	4.9 U	4.8 U	3.2 U	3.1 U	NA	2.7 U	3 U	NA
AROCLOR 1232	UG/KG	6.55	620	NA	NA	7.7 U	7.4 U	NA	9.4 U	10 U	NA	10 U	8.4 U	NA	8.5 U	8.6 U	NA	4.9 U	4.8 U	3.2 U	3.1 U	NA	2.7 U	3 U	NA
AROCLOR 1242	UG/KG	6.55	740	NA	NA	7.7 U	7.4 U	NA	9.4 U	10 U	NA	10 U	8.4 U	NA	8.5 U	8.6 U	NA	4.9 U	4.8 U	3.2 U	3.1 U	NA	2.7 U	3 U	NA
AROCLOR 1248	UG/KG	6.55	740	NA	NA	7.7 U	7.4 U	NA	9.4 U	10 U	NA	10 U	8.4 U	NA	8.5 U	8.6 U	NA	4.9 U	4.8 U	3.2 U	3.1 U	NA	2.7 U	3 U	NA
AROCLOR 1254	UG/KG	6.55	740	NA	NA	7.7 U	7.4 U	NA	9.4 U	10 U	NA	10 U	8.4 U	NA	8.5 U	8.6 U	NA	4.9 U	4.8 U	**1.5 J**	3.1 U	NA	2.7 U	3 U	NA
AROCLOR 1260	UG/KG	6.55	740	NA	NA	7.7 U	7.4 U	NA	9.4 U	10 U	NA	10 U	8.4 U	NA	8.5 U	8.6 U	NA	4.9 U	4.8 U	3.2 U	3.1 U	NA	2.7 U	3 U	NA
TOTAL PCBs (ND=RL)	UG/KG	NA	25,200	NA	NA	53.9	51.8	NA	65.8	53.9	NA	70	58.8	NA	59.5	60.2	NA	34.3	33.6	20.7	21.7	NA	18.9	21	NA

*Proposed Virginia exclusion criteria for placement of dredged material at Weanack.

NOTES: Bold values represent detected concentrations. RL is reported for non-detected constituents.

NA = Not Analyzed

J = compound was detected, but below the reporting limit (value is estimated)

U = compound was analyzed, but not detected

TABLE 4-12. DIOXIN AND FURAN CONGENER CONCENTRATIONS (NG/KG) IN SEDIMENT

JBLE BACK RIVER CHANNEL, HAMPTON, VIRGINIA (DECEMBER 2015)

ANALYTE	UNITS	Average RL	TEF*	VA Exclusion Criteria**	Reference Sites		Dredging Unit 1			Dredging Unit 2		
					Willoughby Bank Reference	Atlantic Ocean Reference	BRC-01	BRC-02	BRC-01/02	BRC-03	BRC-04	BRC-03/04
2,3,7,8-TCDD	NG/KG	0.94	1	18	1 U	0.97 U	0.98 U	0.89 U	0.92 U	1.1 U	1.1 U	0.48 Q J
1,2,3,7,8-PECDD	NG/KG	4.68	1	NA	0.74 Q J	0.15 Q B J	5.8	4.1 Q J	5.4 Q	5 J	4.5 Q J	4.9 J
1,2,3,4,7,8-HXCDD	NG/KG	4.68	0.1	NA	0.95 Q J	0.2 J	9	7.9	8.8	7.7	7.2	8.5
1,2,3,6,7,8-HXCDD	NG/KG	4.68	0.1	NA	1.7 Q J	0.25 Q J	15	11	15	12	14	12
1,2,3,7,8,9-HXCDD	NG/KG	4.68	0.1	NA	3.7 J	0.49 B J	33	30	34	27	29	29
1,2,3,4,6,7,8-HPCDD	NG/KG	4.68	0.01	NA	39	3.9 B J	330	240	300	280	300	320
OCDD	NG/KG	9.39	0.0003	NA	630 B	49 B	4900 B E	2700 B	3800 B E	3400 B	4500 B E	4700 B E
2,3,7,8-TCDF	NG/KG	0.94	0.1	NA	0.4 Q J	0.26 J	1.1	0.67 J	0.35 Q J	2.1 Q	2	2.1
1,2,3,7,8-PECDF	NG/KG	4.68	0.03	NA	0.23 Q B J	0.088 Q B J	1.2 B J	0.31 Q B J	0.74 B J	1 Q B J	0.83 Q B J	1.2 B J
2,3,4,7,8-PECDF	NG/KG	4.68	0.3	NA	0.27 Q J	0.14 J	0.96 J	0.52 Q J	1.1 J	1.3 Q J	0.95 Q J	1.3 Q J
1,2,3,4,7,8-HXCDF	NG/KG	4.68	0.1	NA	0.75 Q B J	0.26 B J	0.96 Q B J	0.82 Q B J	0.87 B J	1.7 Q B J	2.8 B J	2.6 B J
1,2,3,6,7,8-HXCDF	NG/KG	4.68	0.1	NA	0.13 Q J	0.1 Q B J	0.81 Q J	0.23 Q J	0.49 Q J	1.2 J	1.4 Q J	1.5 J
1,2,3,7,8,9-HXCDF	NG/KG	4.68	0.1	NA	5 U	0.09 B J	0.66 Q J	0.3 Q J	0.33 Q J	1.1 J	1.2 Q J	0.89 Q J
2,3,4,6,7,8-HXCDF	NG/KG	4.68	0.1	NA	5 U	4.9 U	4.9 U	4.4 U	4.6 U	5.5 U	5.6 U	5.4 U
1,2,3,4,6,7,8-HPCDF	NG/KG	4.68	0.01	NA	1.7 Q J	0.43 Q B J	7.3	2 Q J	4.8 Q	7.6	11	10
1,2,3,4,7,8,9-HPCDF	NG/KG	4.68	0.01	NA	0.19 Q J	4.9 U	0.73 Q J	4.4 U	4.6 U	5.5 U	1.3 Q J	1.2 J
OCDF	NG/KG	9.39	0.0003	NA	3.1 B J	0.61 B J	14 Q B	2.9 Q B J	6.3 B J	10 B J	14 B	13 B
DIOXIN TEQ (ND=0)	NG/KG	NA	NA	NA	0.4	0.0	15.0	7.3	8.8	7.5	8.3	8.5
DIOXIN TEQ (ND=1/2RL)	NG/KG	NA	NA	NA	1.4	0.8	15.7	8.0	9.5	8.4	9.2	8.7
DIOXIN TEQ (ND=RL)	NG/KG	NA	NA	NA	2.4	1.5	16.5	8.7	10.2	9.3	10.0	9.0

ANALYTE	Dredging Unit 3			Dredging Unit 4			Dredging Unit 5					Dredging Unit 6		
	BRC-05	BRC-06	BRC-05/06	BRC-07	BRC-08	BRC-07/08	BRC-09	BRC-09-FD	BRC-10	BRC-10-FD	BRC-09/10	BRC-11	BRC-12	BRC-11/12
2,3,7,8-TCDD	1.2 U	0.84 U	1.1 U	0.94 U	0.95 U	0.94 U	0.34 Q J	0.24 J	0.74 U	0.74 U	0.3 J	0.7 U	0.69 U	0.7 U
1,2,3,7,8-PECDD	5.5 J	3.3 J	4.3 J	3.4 J	3 Q J	3.7 J	2.8 B J	1.9 B J	1 B J	1.2 B J	1.8 Q B J	0.26 Q B J	0.22 Q B J	0.24 B J
1,2,3,4,7,8-HXCDD	7.9	7.3	7.3	4.8 Q	4.8	6	4.5 J	3.1 J	1.7 J	1.8 J	3.2 J	0.4 J	0.34 J	0.39 J
1,2,3,6,7,8-HXCDD	14	9.3	12	8.7	8.5	9.4	7.5	5.1 J	2.6 J	3 J	4.9	0.67 J	0.58 J	0.6 J
1,2,3,7,8,9-HXCDD	29	22	27	22	24	23	18 B	12 B	6.5 B	7.3 B	12 B	1.6 B J	1.4 B J	1.4 B J
1,2,3,4,6,7,8-HPCDD	320	210	280	230	190	220	190 B	140 B	74 B	81 B	120 B	18 B	15 B	16 B
OCDD	5100 B E	2800 B	4200 B	4600 B E	2700 B	3700 B	3000 B	2500 B	1300 B	1500 B	1800 B	330 B	270 B	280 B
2,3,7,8-TCDF	2.3	1.1	2	1.1	0.95 U	1.1	1.2	1.1	0.61 J	0.6 Q J	0.6 J	0.066 Q J	0.08 Q J	0.034 Q J
1,2,3,7,8-PECDF	1.1 Q B J	0.57 B J	0.81 Q B J	4.7 U	4.7 U	0.68 Q B J	0.52 B J	0.35 B J	0.17 B J	0.24 B J	0.39 B J	3.5 U	3.4 U	3.5 U
2,3,4,7,8-PECDF	1.5 J	1.2 J	1.6 J	0.79 Q J	0.8 Q J	0.4 Q J	0.76 J	0.49 J	0.27 J	0.28 J	0.5 Q J	0.059 J	0.059 Q J	3.5 U
1,2,3,4,7,8-HXCDF	1.1 Q B J	1.8 Q B J	2.5 B J	0.93 B J	0.92 Q B J	0.89 Q B J	1.4 B J	0.95 Q B J	0.52 B J	0.6 B J	0.96 B J	0.14 B J	0.11 Q B J	0.15 Q B J
1,2,3,6,7,8-HXCDF	1.9 J	0.71 J	1.6 J	0.8 Q J	4.7 U	0.62 Q J	0.79 Q B J	0.53 Q B J	0.28 B J	0.3 B J	0.49 Q B J	0.06 Q B J	0.048 Q B J	0.044 Q B J
1,2,3,7,8,9-HXCDF	1.3 Q J	0.9 J	0.93 Q J	0.78 J	0.98 Q J	0.7 J	0.61 B J	0.46 B J	0.23 B J	0.27 B J	0.41 B J	0.049 B J	0.054 B J	0.03 Q B J
2,3,4,6,7,8-HXCDF	5.9 U	4.2 U	5.3 U	4.7 U	4.7 U	4.7 U	5.6 U	5.6 U	3.7 U	3.7 U	4.2 U	3.5 U	3.4 U	3.5 U
1,2,3,4,6,7,8-HPCDF	11	5	8.1	6	5.3	5.6	4.5 B J	3.3 B J	1.8 B J	2 B J	2.7 B J	0.34 B J	0.23 Q B J	0.26 Q B J
1,2,3,4,7,8,9-HPCDF	1.1 J	0.42 Q J	0.57 Q J	0.38 J	4.7 U	0.55 Q J	0.44 B J	0.25 Q B J	0.15 B J	0.17 Q B J	0.23 B J	3.5 U	3.4 U	3.5 U
OCDF	18 B	7 B J	11 B	8.1 B J	5.2 B J	4.1 Q B J	5.4 B J	4.3 B J	2 B J	2.4 B J	3.2 Q B J	0.4 B J	0.36 B J	0.39 B J
DIOXIN TEQ (ND=0)	8.6	6.1	7.7	5.7	5.7	6.2	0.9	0.1	0.0	0.0	0.5	0.0	0.0	0.0
DIOXIN TEQ (ND=1/2RL)	9.5	6.8	8.5	6.4	6.8	6.9	1.2	0.4	0.6	0.6	0.7	0.6	0.6	1.1
DIOXIN TEQ (ND=RL)	10.4	7.4	9.3	7.2	7.9	7.6	1.4	0.7	1.1	1.1	0.9	1.2	1.2	2.2

**Source* : Van den Berg, M, et al. 2006. The 2005 World Health Organization Re-evaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-Like Compounds.

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**Proposed Virginia exclusion criteria for placement of dredged material at Weanack.

There are no sediment quality guidelines for dioxin and furan congeners.

NOTES: Bold values represent detected concentrations.

RL is reported for non-detected constituents.

RL = average reporting limit

TEF = toxicity equivalency factor

TEQ = toxicity equivalency quotient

NA = no value available

B = compound was detected in the laboratory method blank

E = result exceeded calibration range

J = compound was detected, but below the reporting limit (value is estimated)

Q = compound was detected, but as an estimated maximum concentration

U = compound was analyzed, but not detected

TABLE 4-13. CHLORINATED AND ORGANOPHOSPHORUS PESTICIDE CONCENTRATIONS (UG/KG) IN SEDIMENT

JBLE BACK RIVER CHANNEL, HAMPTON, VIRGINIA (DECEMBER 2015)

ANALYTE	UNITS	Average RL	TEL*	PEL*	VA Exclusion Criteria**	Reference Sites		Dredging Unit 1			Dredging Unit 2		
						Willoughby Bank Reference	Atlantic Ocean Reference	BRC-01	BRC-02	BRC-01/02	BRC-03	BRC-04	BRC-03/04
2,4'-DDD	UG/KG	0.22	NSL	NSL	NSL	0.28 U	0.3 U	0.077 U	0.074 U	0.084 U	0.094 U	0.1 U	0.092 U
2,4'-DDE	UG/KG	0.22	NSL	NSL	NSL	**0.22 J P**	0.3 U	0.077 U	**0.029 J P B**	**0.14 P B**	**0.015 J P B**	0.1 U	**0.1 P B**
2,4'-DDT	UG/KG	0.22	NSL	NSL	NSL	0.28 U	0.3 U	0.077 U	**0.012 J P B**	**0.025 J P B**	0.094 U	**0.024 J B**	0.092 U
4,4'-DDD	UG/KG	0.22	1.22	7.81	7,200	**0.14 J**	0.3 U	**0.043 J P**	**0.1 P**	**0.14 P**	**0.34 P**	**0.16 P**	**0.18 P**
4,4'-DDE	UG/KG	0.22	2.07	374	5100	**0.34 P B**	0.3 U	**0.2 B**	**0.71 B**	**3 B**	**0.58 B**	**1.4 B**	**1.2 B**
4,4'-DDT	UG/KG	0.33	1.19	4.77	7,000	**0.27 J B**	0.3 U	**0.06 J**	**0.16**	**0.11**	**0.55**	**0.17**	**0.27**
TOTAL DDT (ND=RL)	UG/KG	--	NSL	NSL	NSL	**0.75**	**0.90**	**0.30**	**0.97**	**3.25**	**1.47**	**1.73**	**1.65**
ALDRIN	UG/KG	0.22	NSL	NSL	110	0.28 U	0.3 U	0.077 U	0.074 U	**0.029 J P**	0.094 U	0.1 U	0.092 U
ALPHA-BHC	UG/KG	0.22	NSL	NSL	NSL	0.28 U	0.3 U	0.077 U	0.074 U	**0.051 J**	**0.023 J P**	**0.056 J**	**0.036 J**
BETA-BHC	UG/KG	0.22	NSL	NSL	NSL	0.28 U	0.3 U	0.077 U	0.074 U	0.084 U	**0.11 P**	**0.22 P**	0.092 U
CHLORDANE (TECHNICAL)	UG/KG	2.22	NSL	NSL	NSL	2.8 U	3 U	0.77 U	0.74 U	0.84 U	0.94 U	1 U	0.92 U
CHLOROBENSIDE	UG/KG	0.22	NSL	NSL	NSL	0.28 U	0.3 U	0.077 U	0.074 U	0.084 U	0.094 U	0.1 U	0.092 U
DACTHAL	UG/KG	0.22	NSL	NSL	NSL	0.28 U	0.3 U	**0.016 J P**	**0.052 J**	**0.058 J P**	**0.03 J**	**0.048 J**	**0.032 J P**
DELTA-BHC	UG/KG	0.22	NSL	NSL	NSL	0.28 U	0.3 U	0.077 U	0.074 U	**0.034 J P**	0.094 U	**0.043 J P**	**0.052 J**
DIELDRIN	UG/KG	0.22	0.715	4.3	110	0.28 U	0.3 U	**0.027 J P**	**0.015 J P**	**0.077 J P**	**0.036 J P**	**0.028 J P**	**0.026 J P**
ENDOSULFAN I	UG/KG	0.22	NSL	NSL	3,700,000	0.28 U	0.3 U	0.077 U	0.074 U	0.084 U	0.094 U	0.1 U	0.092 U
ENDOSULFAN II	UG/KG	0.22	NSL	NSL	3,700,000	0.28 U	0.3 U	0.077 U	**0.013 J P**	**0.038 J P**	0.094 U	0.1 U	0.092 U
ENDOSULFAN SULFATE	UG/KG	0.22	NSL	NSL	3,700,000	0.28 U	0.3 U	0.077 U	0.074 U	**0.061 J B**	0.094 U	0.1 U	0.092 U
ENDRIN	UG/KG	0.22	NSL	NSL	180,000	0.28 U	0.3 U	**0.083**	**0.088**	**0.14 P**	**0.13**	**0.2**	**0.19**
ENDRIN ALDEHYDE	UG/KG	0.22	NSL	NSL	180,000	0.28 U	0.3 U	0.077 U	**0.024 J P**	**0.032 J P**	**0.019 J P**	**0.045 J**	0.092 U
GAMMA-BHC (LINDANE)	UG/KG	0.22	0.32	0.99	520	0.28 U	0.3 U	**0.017 J P**	0.074 U	**0.058 J**	**0.036 J**	**0.062 J P**	0.092 U
HEPTACHLOR	UG/KG	0.22	NSL	NSL	380	0.28 U	0.3 U	0.077 U	0.074 U	0.084 U	0.094 U	0.1 U	0.092 U
HEPTACHLOR EPOXIDE	UG/KG	0.22	NSL	2.74***	190	0.28 U	0.3 U	0.077 U	0.074 U	**0.046 J P**	**0.046 J P**	**0.081 J P**	**0.077 J P**
METHOXYCHLOR	UG/KG	0.44	NSL	NSL	3,100,000	0.57 U	**0.32 J**	**0.025 J P**	0.15 U	**0.045 J P**	**0.021 J P**	**0.14 J**	**0.03 J P**
MIREX	UG/KG	0.22	NSL	NSL	NSL	0.28 U	0.3 U	**0.13**	**0.015 J P**	**0.33**	**0.16**	**0.095 J P**	**0.27**
TOXAPHENE	UG/KG	8.93	NSL	NSL	1,600	11 U	12 U	3.1 U	3 U	3.3 U	3.8 U	4.1 U	3.7 U
ORGANOPHOSPHORUS PESTICIDES													
AZINPHOS-METHYL	UG/KG	35.5	NSL	NSL	NSL	110 U	23 U	31 U	30 U	33 U	38 U	41 U	37 U
BOLSTAR	UG/KG	35.5	NSL	NSL	NSL	110 U	23 U	31 U	30 U	33 U	38 U	41 U	37 U
CHLORPYRIFOS	UG/KG	35.5	NSL	NSL	NSL	110 U	23 U	31 U	30 U	33 U	38 U	41 U	37 U
COUMAPHOS	UG/KG	35.5	NSL	NSL	NSL	110 U	23 U	31 U	30 U	33 U	38 U	41 U	37 U
DEMETON, TOTAL	UG/KG	70.8	NSL	NSL	NSL	220 U	47 U	61 U	59 U	66 U	75 U	82 U	73 U
MALATHION	UG/KG	35.5	NSL	NSL	NSL	110 U	23 U	31 U	30 U	33 U	38 U	41 U	37 U
METHYL PARATHION	UG/KG	35.5	NSL	NSL	NSL	110 U	23 U	31 U	30 U	33 U	38 U	41 U	37 U
PARATHION	UG/KG	35.5	NSL	NSL	NSL	110 U	23 U	31 U	30 U	33 U	38 U	41 U	37 U

ANALYTE	Dredging Unit 3			Dredging Unit 4			Dredging Unit 5					Dredging Unit 6		
	BRC-05	BRC-06	BRC-05/06	BRC-07	BRC-08	BRC-07/08	BRC-09	BRC-09-FD	BRC-10	BRC-10-FD	BRC-09/10	BRC-11	BRC-12	BRC-11/12
2,4'-DDD	0.1 U	0.085 U	0.095 U	0.084 U	0.086 U	0.082 U	**0.075 J**	**0.35 J**	0.32 U	0.31 U	**0.064 J**	0.27 U	0.3 U	0.27 U
2,4'-DDE	0.1 U	**0.058 J P B**	0.095 U	0.084 U	**0.069 J P B**	**0.11 P B**	**0.18 J P**	**1.4**	0.32 U	0.31 U	**0.15 J**	0.27 U	0.3 U	0.27 U
2,4'-DDT	0.1 U	0.085 U	0.095 U	0.084 U	0.086 U	0.082 U	0.49 U	0.48 U	0.32 U	0.31 U	0.41 U	0.27 U	0.3 U	0.27 U
4,4'-DDD	**0.3**	**0.16**	**0.11 P**	**0.11 P**	**0.11 P**	**0.19**	**0.54**	**2**	**0.11 J P**	**0.062 J P**	**0.34 J**	0.27 U	0.3 U	0.27 U
4,4'-DDE	**0.8 B**	**1.3 B**	**0.65 B**	**0.41 B**	**0.37 B**	**0.82 B**	**0.43 J P**	**2.3 P**	**0.18 J**	**0.11 J P**	**0.31 J P**	0.27 U	0.3 U	0.27 U
4,4'-DDT	**0.45**	**0.16**	**0.13 P**	**0.15**	0.087 U	**0.03 J P**	**2.5**	**6**	**0.6**	**0.37**	**0.73**	0.27 U	0.3 U	0.27 U
TOTAL DDT (ND=RL)	**1.55**	**1.62**	**0.89**	**0.67**	**0.57**	**1.04**	**3.47**	**10.30**	**0.89**	**0.54**	**1.38**	**0.81**	**0.90**	**0.81**
ALDRIN	0.1 U	0.085 U	0.095 U	0.084 U	0.086 U	**0.042 J P**	0.49 U	0.48 U	0.32 U	0.31 U	0.41 U	0.27 U	0.3 U	0.27 U
ALPHA-BHC	**0.017 J P**	**0.025 J**	**0.016 J P**	0.084 U	**0.041 J**	0.082 U	0.49 U	0.48 U	0.32 U	0.31 U	0.41 U	0.27 U	0.3 U	0.27 U
BETA-BHC	0.1 U	0.085 U	0.095 U	**0.028 J P**	0.086 U	**0.11 P**	**0.62 P**	**0.57 P**	**0.15 J P**	0.31 U	**0.3 J P**	0.27 U	0.3 U	0.27 U
CHLORDANE (TECHNICAL)	1 U	0.85 U	0.95 U	0.84 U	0.86 U	0.82 U	4.9 U	4.8 U	3.2 U	3.1 U	4.1 U	2.7 U	3 U	2.7 U
CHLOROBENSIDE	0.1 U	0.085 U	0.095 U	0.084 U	0.086 U	0.082 U	0.49 U	0.48 U	0.32 U	0.31 U	0.41 U	0.27 U	0.3 U	0.27 U
DACTHAL	**0.021 J P**	**0.033 J P**	**0.017 J P**	0.084 U	**0.017 J P**	**0.095**	0.49 U	0.48 U	0.32 U	0.31 U	0.41 U	0.27 U	0.3 U	0.27 U
DELTA-BHC	**0.033 J P**	0.085 U	**0.033 J P**	**0.02 J P**	**0.052 J**	**0.076 J**	**0.18 J P**	**0.073 J P**	0.32 U	0.31 U	0.41 U	0.27 U	0.3 U	0.27 U
DIELDRIN	**0.033 J P**	**0.021 J P**	**0.024 J P**	**0.032 J P**	**0.038 J P**	**0.029 J P**	0.49 U	0.48 U	0.32 U	0.31 U	0.41 U	0.27 U	0.3 U	0.27 U
ENDOSULFAN I	0.1 U	0.085 U	0.095 U	0.084 U	0.086 U	0.082 U	0.49 U	**0.18 J P**	0.32 U	0.31 U	0.41 U	0.27 U	0.3 U	0.27 U
ENDOSULFAN II	**0.021 J P**	**0.066 J P**	**0.092 J P**	**0.025 J P**	0.086 U	0.082 U	0.49 U	0.48 U	0.32 U	0.31 U	0.41 U	0.27 U	0.3 U	0.27 U
ENDOSULFAN SULFATE	0.1 U	**0.012 J P B**	**0.041 J B**	0.084 U	0.086 U	0.082 U	0.49 U	0.48 U	0.32 U	0.31 U	0.41 U	0.27 U	0.3 U	0.27 U
ENDRIN	**0.22**	**0.099**	**0.14**	**0.11**	**0.089 P**	**0.18**	0.49 U	0.48 U	0.32 U	0.31 U	0.41 U	0.27 U	0.3 U	0.27 U
ENDRIN ALDEHYDE	**0.09 J P**	**0.033 J P**	**0.07 J P**	**0.041 J P**	0.086 U	**0.097**	0.49 U	0.48 U	0.32 U	0.31 U	0.41 U	0.27 U	0.3 U	0.27 U
GAMMA-BHC (LINDANE)	**0.053 J**	**0.028 J P**	**0.037 J P**	**0.016 J P**	**0.028 J P**	**0.034 J P**	**0.19 J P**	**0.094 J P**	0.32 U	0.31 U	0.41 U	0.27 U	0.3 U	0.27 U
HEPTACHLOR	0.1 U	0.085 U	0.095 U	0.084 U	0.086 U	0.082 U	0.49 U	0.48 U	0.32 U	0.31 U	0.41 U	0.27 U	0.3 U	0.27 U
HEPTACHLOR EPOXIDE	**0.12**	**0.042 J**	**0.075 J**	**0.033 J P**	**0.023 J P**	**0.072 J P**	0.49 U	0.48 U	0.32 U	0.31 U	0.41 U	0.27 U	0.3 U	0.27 U
METHOXYCHLOR	**0.064 J P**	**0.16 J**	**0.11 J P**	**0.041 J P**	**0.13 J P**	**0.2 P**	0.98 U	0.95 U	**0.25 J**	**0.24 J**	0.82 U	0.55 U	0.59 U	0.54 U
MIREX	**0.11 P**	**0.064 J P**	**0.029 J P**	**0.017 J P**	**0.029 J P**	**0.28**	0.49 U	**0.16 J**	0.32 U	0.31 U	0.41 U	0.27 U	0.3 U	0.27 U
TOXAPHENE	4 U	3.4 U	3.8 U	3.4 U	3.5 U	3.3 U	20 U	19 U	13 U	13 U	16 U	11 U	12 U	11 U
ORGANOPHOSPHORUS PESTICIDES														
AZINPHOS-METHYL	40 U	34 U	37 U	34 U	34 U	32 U	39 U	38 U	26 U	25 U	32 U	22 U	24 U	21 U
BOLSTAR	40 U	34 U	37 U	34 U	34 U	32 U	39 U	38 U	26 U	25 U	32 U	22 U	24 U	21 U
CHLORPYRIFOS	40 U	34 U	37 U	34 U	34 U	32 U	39 U	38 U	26 U	25 U	32 U	22 U	24 U	21 U
COUMAPHOS	40 U	34 U	37 U	34 U	34 U	32 U	39 U	38 U	26 U	25 U	32 U	22 U	24 U	21 U
DEMETON, TOTAL	80 U	67 U	75 U	67 U	69 U	65 U	77 U	75 U	51 U	50 U	65 U	44 U	47 U	43 U
MALATHION	40 U	34 U	37 U	34 U	34 U	32 U	39 U	38 U	26 U	25 U	32 U	22 U	24 U	21 U
METHYL PARATHION	40 U	34 U	37 U	34 U	34 U	32 U	39 U	38 U	26 U	25 U	32 U	22 U	24 U	21 U
PARATHION	40 U	34 U	37 U	34 U	34 U	32 U	39 U	38 U	26 U	25 U	32 U	22 U	24 U	21 U

Source: MacDonald et al. 1996. *Ecotoxicology* 5: 253-278.

**Proposed Virginia exclusion criteria for placement of dredged material at Weanack.

***Source: Canadian Council of Ministers of the Environment. 2001. Canadian sediment quality guidelines for the protection of aquatic life: Polychlorinated dioxins and furans (PCDD/Fs), in Canadian Environmental Quality Guidelines. Winnipeg.

NOTES: Bold values represent detected concentrations. Shaded concentrations exceed sediment quality guidelines.

RL is reported for non-detected constituents.

RL = average detection limit

TEL = threshold effects level — **exceeds TEL value**

PEL = probable effects level — **exceeds PEL value**

NSL = no screening level

B = compound was detected in the laboratory method blank

J = compound was detected, but below the reporting limit (value is estimated)

P = the percent difference between the original and confirmation analysis is greater than 40%

U = compound was analyzed, but not detected

TABLE 4-14. SEMIVOLATILE ORGANIC COMPOUND (SVOC) CONCENTRATIONS (UG/KG) IN SEDIMENT
JBLE BACK RIVER CHANNEL, HAMPTON, VIRGINIA (DECEMBER 2015)

						Reference Sites		Dredging Unit 1			Dredging Unit 2			Dredging Unit 3			Dredging Unit 4			Dredging Unit 5					Dredging Unit 6		
ANALYTE	UNITS	Average RL	TEL*	PEL*	VA Exclusion Criteria **	Willoughby Bank Reference	Atlantic Ocean Reference	BRC-01	BRC-02	BRC-01/02	BRC-03	BRC-04	BRC-03/04	BRC-05	BRC-06	BRC-05/06	BRC-07	BRC-08	BRC-07/08	BRC-09	BRC-09-FD	BRC-10	BRC-10-FD	BRC-09/10	BRC-11	BRC-12	BRC-11/12
1,2,4-TRICHLOROBENZENE	UG/KG	206	NSL	NSL	400,000	110 U	120 U	150 U	150 U	160 U	190 U	200 U	180 U	200 U	170 U	190 U	170 U	170 U	160 U	190 U	190 U	130 U	120 U	160 U	110 U	120 U	110 U
1,2-DICHLOROBENZENE	UG/KG	206	NSL	NSL	10,000,000	110 U	120 U	150 U	150 U	160 U	190 U	200 U	180 U	200 U	170 U	190 U	170 U	170 U	160 U	190 U	190 U	130 U	120 U	160 U	110 U	120 U	110 U
1,2-DIPHENYLHYDRAZINE(AS AZOBENZENE)	UG/KG	206	NSL	NSL	NSL	110 U	120 U	150 U	150 U	160 U	190 U	200 U	180 U	200 U	170 U	190 U	170 U	170 U	160 U	190 U	190 U	130 U	120 U	160 U	110 U	120 U	110 U
1,3-DICHLOROBENZENE	UG/KG	206	NSL	NSL	5,100,000	110 U	120 U	150 U	150 U	160 U	190 U	200 U	180 U	200 U	170 U	190 U	170 U	170 U	160 U	190 U	190 U	130 U	120 U	160 U	110 U	120 U	110 U
1,4-DICHLOROBENZENE	UG/KG	206	NSL	NSL	570,000	110 U	120 U	150 U	150 U	160 U	190 U	200 U	180 U	200 U	170 U	190 U	170 U	170 U	160 U	190 U	190 U	130 U	120 U	160 U	110 U	120 U	110 U
2,2'-OXYBIS[1-CHLOROPROPANE]	UG/KG	42	NSL	NSL	62,000,000	23 U	24 U	31 U	30 U	33 U	38 U	42 U	37 U	41 U	34 U	38 U	34 U	35 U	33 U	40 U	38 U	26 U	25 U	33 U	22 U	24 U	22 U
2,4,6-TRICHLOROPHENOL	UG/KG	206	NSL	NSL	NSL	110 U	120 U	150 U	150 U	160 U	190 U	200 U	180 U	200 U	170 U	190 U	170 U	170 U	160 U	190 U	190 U	130 U	120 U	160 U	110 U	120 U	110 U
2,4-DICHLOROPHENOL	UG/KG	42	NSL	NSL	1,800,000	23 U	24 U	31 U	30 U	33 U	38 U	42 U	37 U	41 U	34 U	38 U	34 U	35 U	33 U	40 U	38 U	26 U	25 U	33 U	22 U	24 U	22 U
2,4-DIMETHYLPHENOL	UG/KG	206	NSL	NSL	12,000,000	110 U	120 U	150 U	150 U	160 U	190 U	200 U	180 U	200 U	170 U	190 U	170 U	170 U	160 U	190 U	190 U	130 U	120 U	160 U	110 U	120 U	110 U
2,4-DINITROPHENOL	UG/KG	1062	NSL	NSL	1,200,000	570 U	610 U	790 U	760 U	840 U	960 U	1100 U	940 U	1000 U	860 U	960 U	870 U	880 U	830 U	1000 U	970 U	660 U	640 U	840 U	560 U	600 U	550 U
2,4-DINITROTOLUENE	UG/KG	206	NSL	NSL	1,200,000	110 U	120 U	150 U	150 U	160 U	190 U	200 U	180 U	200 U	170 U	190 U	170 U	170 U	160 U	190 U	190 U	130 U	120 U	160 U	110 U	120 U	110 U
2,6-DINITROTOLUENE	UG/KG	206	NSL	NSL	620,000	110 U	120 U	150 U	150 U	160 U	190 U	200 U	180 U	200 U	170 U	190 U	170 U	170 U	160 U	190 U	190 U	130 U	120 U	160 U	110 U	120 U	110 U
2-CHLORONAPHTHALENE	UG/KG	42	NSL	NSL	NA	23 U	24 U	31 U	30 U	33 U	38 U	42 U	37 U	41 U	34 U	38 U	34 U	35 U	33 U	40 U	38 U	26 U	25 U	33 U	22 U	24 U	22 U
2-CHLOROPHENOL	UG/KG	206	NSL	NSL	5,100,000	110 U	120 U	150 U	150 U	160 U	190 U	200 U	180 U	200 U	170 U	190 U	170 U	170 U	160 U	190 U	190 U	130 U	120 U	160 U	110 U	120 U	110 U
2-METHYLPHENOL	UG/KG	206	NSL	NSL	2,800,000	110 U	120 U	150 U	150 U	160 U	190 U	200 U	180 U	200 U	170 U	190 U	170 U	170 U	160 U	190 U	190 U	130 U	120 U	160 U	110 U	120 U	110 U
2-NITROPHENOL	UG/KG	206	NSL	NSL	NSL	110 U	120 U	150 U	150 U	160 U	190 U	200 U	180 U	200 U	170 U	190 U	170 U	170 U	160 U	190 U	190 U	130 U	120 U	160 U	110 U	120 U	110 U
3,3'-DICHLOROBENZIDINE	UG/KG	206	NSL	NSL	3,800	110 U	120 U	150 U	150 U	160 U	190 U	200 U	180 U	200 U	170 U	190 U	170 U	170 U	160 U	190 U	190 U	130 U	120 U	160 U	110 U	120 U	110 U
4,6-DINITRO-2-METHYLPHENOL	UG/KG	1062	NSL	NSL	NSL	570 U	610 U	790 U	760 U	840 U	960 U	1100 U	940 U	1000 U	860 U	960 U	870 U	880 U	830 U	1000 U	970 U	660 U	640 U	840 U	560 U	600 U	550 U
4-BROMOPHENYL PHENYL ETHER	UG/KG	206	NSL	NSL	NSL	110 U	120 U	150 U	150 U	160 U	190 U	200 U	180 U	200 U	170 U	190 U	170 U	170 U	160 U	190 U	190 U	130 U	120 U	160 U	110 U	120 U	110 U
4-CHLORO-3-METHYLPHENOL	UG/KG	206	NSL	NSL	10,000,000	110 U	120 U	150 U	150 U	160 U	190 U	200 U	180 U	200 U	170 U	190 U	170 U	170 U	160 U	190 U	190 U	130 U	120 U	160 U	110 U	120 U	110 U
4-CHLOROPHENYL PHENYL ETHER	UG/KG	206	NSL	NSL	NSL	110 U	120 U	150 U	150 U	160 U	190 U	200 U	180 U	200 U	170 U	190 U	170 U	170 U	160 U	190 U	190 U	130 U	120 U	160 U	110 U	120 U	110 U
4-NITROPHENOL	UG/KG	1062	NSL	NSL	NSL	570 U	610 U	790 U	760 U	840 U	960 U	1100 U	940 U	1000 U	860 U	960 U	870 U	880 U	830 U	1000 U	970 U	660 U	640 U	840 U	560 U	600 U	550 U
BENZIDINE	UG/KG	4179	NSL	NSL	NSL	2300 U	2400 U	3100 U	3000 U	3300 U	3800 U	4200 U	3700 U	4100 U	3400 U	3800 U	3400 U	3500 U	3300 U	4000 U	3800 U	2600 U	2500 U	3300 U	2200 U	2400 U	2200 U
BENZOIC ACID	UG/KG	1062	NSL	NSL	NSL	570 U	610 U	790 U	760 U	840 U	960 U	1100 U	940 U	1000 U	860 U	960 U	870 U	880 U	830 U	1000 U	970 U	660 U	640 U	840 U	560 U	600 U	550 U
BENZYL ALCOHOL	UG/KG	206	NSL	NSL	NSL	110 U	120 U	150 U	150 U	160 U	190 U	200 U	180 U	200 U	170 U	190 U	170 U	170 U	160 U	190 U	190 U	130 U	120 U	160 U	110 U	120 U	110 U
BIS(2-CHLOROETHOXY)METHANE	UG/KG	206	NSL	NSL	1,800,000	110 U	120 U	150 U	150 U	160 U	190 U	200 U	180 U	200 U	170 U	190 U	170 U	170 U	160 U	190 U	190 U	130 U	120 U	160 U	110 U	120 U	110 U
BIS(2-CHLOROETHYL)ETHER	UG/KG	42	NSL	NSL	900	23 U	24 U	31 U	30 U	33 U	38 U	42 U	37 U	41 U	34 U	38 U	34 U	35 U	33 U	40 U	38 U	26 U	25 U	33 U	22 U	24 U	22 U
BIS(2-ETHYLHEXYL) PHTHALATE	UG/KG	417	182	2,647	120,000	230 U	240 U	310 U	300 U	330 U	380 U	410 U	370 U	410 U	340 U	380 U	340 U	350 U	330 U	390 U	380 U	260 U	250 U	330 U	220 U	240 U	220 U
BUTYL BENZYL PHTHALATE	UG/KG	206	NSL	NSL	1,100,000	110 U	120 U	**25 J**	**21 J**	**24 J**	**26 J**	**29 J**	**28 J**	**30 J**	**24 J**	**26 J**	**24 J**	170 U	**24 J**	190 U	190 U	130 U	120 U	160 U	110 U	120 U	110 U
DIBENZOFURAN	UG/KG	206	NSL	NSL	NSL	110 U	120 U	150 U	150 U	160 U	190 U	200 U	180 U	200 U	170 U	190 U	170 U	170 U	160 U	190 U	190 U	130 U	120 U	160 U	110 U	120 U	110 U
DIETHYL PHTHALATE	UG/KG	206	NSL	NSL	490,000,000	110 U	120 U	150 U	150 U	160 U	190 U	200 U	180 U	200 U	170 U	190 U	170 U	170 U	160 U	190 U	190 U	130 U	120 U	160 U	110 U	120 U	110 U
DIMETHYL PHTHALATE	UG/KG	206	NSL	NSL	10,000,000	110 U	120 U	150 U	150 U	160 U	190 U	200 U	180 U	200 U	170 U	190 U	170 U	170 U	160 U	190 U	190 U	130 U	120 U	160 U	110 U	120 U	110 U
DI-N-BUTYL PHTHALATE	UG/KG	206	NSL	NSL	5,700,000	110 U	120 U	150 U	150 U	160 U	190 U	200 U	180 U	200 U	170 U	190 U	170 U	170 U	160 U	190 U	190 U	130 U	120 U	160 U	110 U	120 U	110 U
DI-N-OCTYL PHTHALATE	UG/KG	206	NSL	NSL	1,100,000	110 U	120 U	150 U	150 U	160 U	190 U	200 U	180 U	200 U	170 U	190 U	170 U	170 U	160 U	190 U	190 U	130 U	120 U	160 U	110 U	120 U	110 U
HEXACHLOROBENZENE	UG/KG	42	NSL	NSL	1,100	23 U	24 U	31 U	30 U	33 U	38 U	42 U	37 U	41 U	34 U	38 U	34 U	35 U	33 U	40 U	38 U	26 U	25 U	33 U	22 U	24 U	22 U
HEXACHLOROBUTADIENE	UG/KG	42	NSL	NSL	22,000	23 U	24 U	31 U	30 U	33 U	38 U	42 U	37 U	41 U	34 U	38 U	34 U	35 U	33 U	40 U	38 U	26 U	25 U	33 U	22 U	24 U	22 U
HEXACHLOROCYCLOPENTADIENE	UG/KG	206	NSL	NSL	3,700,000	110 U	120 U	150 U	150 U	160 U	190 U	200 U	180 U	200 U	170 U	190 U	170 U	170 U	160 U	190 U	190 U	130 U	120 U	160 U	110 U	120 U	110 U
HEXACHLOROETHANE	UG/KG	206	NSL	NSL	120,000	110 U	120 U	150 U	150 U	160 U	190 U	200 U	180 U	200 U	170 U	190 U	170 U	170 U	160 U	190 U	190 U	130 U	120 U	160 U	110 U	120 U	110 U
ISOPHORONE	UG/KG	206	NSL	NSL	1,800,000	110 U	120 U	150 U	150 U	160 U	190 U	200 U	180 U	200 U	170 U	190 U	170 U	170 U	160 U	190 U	190 U	130 U	120 U	160 U	110 U	120 U	110 U
METHYLPHENOL, 3 & 4	UG/KG	206	NSL	NSL	NSL	110 U	120 U	150 U	150 U	160 U	190 U	200 U	180 U	200 U	170 U	190 U	170 U	170 U	160 U	190 U	190 U	130 U	120 U	160 U	110 U	120 U	110 U
NITROBENZENE	UG/KG	417	NSL	NSL	280,000	230 U	240 U	310 U	300 U	330 U	380 U	410 U	370 U	410 U	340 U	380 U	340 U	350 U	330 U	390 U	380 U	260 U	250 U	330 U	220 U	240 U	220 U
N-NITROSODIMETHYLAMINE	UG/KG	206	NSL	NSL	NSL	110 U	120 U	150 U	150 U	160 U	190 U	200 U	180 U	200 U	170 U	190 U	170 U	170 U	160 U	190 U	190 U	130 U	120 U	160 U	110 U	120 U	110 U
N-NITROSODI-N-PROPYLAMINE	UG/KG	42	NSL	NSL	660	23 U	24 U	31 U	30 U	33 U	38 U	42 U	37 U	41 U	34 U	38 U	34 U	35 U	33 U	40 U	38 U	26 U	25 U	33 U	22 U	24 U	22 U
N-NITROSODIPHENYLAMINE	UG/KG	206	NSL	NSL	350,000	110 U	120 U	150 U	150 U	160 U	190 U	200 U	180 U	200 U	170 U	190 U	170 U	170 U	160 U	190 U	190 U	130 U	120 U	160 U	110 U	120 U	110 U
PENTACHLOROPHENOL	UG/KG	206	NSL	NSL	9,000	110 U	120 U	150 U	150 U	160 U	190 U	200 U	180 U	200 U	170 U	190 U	170 U	170 U	160 U	190 U	190 U	130 U	120 U	160 U	110 U	120 U	110 U
PHENOL	UG/KG	42	NSL	NSL	180,000,000	23 U	24 U	31 U	30 U	33 U	38 U	42 U	37 U	41 U	34 U	38 U	34 U	35 U	33 U	40 U	38 U	26 U	25 U	33 U	22 U	24 U	22 U

* *Source:* MacDonald et al. 1996. *Ecotoxicology* 5:253-278.

**Proposed Virginia exclusion criteria for placement of dredged material at Weanack.

NOTES: Bold values represent detected concentrations. Shaded concentrations exceed sediment quality guidelines.
RL is reported for non-detected constituents.

RL = average reporting limit

NSL = no screening value

exceeds TEL value

exceeds PEL value

TEL = threshold effects level

PEL = probable effects level

B = compound was detected in the laboratory method blank

J = compound was detected, but below the reporting limit (value is estimated)

U = compound was analyzed, but not detected

TABLE 4-15. ALTERNATE DISPOSAL RESULTS FOR SEDIMENT

JBLE BACK RIVER CHANNEL, HAMPTON, VIRGINIA (DECEMBER 2015)

			Reference Sites		Dredging Unit 1		Dredging Unit 2		Dredging Unit 3		Dredging Unit 4		Dredging Unit 5				Dredging Unit 6		
ANALYTE	UNITS	Average RL	Willoughby Bank Reference	Atlantic Ocean Reference	BRC-01	BRC-02	BRC-03	BRC-04	BRC-05	BRC-06	BRC-07	BRC-08	BRC-09	BRC-09-FD	BRC-10	BRC-10-FD	BRC-11	BRC-12	BRC-11/12
POTENITAL ACIDITY	Tcce/kT		NA	NA	**22.7**	**21.4**	**20.5**	**23.2**	**24.3**	**21.3**	**17.6**	**17.6**	**1.54**	NA	**1.49**	NA	**<.050**	**<.050**	NA
NEUTRALIZATION POTENITAL	Tcce/kT		NA	NA	**18.2**	**19.6**	**14.4**	**19.7**	**12.5**	**<2.7**	**12**	**<2.6**	**10.6**	NA	**9.5**	NA	**6.3**	**5.9**	NA
ACID BASE ACCOUNTING	Tcce/kT		NA	NA	**4.5**	**1.8**	**6.1**	**3.5**	**11.8**	**>18.6**	**5.6**	**>15.0**	**-9.06**	NA	**-8.01**	NA	**< -6.25**	**< -5.85**	NA
NEUTRALIZING VALUE	%		NA	NA	**5.9**	**6.6**	**4.8**	**5.8**	**2.2**	**3.7**	**14.2**	**8.1**	**6.6**	NA	**3.9**	NA	**<.1**	**3.6**	NA
pH	SU	0.1	NA	NA	**8.38**	**7.97**	**7.82**	**7.95**	**7.97**	**8.11**	**8.02**	**7.85**	**8.09**	NA	**8.21**	NA	**8.02**	**7.99**	NA
SALINITY (EC)	dS/m		NA	NA	**19**	**18.7**	**20.5**	**21.3**	**22.3**	**20.4**	**21.6**	**20.8**	**27.9**	NA	**26.4**	NA	**20.2**	**21.5**	NA
FIZZ RATING	--		NA	NA	**None**	**None**	**None**	**None**	**None**	**Strong**	**None**	**Strong**	**None**	NA	**None**	NA	**None**	**None**	NA
PYRITIC SULFUR	%		NA	NA	**<0.100**	**0.371**	**0.174**	**0.128**	**0.132**	**0.498**	**0.364**	**0.296**	**0.25**	NA	**0.19**	NA	**<.010**	**0.13**	NA
PAINT FILTER TEST AND EXTRACTABLE ORGANIC HALOGENS																			
PAINT FILTER TEST	--	--	NA	NA	**CNF**	**CNF**	**CNF**	**CNF**	**CNF**	**CNF**	**CNF**	**CFL**	**CFL**	**CNF**	**CFL**	**CNF**	**CFL**	**CFL**	NA
EXTRACTABLE ORGANIC HALOGENS	MG/KG	395.8	NA	NA	370 U	370 U	460 U	490 U	490 U	410 U	410 U	420 U	480 U	NA	300 U	NA	270 U	280 U	NA
TOTAL PETROLEUM HYDROCARBONS (TPH)																			
GAS RANGE ORGANICS (C6 TO C10)	UG/KG	195	NA	NA	180 U	180 U	230 U	250 U	240 U	200 U	200 U	210 U	230 U	230 U	160 U	150 U	130 U	140 U	NA
DIESEL RANGE ORGANICS (C10 TO C34)	MG/KG	32.64	NA	NA	**25 J B**	**40 B**	**49 B**	**230 B**	**33 J B**	**34 B**	**34 B**	**62 B**	**45**	**43**	**15 J**	**19 J**	**13 J**	**9.6 J**	NA
BTEX																			
BENZENE	UG/KG	9.73	NA	NA	9.3 U	9 U	11 U	12 U	12 U	10 U	10 U	10 U	12 U	NA	7.8 U	NA	6.6 U	7.1 U	NA
TOLUENE	UG/KG	9.73	NA	NA	9.3 U	9 U	11 U	**1.9 J**	12 U	10 U	10 U	10 U	12 U	NA	7.8 U	NA	6.6 U	7.1 U	NA
ETHYLBENZENE	UG/KG	9.73	NA	NA	9.3 U	9 U	11 U	12 U	12 U	10 U	10 U	10 U	12 U	NA	7.8 U	NA	6.6 U	7.1 U	NA
XYLENES (TOTAL)	UG/KG	29.58	NA	NA	28 U	27 U	34 U	37 U	37 U	31 U	31 U	31 U	35 U	NA	23 U	NA	20 U	21 U	NA
IGNITABILITY, REACTIVITY, AND CORROSIVITY (ICR)																			
IGNITABILITY	°F		NA	NA	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**	**NF**	NA	**NF**	NA	**NF**	**NF**	NA
Total Sulfur	mg/kg		NA	NA	**5230**	**5220**	**4580**	**4730**	**4530**	**4500**	**3790**	**4310**	**3370**	NA	**1700**	NA	**634**	**380**	NA
pH	SU		NA	NA	**7.5**	**6.26**	**7.8**	**7.86**	**8.03**	**8.12**	**7.87**	**7.58**	**7.17**	NA	**6.47**	NA	**6.35**	**6.72**	NA

NOTES: Bold values represent detected concentrations. RL is reported for non-detected constituents.
CFL = contains free liquid
CNF = contains no free liquid
NA = Not Analyzed
NF = not flammable
B = compound was detected, but below the reporting limit (value is estimated)
J = compound was detected, but below the reporting limit (value is estimated)
U = compound was analyzed, but not detected

TABLE 4-16. TCLP LEACHATE RESULTS (MG/L AND UG/L) FOR SEDIMENT

JBLE BACK RIVER CHANNEL, HAMPTON, VIRGINIA (DECEMBER 2015)

				Dredging Unit 1			Dredging Unit 2			Dredging Unit 3			Dredging Unit 4			Dredging Unit 5					Dredging Unit 6		
ANALYTE	UNITS	Average RL	TCLP SCREENING VALUE*	BRC-01	BRC-02	BRC-01/02	BRC-03	BRC-04	BRC-03/04	BRC-05	BRC-06	BRC-05/06	BRC-07	BRC-08	BRC-07/08	BRC-09	BRC-09-FD	BRC-10	BRC-10-FD	BRC-09/10	BRC-11	BRC-12	BRC-11/12
METALS																							
ARSENIC	MG/L	0.5	5	0.5 U	0.5 U	NA	0.5 U	0.5 U	NA	0.5 U	0.5 U	NA	0.5 U	0.5 U	NA	0.5 U	NA	**0.042 J**	NA	NA	**0.044 J**	0.5 U	NA
BARIUM	MG/L	2	100	**0.038 J B**	**0.034 J B**	NA	**0.069 J B**	**0.066 J B**	NA	**0.06 J B**	**0.073 J B**	NA	**0.063 J B**	**0.07 J B**	NA	**0.078 J B**	NA	**0.045 J B**	NA	NA	**0.027 J B**	**0.027 J B**	NA
CADMIUM	MG/L	0.5	1	0.5 U	0.5 U	NA	0.5 U	0.5 U	NA	0.5 U	**0.0027 J**	NA	0.5 U	0.5 U	NA	0.5 U	NA	0.5 U	NA	NA	0.5 U	0.5 U	NA
CHROMIUM	MG/L	0.5	5	0.5 U	0.5 U	NA	0.5 U	0.5 U	NA	0.5 U	0.5 U	NA	0.5 U	0.5 U	NA	0.5 U	NA	0.5 U	NA	NA	0.5 U	0.5 U	NA
LEAD	MG/L	0.5	5	0.5 U	0.5 U	NA	0.5 U	0.5 U	NA	0.5 U	**0.025 J**	NA	0.5 U	0.5 U	NA	0.5 U	NA	**0.024 J**	NA	NA	0.5 U	0.5 U	NA
MERCURY	MG/L	0.0002	0.2	0.0002 U	0.0002 U	NA	0.0002 U	0.0002 U	NA	0.0002 U	0.0002 U	NA	0.0002 U	0.0002 U	NA	0.0002 U	NA	0.0002 U	NA	NA	0.0002 U	0.0002 U	NA
SELENIUM	MG/L	0.5	1	0.5 U	0.5 U	NA	0.5 U	0.5 U	NA	0.5 U	0.5 U	NA	0.5 U	**0.03 J**	NA	**0.031 J**	NA	**0.037 J**	NA	NA	**0.031 J**	**0.033 J**	NA
SILVER	MG/L	0.5	5	0.5 U	0.5 U	NA	0.5 U	0.5 U	NA	0.5 U	0.5 U	NA	0.5 U	0.5 U	NA	0.5 U	NA	0.5 U	NA	NA	0.5 U	0.5 U	NA
CHLORINATED PESTICIDES																							
CHLORDANE (TECHNICAL)	MG/L	0.005	0.03	0.005 U	0.005 U	NA	0.005 U	0.005 U	NA	0.005 U	0.005 U	NA	0.005 U	0.005 U	NA	0.005 U	NA	0.005 U	NA	NA	0.005 U	0.005 U	NA
ENDRIN	MG/L	0.0005	0.02	0.0005 U	0.0005 U	NA	0.0005 U	0.0005 U	NA	0.0005 U	0.0005 U	NA	0.0005 U	0.0005 U	NA	0.0005 U	NA	0.0005 U	NA	NA	0.0005 U	0.0005 U	NA
GAMMA-BHC (LINDANE)	MG/L	0.0005	0.4	0.0005 U	0.0005 U	NA	0.0005 U	0.0005 U	NA	0.0005 U	0.0005 U	NA	0.0005 U	0.0005 U	NA	0.0005 U	NA	0.0005 U	NA	NA	0.0005 U	0.0005 U	NA
HEPTACHLOR	MG/L	0.0005	0.008	0.0005 U	0.0005 U	NA	0.0005 U	0.0005 U	NA	0.0005 U	0.0005 U	NA	0.0005 U	0.0005 U	NA	0.0005 U	NA	0.0005 U	NA	NA	0.0005 U	0.0005 U	NA
HEPTACHLOR EPOXIDE	MG/L	0.0005	0.008	0.0005 U	0.0005 U	NA	0.0005 U	0.0005 U	NA	0.0005 U	0.0005 U	NA	0.0005 U	0.0005 U	NA	0.0005 U	NA	0.0005 U	NA	NA	0.0005 U	0.0005 U	NA
METHOXYCHLOR	MG/L	0.001	10	0.001 U	0.001 U	NA	0.001 U	0.001 U	NA	0.001 U	0.001 U	NA	0.001 U	0.001 U	NA	0.001 U	NA	0.001 U	NA	NA	0.001 U	0.001 U	NA
TOXAPHENE	MG/L	0.02	0.5	0.02 U	0.02 U	NA	0.02 U	0.02 U	NA	0.02 U	0.02 U	NA	0.02 U	0.02 U	NA	0.02 U	NA	0.02 U	NA	NA	0.02 U	0.02 U	NA
HERBICIDES																							
2,4,5-TP (SILVEX)	MG/L	0.04	10	0.04 U	0.04 U	NA	0.04 U	0.04 U	NA	0.04 U	0.04 U	NA	0.04 U	0.04 U	NA	0.04 U	NA	0.04 U	NA	NA	0.04 U	0.04 U	NA
2,4-D	MG/L	0.01	1	0.01 U	0.01 U	NA	0.01 U	0.01 U	NA	0.01 U	0.01 U	NA	0.01 U	0.01 U	NA	0.01 U	NA	0.01 U	NA	NA	0.01 U	0.01 U	NA
SEMIVOLATILE ORGANIC COMPOUNDS (SVOCs)																							
1,4-DICHLOROBENZENE	MG/L	0.05	7.5	0.05 U	0.05 U	NA	0.05 U	0.05 U	NA	0.05 U	0.05 U	NA	0.05 U	0.05 U	NA	0.05 U	NA	0.05 U	NA	NA	0.05 U	0.05 U	NA
2,4,5-TRICHLOROPHENOL	MG/L	0.05	400	0.05 U	0.05 U	NA	0.05 U	0.05 U	NA	0.05 U	0.05 U	NA	0.05 U	0.05 U	NA	0.05 U	NA	0.05 U	NA	NA	0.05 U	0.05 U	NA
2,4,6-TRICHLOROPHENOL	MG/L	0.05	2	0.05 U	0.05 U	NA	0.05 U	0.05 U	NA	0.05 U	0.05 U	NA	0.05 U	0.05 U	NA	0.05 U	NA	0.05 U	NA	NA	0.05 U	0.05 U	NA
2,4-DINITROTOLUENE	MG/L	0.05	0.13	0.05 U	0.05 U	NA	0.05 U	0.05 U	NA	0.05 U	0.05 U	NA	0.05 U	0.05 U	NA	0.05 U	NA	0.05 U	NA	NA	0.05 U	0.05 U	NA
2-METHYLPHENOL	MG/L	0.05	200	0.05 U	0.05 U	NA	0.05 U	0.05 U	NA	0.05 U	0.05 U	NA	0.05 U	0.05 U	NA	0.05 U	NA	0.05 U	NA	NA	0.05 U	0.05 U	NA
HEXACHLOROBENZENE	MG/L	0.05	0.13	0.05 U	0.05 U	NA	0.05 U	0.05 U	NA	0.05 U	0.05 U	NA	0.05 U	0.05 U	NA	0.05 U	NA	0.05 U	NA	NA	0.05 U	0.05 U	NA
HEXACHLOROBUTADIENE	MG/L	0.05	0.5	0.05 U	0.05 U	NA	0.05 U	0.05 U	NA	0.05 U	0.05 U	NA	0.05 U	0.05 U	NA	0.05 U	NA	0.05 U	NA	NA	0.05 U	0.05 U	NA
HEXACHLOROETHANE	MG/L	0.05	5	0.05 U	0.05 U	NA	0.05 U	0.05 U	NA	0.05 U	0.05 U	NA	0.05 U	0.05 U	NA	0.05 U	NA	0.05 U	NA	NA	0.05 U	0.05 U	NA
METHYLPHENOL, 3 & 4	MG/L	0.05	200	0.05 U	0.05 U	NA	0.05 U	0.05 U	NA	0.05 U	0.05 U	NA	0.05 U	0.05 U	NA	0.05 U	NA	0.05 U	NA	NA	0.05 U	0.05 U	NA
NITROBENZENE	MG/L	0.05	2	0.05 U	0.05 U	NA	0.05 U	0.05 U	NA	0.05 U	0.05 U	NA	0.05 U	0.05 U	NA	0.05 U	NA	0.05 U	NA	NA	0.05 U	0.05 U	NA
PENTACHLOROPHENOL	MG/L	0.25	100	0.25 U	0.25 U	NA	0.25 U	0.25 U	NA	0.25 U	0.25 U	NA	0.25 U	0.25 U	NA	0.25 U	NA	0.25 U	NA	NA	0.25 U	0.25 U	NA
PYRIDINE	MG/L	0.1	5	0.1 U	0.1 U	NA	0.1 U	0.1 U	NA	0.1 U	0.1 U	NA	0.1 U	0.1 U	NA	0.1 U	NA	0.1 U	NA	NA	0.1 U	0.1 U	NA
VOLATILE ORGANIC COMPOUNDS (VOCs)																							
1,1-DICHLOROETHYLENE	UG/L	0.2	0.7	0.2 U	0.2 U	NA	0.2 U	0.2 U	NA	0.2 U	0.2 U	NA	0.2 U	0.2 U	NA	0.2 U	NA	0.2 U	NA	NA	0.2 U	0.2 U	NA
1,2-DICHLOROETHANE	UG/L	0.2	0.5	0.2 U	0.2 U	NA	0.2 U	0.2 U	NA	0.2 U	0.2 U	NA	0.2 U	0.2 U	NA	0.2 U	NA	0.2 U	NA	NA	0.2 U	0.2 U	NA
2-BUTANONE (MEK)	UG/L	0.2	200	0.2 U	0.2 U	NA	0.2 U	0.2 U	NA	0.2 U	0.2 U	NA	0.2 U	0.2 U	NA	0.2 U	NA	0.2 U	NA	NA	0.2 U	0.2 U	NA
BENZENE	UG/L	0.2	3	0.2 U	0.2 U	NA	0.2 U	0.2 U	NA	0.2 U	0.2 U	NA	0.2 U	0.2 U	NA	0.2 U	NA	0.2 U	NA	NA	0.2 U	0.2 U	NA
CARBON TETRACHLORIDE	UG/L	0.2	0.5	0.2 U	0.2 U	NA	0.2 U	0.2 U	NA	0.2 U	0.2 U	NA	0.2 U	0.2 U	NA	0.2 U	NA	0.2 U	NA	NA	0.2 U	0.2 U	NA
CHLOROBENZENE	UG/L	0.2	100	0.2 U	0.2 U	NA	0.2 U	0.2 U	NA	0.2 U	0.2 U	NA	0.2 U	0.2 U	NA	0.2 U	NA	0.2 U	NA	NA	0.2 U	0.2 U	NA
CHLOROFORM	UG/L	0.2	6	0.2 U	0.2 U	NA	0.2 U	0.2 U	NA	0.2 U	0.2 U	NA	0.2 U	0.2 U	NA	0.2 U	NA	0.2 U	NA	NA	0.2 U	0.2 U	NA
TETRACHLOROETHENE	UG/L	0.2	0.7	0.2 U	0.2 U	NA	0.2 U	0.2 U	NA	0.2 U	0.2 U	NA	0.2 U	0.2 U	NA	0.2 U	NA	0.2 U	NA	NA	0.2 U	0.2 U	NA
TRICHLOROETHENE	UG/L	0.2	0.5	0.2 U	0.2 U	NA	0.2 U	0.2 U	NA	0.2 U	0.2 U	NA	0.2 U	0.2 U	NA	0.2 U	NA	0.2 U	NA	NA	0.2 U	0.2 U	NA
VINYL CHLORIDE	UG/L	0.2	0.2	0.2 U	0.2 U	NA	0.2 U	0.2 U	NA	0.2 U	0.2 U	NA	0.2 U	0.2 U	NA	0.2 U	NA	0.2 U	NA	NA	0.2 U	0.2 U	NA

**Source*: 40 CFR 261.24

NOTE: Bold values represent detected concentrations; RL is reported for non-detected constituents.

J = compound was detected, but below the reporting limit (value is estimated)

U = compound was analyzed, but not detected

5. RECEIVING WATER, SITE WATER AND STANDARD ELUTRIATE RESULTS

Standard elutriates simulate the potential release of dissolved chemical constituents during ocean placement of dredged material. For the JBLE Back River Channel project, a site water sample was collected from one location from the dredging footprint for chemical analysis and preparation of standard elutriates. A total of six standard elutriates were prepared and analyzed for the JBLE Back River Channel project. Four equipment blanks were also collected and submitted for chemical analyses (Appendix D). Receiving water was also collected from the NODS and submitted for chemical analysis for use in the STFATE modeling.

The SET was performed following the procedures in the Inland Testing Manual (USEPA/USACE 1998). For the SET, the laboratory created each elutriate based on a sediment-to-water ratio of 1:4, on a volume basis. The sediment/water mixture was thoroughly mixed for 30 minutes. The mixture was then allowed to settle, and the supernatant was siphoned off, filtered to remove particulates, and then analyzed for the dissolved chemical constituents specified in the Analytical QAPP (Attachment II of the SAP [EA 2015d]). The reported results from the SET included a "dissolved" value for each of the target parameters to be determined. Quantitation limits for the "dissolved" elutriate fraction were the same as for aqueous samples (Table 3-3).

5.1 DATA ANALYSIS

Site water, receiving water, equipment blanks, and standard elutriates were analyzed for target analytes identified in the approved Analytical QAPP (Attachment II of the SAP EA2015d). Project-specific analytical methods and detection limits for aqueous samples are provided in Tables 3-1 and 3-3, respectively.

5.1.1 Comparison to USEPA Saltwater Acute Water Quality Criteria for Aquatic Life

Section 304(a)(1) of the Clean Water Act requires USEPA to develop, publish, and periodically revise criteria for water quality accurately reflecting the latest scientific knowledge. WQC developed under Section 304(a)(1) are based solely on data and scientific judgments on the relationship between pollutant concentrations and environmental effects. National recommended WQC include previously published criteria that are unchanged, criteria that have been recalculated from earlier criteria, and newly calculated criteria based on peer-reviewed assessments and data.

Analytes detected in the full-strength standard elutriates were compared to USEPA saltwater acute WQC (Table 5-1) and are provided on the site water and standard elutriate data tables. Criteria were derived from USEPA's *National Recommended Water Quality Criteria* (2016), and criteria values for chemical constituents that were detected in the standard elutriate samples are provided on the site water and standard elutriate data tables. The USEPA acute criterion is based on 1-hour average exposure concentrations.

5.1.2 Calculation of Acute Ammonia (NH_3-N) Criterion

Un-ionized ammonia (NH_3) is a natural, toxic by-product of animal metabolism, and its toxicity in saltwater is highly dependent on pH, temperature, and salinity in the water column. Therefore, a placement site-specific ammonia criterion value was calculated based on the temperature, pH, and salinity at the mid-depth of the water column at the NODS (Table 2-2). The criterion was based on a salinity of 32.8 parts per thousand (ppt), a temperature of 14.1°C, and a pH of 8.2. The calculated acute ammonia criterion for the standard elutriates was 5.88 mg/L (Table 5-2).

5.1.3 Calculation of Total Polychlorinated Biphenyl Congeners and Total Polycyclic Aromatic Hydrocarbons

For each individual water sample, total PCB concentrations were determined by summing the concentrations of the 18 summation congeners (as specified in Table 5-6 of the *SERIM*) and multiplying the total by a factor of 2. Multiplying by a factor of 2 estimated the total PCB concentration and accounted for additional congeners that were not tested as part of this program. These determinations were based upon testing of specific congeners recommended in the ITM and upon the NOAA (1993) approach for total PCB determinations.

PAHs were also summed because PAHs are usually found in mixtures containing two or more compounds (ATSDR 1995). Total PAH concentrations were determined for each sample by summing the concentrations of the individual PAHs. In addition, total PAHs were determined as total LPAHs (2 or 3 carbon rings) and total HPAHs (4, 5, or 6 carbon rings). HPAHs and LPAHs have different sources as well as act differently in marine environments. LPAHs are often associated with petroleum, while HPAHs are associated with combustion products (NOAA 1989).

- LPAHs included in the total LPAH (as per USEPA/USACE 2008): 1-methylnaphthalene, 2-methylnaphthalene, anthracene, acenaphthene, fluorene, naphthalene, and phenanthrene.

- HPAHs included in the total HPAH (as per USEPA/USACE 2008): benzo(a)anthracene, benzo(a)pyrene, chrysene, dibenzo(a,h)anthracene, fluoranthene, and pyrene.

Three values were reported for total PCBs and total PAHs, representing the following method for treating concentrations below the analytical detection limit:

- Non-detects = 0 (ND=0)
- Non-detects = one-half of the reporting limit (ND=½RL)
- Non-detects = the reporting limit (ND=RL)

Substituting 0 (ND=0), ½ the reporting limit (ND=½RL), and the reporting limit (ND=RL) for each non-detect provides a range of conservative estimates for the concentrations. Substituting ND=RL is the most conservative and produces results that are biased high, especially in data sets where the majority of samples are non-detects. This overestimation is important to consider when comparing the calculated total values to criteria values.

5.1.4 Calculation of Dioxin Toxicity Equivalency Quotients

The TEQs for dioxin and furan congeners were calculated following the approach recommended by the WHO (Van den Berg et al. 2006). Each congener was multiplied by a WHO recommended

TEF for human health (Van den Berg et al. 2006) and then the congener concentrations were summed. Concentrations that were flagged with a "B" (detected in blank) or "Q" (estimated maximum possible concentration) were not included in the TEQ calculation as per the USEPA dioxin validation guidance (USEPA 2005). The dioxin TEQs were calculated using ND=0, ND=½RL, and ND=RL. Substituting the reporting limit (ND=RL) for each value below the RL provides a conservative estimate of the concentration. This method, however, tends to produce results that are biased high, especially in data sets where samples are predominantly non-detected.

5.1.5 Calculation of Total DDTs

For each sample, total DDT concentrations were determined by summing the concentrations of 4'4'-DDT, 4'4'-DDE, and 4'4'-DDD. If one of the DDT components was not detected ("U" qualified), the RL was utilized in the calculation. As noted for PCB congeners and PAHs this results in a conservative estimate of total DDTs.

5.2 RECEIVING WATER, SITE WATER, AND STANDARD ELUTRIATE CHEMISTRY

Results of the receiving water, site water, and standard elutriate chemical analyses are presented in Tables 5-2 through 5-8. Definitions of inorganic, organic, and dioxin and furan data qualifiers are presented in Tables 4-3 through 4-5. Values for detected chemical constituents are bolded in the data tables, and RLs are presented for non-detected constituents. Shaded cells indicate that detected concentrations exceed applicable WQC. Copies of final summary data sheets (Form Is) and analytical narratives that include an evaluation of laboratory QA/QC results are provided in Appendix D. TestAmerica-Pittsburgh will retain and archive the results of these analyses for seven years from the date of issuance of the final results.

5.2.1 Nutrients and General Chemistry Parameters

Results of the nutrient and general chemistry analyses for the receiving water, site water, and standard elutriates are presented in Table 5-2.

5.2.1.a Site Water and Receiving Water Dissolved organic carbon (DOC) was detected at a concentration of 1.1 mg/L in the site water sample and estimated below the laboratory RL in the receiving water sample. Ammonia, nitrogen, nitrate+nitrite, TKN, sulfide, and total phosphorus were not detected in either the receiving water or site water/elutriate preparation water. The laboratory RL for cyanide exceeded the acute WQC for each sample.

5.2.1.b Standard Elutriates Ammonia-nitrogen was detected in the standard elutriates, ranging from 0.79 (BRC-11/12) to 15 (BRC-03/04) mg/L. Concentrations exceeded the calculated acute WQC (5.88 mg/L) in four samples by factors ranging from 1.7 to 2.5 mg/L. DOC and TKN were detected in the standard elutriates ranging from 1.8 to 3.6 mg/L, and 2.8 to 16 mg/L, respectively. DOC was higher in the elutriates than in the receiving water (0.36 mg/L) and site water/elutriate preparation water (1.1 mg/L). The laboratory RL for cyanide exceeded the acute WQC in each of the six standard elutriates. Sulfide was only detected in one sample (BRC-09/10) at a concentration estimated below the laboratory RL. Total phosphorus was detected in four samples (BRC-01/02, BRC-03/04, BRC-05/06, and BRC-07-08) and was estimated at a concentration below the laboratory RL in two of those four (BRC-05/06 and BRC-07/08) (Table 5-1).

5.2.2 Metals and Butyltins

Results of the metal analyses for receiving water, site water, and standard elutriates are presented in Table 5-3. There are no USEPA saltwater acute WQC for aluminum, antimony, barium, beryllium, cobalt, iron, manganese, thallium, or vanadium. Concentrations of metals in the standard elutriates were generally higher than the concentrations in the site water samples. Criteria values for metals were developed for metal concentrations in the dissolved phase, but are applied to the results of total analyses as a conservative comparison, because the site water concentrations were measured as the total recoverable fraction of each tested metal.

5.2.2.a Site Water and Receiving Water Of the 19 tested metals, 9 were detected in the site water and/or receiving water samples, each at a concentration estimated below the laboratory RL. The laboratory RL for silver exceeded the acute WQC in both the site water and receiving water samples. None of the analyzed butyltins were detected in the site water or receiving water samples.

5.2.2.b Standard Elutriates Of the 19 tested metals, 12 were detected in the standard elutriates (beryllium, cadmium, iron, mercury, selenium, silver, and thallium) were not detected. The laboratory RL for silver exceeded the acute WQC in each of the standard elutriates. All of the metals detected in the standard elutriates were also detected in the site water. None of the analyzed butyltins were detected in the standard elutriate samples.

5.2.3 Polycyclic Aromatic Hydrocarbons

Results of the PAH analyses for receiving water, site water, and standard elutriates are presented in Table 5-4. There are no USEPA saltwater acute criteria for any of the individual PAHs or for total PAH concentrations.

5.2.3.a Site Water and Receiving Water None of the individual PAHs were detected in site water or receiving water samples and the total PAH concentration (ND=RL) in each sample was 3.4 micrograms per liter (μg/L), calculated by substituting the RL for each individual PAH.

5.2.3.b Standard Elutriates Ten of the 18 analyzed individual PAHs were detected in one sample (BRC-09/10). Total PAH concentrations (ND=RL) ranged from 3.4 to 4.9 μg/L in the standard elutriates. These totals were based on substitution of the RL for each individual PAH that was not detected in the calculation.

5.2.4 Polychlorinated Biphenyl Congeners

The results of the PCB congener analyses for receiving water, site water, and standard elutriates are presented in Table 5-5. There are no USEPA saltwater acute saltwater criteria for individual or total PCB congeners.

5.2.4.a Site Water and Receiving Water Five individual PCB congeners were detected in the receiving water sample and six individual PCB congeners were detected in the site water sample. The total NOAA PCB (ND=RL) concentrations in the site water and receiving water samples were 37.5 and 29.9 nanograms per liter (ng/L, pptr), respectively. The total USEPA Region 4 PCB (ND=RL) concentrations in the site water and receiving water samples were 52.5 and 42.7 ng/L, respectively.

5.2.4.b Standard Elutriates In the standard elutriates, three individual PCB congeners were detected in BRC-03/04, two individual PCB congeners were detected in BRC-01/02, and one PCB congener was detected in BRC-05/06, BRC-07/08, and BRC-09/10. PCB congeners were not detected in BRC-11/12. The majority of detected concentrations were estimated below the laboratory RL. Concentrations of total NOAA PCBs (ND=RL) ranged from 31.9 (BRC-01/02) to 39.2 (BRC-09/10) ng/L. Concentrations of total USEPA Region 4 PCBs (ND=RL) ranged from 47.5 (BRC-01/02) to 54.7 (BRC-09/10) ng/L.

5.2.5 Dioxin and Furan Congeners

The results of dioxin and furan congener analyses for receiving water, site water, and standard elutriates are presented in Table 5-6. There are no USEPA saltwater acute WQC for dioxin and furan congeners or dioxin TEQs.

5.2.5.a Site Water and Receiving Water Of the 17 tested dioxin and furan congeners analyzed, three were detected at low concentrations and were estimated below the laboratory RL. The most toxic dioxin congener, 2,3,7,8-TCDD, was not detected in the site water or receiving water samples. The dioxin TEQ (ND=RL) values were 104.4 and 104.5 picograms per liter (pg/L, parts per quadrillion) in the receiving water and site water samples, respectively.

5.2.5.b Standard Elutriates Fourteen of the 17 tested dioxin and furan congeners were detected in at least one of the standard elutriates. The most toxic dioxin congener, 2,3,7,8-TCDD, was detected in one elutriate (BRC-09/10) at a concentration estimated below the laboratory RL. The dioxin TEQ (ND=RL) values in the standard elutriates ranged from 33.0 (BRC-09/10) to 114.9 pg/L (BRC-05/06) (Table 5-6).

5.2.6 Chlorinated and Organophosphorus Pesticides

The results of the chlorinated and organophosphorus pesticide analyses for receiving water, site water, and standard elutriates are presented in Table 5-7.

5.2.6.a Site Water and Receiving Water Delta-BHC was the only chlorinated pesticide detected in the site water, and the concentration was estimated below the laboratory RL. None of the tested pesticides were detected in the receiving water. Total DDT (ND=RL) values for each sample were 0.0036 µg/L. None of the organophosphorus pesticides were detected in the site water or receiving water.

5.2.6.b Standard Elutriates In the standard elutriates, 9 of the 25 tested chlorinated pesticides were detected and the majority were estimated at low concentrations below the laboratory RL. Delta-BHC and gamma-BHC were each detected above the RL at low concentrations in at least one standard elutriate sample. Total DDT (ND=RL) values in the standard elutriates ranged from 0.0034 (BRC-05/06) to 0.0039 µg/L (BRC-01/02 and BRC-03/04). None of the organophosphorus pesticides were detected in the standard elutriates (Table 5-7).

5.2.7 Semivolatile Organic Compounds

The results of the SVOC analyses for receiving water, site water, and standard elutriate samples are presented in Table 5-8. Only one SVOC (pentachlorophenol) has a USEPA saltwater acute water quality criterion.

5.2.7.a Site Water and Receiving Water Of the 46 tested SVOCs, none were detected in the site water or receiving water samples.

5.2.7.b Standard Elutriates Bis(2-ethylhexyl)phthalate and butyl benzyl phthalate were the only SVOCs detected in the standard elutriates, and concentrations were each estimated below laboratory RLs. None of the detected SVOCs have USEPA saltwater acute WQC.

5.3 STFATE MODELING AND LIMITING PERMISSIBLE CONCENTRATION COMPLIANCE

To determine whether the elutriates from the JBLE Back River Channel DUs meet the LPC for WQC, STFATE modeling was conducted using the specifications of the NODS (i.e., dimensions and water column properties) and physical characteristics of the sediment (i.e., grain size and specific gravity) collected from each DU. The model predicted the dilution achieved within a 4-hour period inside the boundary of the NODS.

Each of the DUs were modeled separately. STFATE model results demonstrate compliance with the LPC for WQC. As part of the Tier III evaluation, additional STFATE modeling was conducted to determine the maximum dredged material placement volume that would comply with the LPC for both water quality criteria and water column toxicity (Chapter 6). Receiving water concentrations at the NODS were used as background inputs for the STFATE model. For each standard elutriate, the lowest achievable cyanide RL (10 µg/L) exceeded the acute water quality criterion (1.0 µg/L) and required a 9-fold dilution to achieve LPC compliance. This was the most conservative dilution requirement of all the analytes with concentrations that exceeded respective acute WQC in each of the standard elutriates and was therefore used in the STFATE models for each DU. The results of the STFATE modeling to assess compliance with the LPC for Tier II

WQC are summarized in Table 5-9.

STFATE modeling indicated that the required dilution to comply with the LPC would occur for each DU within 4 hours following placement at the NODS and the plume would stay within the site boundary. ***Therefore, the standard elutriates from JBLE Back River Channel DU1 through DU6 meet the LPC for water quality criteria.***

5.4 SUMMARY OF RECEIVING WATER, SITE WATER, AND STANDARD ELUTRIATE RESULTS

One receiving water sample was collected from the NODS and one site water sample was collected from JBLE Back River Channel for chemical analysis and six standard elutriates were prepared. Standard elutriates were created using a composite sediment sample for each DU and the site water sample collected in the JBLE Back River Channel. Analytes detected in the receiving water, site water, and standard elutriates were compared to USEPA saltwater acute WQC. Criteria were derived from USEPA's *National Recommended Water Quality Criteria* (2016). The USEPA acute criteria are based on 1-hour average exposure concentrations.

Comparison of chemical concentrations detected in the standard elutriates created from site sediments and site water indicated that one constituent (ammonia) was detected in the full strength elutriates from four of the six DUs at concentrations that exceeded the USEPA saltwater acute WQC for the protection of aquatic life. The laboratory RLs for cyanide and silver also exceeded respective acute WQC. For the organic constituents, (PAHs, PCB congeners, dioxin and furan congeners, chlorinated pesticides, organophosphorus pesticides, SVOCs, and butyltins) few constituents were detected, and most of the concentrations were low and estimated below the laboratory RL. Cyanide was used in the STFATE modeling to provide the most conservative dilution required for each DU. STFATE modeling indicated that sufficient dilution of the elutriates would occur to meet the acute WQC for cyanide within the first 4 hours following placement and the plume would stay within the site boundary. Therefore, the dredged material for each DU from JBLE Back River Channel meets the ocean placement LPC for water quality criteria.

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TABLE 5-1. USEPA SALTWATER ACUTE WATER QUALITY CRITERIA FOR TARGET ANALYTES
JBLE BACK RIVER CHANNEL, HAMPTON, VIRGINIA (DECEMBER 2015)

ANALYTE	UNITS	ACUTE CRITERIA [a]
NUTRIENTS		
AMMONIA	mg/L	5.88 [b]
CYANIDE	µg/L	1 [c]
METALS		
ARSENIC	µg/L	69 [d][e]
CADMIUM	µg/L	40 [e]
CHROMIUM	µg/L	1,100 [e][f]
COPPER	µg/L	4.8 [e]
LEAD	µg/L	210
MERCURY	µg/L	1.8 [e][g]
NICKEL	µg/L	74 [e]
SILVER	µg/L	1.9 [e]
ZINC	µg/L	90 [e]
CHLORINATED PESTICIDES		
4,4'-DDT	µg/L	0.13 [h]
ALDRIN	µg/L	1.3
CHLORDANE	µg/L	0.09
DIELDRIN	µg/L	0.71
ENDOSULFAN I	µg/L	0.034 [i]
ENDOSULFAN II	µg/L	0.034 [i]
ENDRIN	µg/L	0.037
GAMMA-BHC (LINDANE)	µg/L	0.16
HEPTACHLOR	µg/L	0.053
HEPTACHLOR EPOXIDE	µg/L	0.053 [j]
TOXAPHENE	µg/L	0.21
SVOCs		
PENTACHLOROPHENOL	µg/L	13
BUTYLTINS		
TRIBUTYLTIN	µg/L	0.42

Source : USEPA. 2016. National Recommended Water Quality Criteria.

NOTES:

(a) Acute aquatic life criteria based on 1-hour average exposure concentrations.

(b) Total ammonia as nitrogen, calculated based on salinity, water temperature, and pH as measured at mid-depth of the water column at the NODS on 12/9/15.

(c) Free cyanide as mg CN/L.

(d) Derived based on data for arsenic^{+3}, but applied to total arsenic concentrations.

(e) Saltwater criteria expressed in terms of dissolved metal in the water column.

(f) Derived for hexavalent chromium (Cr^{+6}) but applied here to total chromium concentrations.

(g) Derived from data for inorganic mercury^{+2}, but applied to total mercury concentrations.

(h) This criterion applies to DDT and its metabolites (the total concentration of DDT and its metabolites should not exceed this value).

(i) Value was derived for endosulfan and is most appropriately applied to the sum of endosulfan I and endosulfan II.

(j) This value was derived from data for heptachlor and the criteria document provides insufficient data to estimate the relative toxicities of heptachlor and heptachlor epoxide.

TABLE 5-2. GENERAL CHEMISTY RESULTS FOR RECEIVING WATER, SITE WATER, AND STANDARD ELUTRIATES
JBLE BACK RIVER CHANNEL, HAMPTON, VIRGINIA (DECEMBER 2015)

				Receiving Water	Site Water	Standard Elutriates					
ANALYTE	**UNITS**	**Average RL**	**USEPA ACUTE CRITERIA [(a)]**	**NODS-WAT**	**BRC-WAT**	**BRC-01/02**	**BRC-03/04**	**BRC-05/06**	**BRC-07/08**	**BRC-09/10**	**BRC-11/12**
AMMONIA AS N	MG/L	0.25	5.88	0.1 U	0.1 U	**8.4**	**15**	**15**	**9.8**	**2.3**	**0.79**
CYANIDE, TOTAL	UG/L	10.0	1	10 U [(b)]	10 U [(b)]	10 U [(b)]	10 U [(b)]	10 U [(b)]	10 U [(b)]	10 U [(b)]	10 U [(b)]
NITRATE NITRITE AS N	MG/L	0.1	NSL	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	**0.052 J**	**0.17**
NITROGEN, KJELDAHL	MG/L	5.0	NSL	5 U	5 U	**9**	**16**	**13**	**12**	**2.8 J**	5 U
SULFIDE	MG/L	3.0	NSL	3 U	3 U	3 U	3 U	3 U	3 U	**1.1 J**	3 U
DISSOLVED ORGANIC CARBON	MG/L	1.0	NSL	**0.36 J**	**1.1**	**3.6**	**3.3**	**2.9**	**2.7**	**2.4**	**1.8**
TOTAL PHOSPHORUS AS P	MG/L	0.1	NSL	0.1 U	0.1 U	**0.63**	**0.11**	**0.079 J**	**0.095 J**	0.1 U	0.1 U

Sources: USEPA 2016. *National Recommended Water Quality Criteria.*

(a) Calculated based on salinity of 32.8 ppt, water temperature of 14.1°C, and pH of 8.2 as measured on 12/9/15 at mid-depth of the water column at the NODS.

(b) Laboratory reporting limit exceeds acute water quality criterion

NOTES: Bold values represent detected concentrations. RL is reported for non-detected constituents.

RL = average reporting limit

NSL = No screening level

J = compound was detected, but below the reporting limit (value is estimated)

U = compound was analyzed, but not detected

exceeds acute criterion

TABLE 5-3. METAL AND BUTYLTIN CONCENTRATIONS (UG/L) IN RECEIVING WATER, SITE WATER, AND STANDARD ELUTRIATES
JBLE BACK RIVER CHANNEL, HAMPTON, VIRGINIA (DECEMBER 2015)

				Receiving Water	Site Water	Standard Elutriates					
ANALYTE	UNITS	Average RL	USEPA ACUTE CRITERIA (a)	NODS-WAT	BRC-WAT	BRC-01/02	BRC-03/04	BRC-05/06	BRC-07/08	BRC-09/10	BRC-11/12
ALUMINUM	UG/L	94.0	NSL	**36 J**	**48 J**	**13 J**	150 U	150 U	150 U	**14 J**	150 U
ANTIMONY	UG/L	6.3	NSL	10 U	10 U	**2.7 J B**	**2.5 J B**	**2 J B**	**1.2 J B**	**2.4 J B**	**0.44 J B**
ARSENIC	UG/L	3.1	69	**3.5 J**	**2.2 J**	**26**	**4.8 J**	**3.5 J**	**2.6 J**	**2.4 J**	**2.5 J**
BARIUM	UG/L	31.3	NSL	**6.4 J**	**22 J**	**63**	**50**	**60**	**93**	**37 J**	**26 J**
BERYLLIUM	UG/L	3.1	NSL	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
CADMIUM	UG/L	3.1	33	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
CALCIUM	UG/L	1566.7	NSL	**390000 B**	**240000 B**	**230000**	**230000**	**250000**	**250000**	**240000**	**260000**
CHROMIUM	UG/L	6.3	1100	10 U	10 U	10 U	**2.8 J**	10 U	10 U	10 U	**3.4 J**
COBALT	UG/L	1.6	NSL	**0.46 J**	**0.35 J**	**0.25 J**	**0.29 J**	**0.31 J**	**0.26 J**	**0.31 J**	**0.41 J**
COPPER	UG/L	6.3	4.8	**3 J**	**3.3 J**	**2.6 J**	**2.3 J**	**2.2 J**	**2.4 J**	**2.1 J**	**2.8 J**
IRON	UG/L	156.7	NSL	**70 J**	**61 J**	250 U	250 U	250 U	250 U	250 U	250 U
LEAD	UG/L	3.1	210	5 U	5 U	**0.17 J**	**0.15 J**	5 U	5 U	5 U	5 U
MAGNESIUM	UG/L	1566.7	NSL	**1200000**	**740000**	**740000**	**740000**	**760000**	**780000**	**730000**	**760000**
MANGANESE	UG/L	15.7	NSL	**2.8 J**	**5.8 J**	**24 J**	**73**	**42**	**29**	**26**	**7.6 J**
MERCURY	UG/L	0.2	1.8	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
NICKEL	UG/L	3.1	74	5 U	**0.88 J**	**2.4 J**	**1.4 J**	**1.3 J**	**1.1 J**	**1.5 J**	**2 J**
POTASSIUM	UG/L	1566.7	NSL	**370000**	**220000**	**250000**	**250000**	**250000**	**250000**	**230000**	**240000**
SELENIUM	UG/L	15.7	290	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U
SILVER	UG/L	3.1	1.9	5 U (b)	5 U (b)	5 U (b)	5 U (b)	5 U (b)	5 U (b)	5 U (b)	5 U (b)
SODIUM	UG/L	10566.7	NSL	**9400000**	**6000000**	**5800000**	**5900000**	**5900000**	**5900000**	**6100000**	**6000000**
THALLIUM	UG/L	3.1	NSL	**0.26 J**	5 U	5 U	5 U	5 U	5 U	5 U	5 U
VANADIUM	UG/L	3.1	NSL	5 U	5 U	**62**	**8.7**	**7**	**11**	**2.3 J**	**2.6 J**
ZINC	UG/L	15.7	90	25 U	25 U	**7 J**	**6.6 J**	25 U	25 U	25 U	**5.7 J**
BUTYLTINS											
MONOBUTYLTIN	UG/L	0.61	NSL	0.59 U	0.58 U	0.66 U	0.66 U	0.7 U	0.58 U	0.62 U	0.6 U
DIBUTYLTIN	UG/L	0.04	NSL	0.037 U	0.037 U	0.041 U	0.041 U	0.044 U	0.037 U	0.039 U	0.038 U
TRIBUTYLTIN	UG/L	0.04	0.42	0.043 U	0.042 U	0.048 U	0.048 U	0.051 U	0.042 U	0.045 U	0.044 U
TETRABUTYLTIN	UG/L	0.05	NSL	0.047 U	0.047 U	0.053 U	0.053 U	0.056 U	0.047 U	0.05 U	0.049 U

(a) *Source* : USEPA 2016. *National Recommended Water Quality Criteria.*

(b) Laboratory reporting limit exceeds acute water quality criterion.

NOTES: Bold values represent detected concentrations. Shaded values represent concentrations that exceed water quality criteria.

RL is reported for non-detected constituents.

RL = average method detection limit

NSL = No screening level

exceeds acute criterion

B = compound was detected in the laboratory method blank

J = compound was detected, but below the reporting limit (value is estimated)

U = compound was analyzed, but not detected

TABLE 5-4. PAH CONCENTRATIONS (UG/L) IN RECEIVING WATER, SITE WATER, AND STANDARD ELUTRIATES
JBLE BACK RIVER CHANNEL, HAMPTON, VIRGINIA (DECEMBER 2015)

			Receiving Water	Site Water	Standard Elutriates					
ANALYTE	UNITS	Average RL	NODS-WAT	BRC-WAT	BRC-01/02	BRC-03/04	BRC-05/06	BRC-07/08	BRC-09/10	BRC-11/12
LOW MOLECULAR WEIGHT PAHs (LPAHs)										
1-METHYLNAPHTHALENE	UG/L	0.20	0.19 U	0.19 U	0.2 U	0.19 U	0.22 U	0.19 U	**0.4**	0.19 U
2-METHYLNAPHTHALENE	UG/L	0.20	0.19 U	0.19 U	0.2 U	0.19 U	0.22 U	0.19 U	**0.55**	0.19 U
ACENAPHTHENE	UG/L	0.20	0.19 U	0.19 U	0.2 U	0.19 U	0.22 U	0.19 U	**0.28**	0.19 U
ACENAPHTHYLENE	UG/L	0.20	0.19 U	0.19 U	0.2 U	0.19 U	0.22 U	0.19 U	**0.25**	0.19 U
ANTHRACENE	UG/L	0.20	0.19 U	0.19 U	0.2 U	0.19 U	0.22 U	0.19 U	**0.073 J**	0.19 U
FLUORENE	UG/L	0.20	0.19 U	0.19 U	0.2 U	0.19 U	0.22 U	0.19 U	**0.26**	0.19 U
NAPHTHALENE	UG/L	0.20	0.19 U	0.19 U	0.2 U	0.19 U	0.22 U	0.19 U	**0.97**	0.19 U
PHENANTHRENE	UG/L	0.20	0.19 U	0.19 U	0.2 U	0.19 U	0.22 U	0.19 U	**0.51**	0.19 U
HIGH MOLECULAR WEIGHT PAHs (HPAHs)										
BENZO(A)ANTHRACENE	UG/L	0.20	0.19 U	0.19 U	0.2 U	0.19 U	0.22 U	0.19 U	0.19 U	0.19 U
BENZO(A)PYRENE	UG/L	0.20	0.19 U	0.19 U	0.2 U	0.19 U	0.22 U	0.19 U	0.19 U	0.19 U
BENZO(B)FLUORANTHENE	UG/L	0.20	0.19 U	0.19 U	0.2 U	0.19 U	0.22 U	0.19 U	0.19 U	0.19 U
BENZO(GHI)PERYLENE	UG/L	0.20	0.19 U	0.19 U	0.2 U	0.19 U	0.22 U	0.19 U	0.19 U	0.19 U
BENZO(K)FLUORANTHENE	UG/L	0.20	0.19 U	0.19 U	0.2 U	0.19 U	0.22 U	0.19 U	0.19 U	0.19 U
CHRYSENE	UG/L	0.20	0.19 U	0.19 U	0.2 U	0.19 U	0.22 U	0.19 U	0.19 U	0.19 U
DIBENZO(A,H)ANTHRACENE	UG/L	0.20	0.19 U	0.19 U	0.2 U	0.19 U	0.22 U	0.19 U	0.19 U	0.19 U
FLUORANTHENE	UG/L	0.20	0.19 U	0.19 U	0.2 U	0.19 U	0.22 U	0.19 U	**0.041 J**	0.19 U
INDENO(1,2,3-CD)PYRENE	UG/L	0.20	0.19 U	0.19 U	0.2 U	0.19 U	0.22 U	0.19 U	0.19 U	0.19 U
PYRENE	UG/L	0.20	0.19 U	0.19 U	0.2 U	0.19 U	0.22 U	0.19 U	**0.059 J**	0.19 U
TOTAL PAHs										
TOTAL PAHs (ND=0)	UG/L	--	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**3.4**	**0.0**
TOTAL PAHs (ND=1/2RL)	UG/L	--	**1.7**	**1.7**	**1.8**	**1.7**	**2.0**	**1.7**	**4.2**	**1.7**
TOTAL PAHs (ND=RL)	UG/L	--	**3.4**	**3.4**	**3.6**	**3.4**	**4.0**	**3.4**	**4.9**	**3.4**

There are no USEPA saltwater acute criteria for aquatic life for the tested PAHs or total PAH concentrations.

NOTES: Bold values represent detected concentrations. RL is reported for non-detected constituents.

RL = reporting limit

J = compound was detected, but below the reporting limit (value is estimated)

U = compound was analyzed, but not detected

TABLE 5-5. PCB CONGENER CONCENTRATIONS (NG/L) IN RECEIVING WATER, SITE WATER, AND STANDARD ELUTRIATES

JBLE BACK RIVER CHANNEL, HAMPTON, VIRGINIA (DECEMBER 2015)

			Receiving Water	Site Water	Standard Elutriates					
ANALYTE	UNITS	Average RL	NODS-WAT	BRC-WAT	BRC-01/02	BRC-03/04	BRC-05/06	BRC-07/08	BRC-09/10	BRC-11/12
PCB 8 (BZ)*	NG/L	11.77	0.94 U	0.94 U	0.97 U	0.97 U	0.96 U	0.96 U	**3.1 P**	0.95 U
PCB 18 (BZ)*	NG/L	11.77	0.94 U	0.94 U	0.97 U	0.97 U	0.96 U	0.96 U	0.97 U	0.95 U
PCB 28 (BZ)*	NG/L	11.77	0.94 U	**4 P**	**0.31 J P**	**1.1 P**	0.96 U	0.96 U	0.97 U	0.95 U
PCB 44 (BZ)*	NG/L	3.07	**0.2 J P**	**1.8 P**	**0.14 J P**	**1.9 P**	**0.11 J P**	**0.078 J P**	0.97 U	0.95 U
PCB 49 (BZ)	NG/L	11.77	0.94 U	0.94 U	0.97 U	0.97 U	0.96 U	0.96 U	0.97 U	0.95 U
PCB 52 (BZ)*	NG/L	11.77	0.94 U	0.94 U	0.97 U	0.97 U	0.96 U	0.96 U	0.97 U	0.95 U
PCB 66 (BZ)*	NG/L	3.07	0.94 U	0.94 U	0.97 U	0.97 U	0.96 U	0.96 U	0.97 U	0.95 U
PCB 77 (BZ)*	NG/L	3.07	0.94 U	0.94 U	0.97 U	0.97 U	0.96 U	0.96 U	0.97 U	0.95 U
PCB 87 (BZ)	NG/L	3.07	0.94 U	0.94 U	0.97 U	0.97 U	0.96 U	0.96 U	0.97 U	0.95 U
PCB 101 (BZ)*	NG/L	3.07	0.94 U	**0.77 J P**	0.97 U	**1**	0.96 U	0.96 U	0.97 U	0.95 U
PCB 105 (BZ)*	NG/L	3.07	0.94 U	**0.18 J P**	0.97 U	0.97 U	0.96 U	0.96 U	0.97 U	0.95 U
PCB 118 (BZ)*	NG/L	3.07	0.94 U	0.94 U	0.97 U	0.97 U	0.96 U	0.96 U	0.97 U	0.95 U
PCB 126 (BZ)*	NG/L	3.07	**0.41 J P**	0.94 U	0.97 U	0.97 U	0.96 U	0.96 U	0.97 U	0.95 U
PCB 128 (BZ)*	NG/L	3.07	0.94 U	0.94 U	0.97 U	0.97 U	0.96 U	0.96 U	0.97 U	0.95 U
PCB 138 (BZ)*	NG/L	3.07	0.94 U	**0.23 J P**	0.97 U	0.97 U	0.96 U	0.96 U	0.97 U	0.95 U
PCB 153 (BZ)*	NG/L	3.07	**0.34 J P**	0.94 U	0.97 U	0.97 U	0.96 U	0.96 U	0.97 U	0.95 U
PCB 156 (BZ)	NG/L	3.07	0.94 U	0.94 U	0.97 U	0.97 U	0.96 U	0.96 U	0.97 U	0.95 U
PCB 169 (BZ)*	NG/L	3.07	**0.35 J P**	0.94 U	0.97 U	0.97 U	0.96 U	0.96 U	0.97 U	0.95 U
PCB 170 (BZ)*	NG/L	3.07	0.94 U	0.94 U	0.97 U	0.97 U	0.96 U	0.96 U	0.97 U	0.95 U
PCB 180 (BZ)*	NG/L	3.07	0.94 U	0.94 U	0.97 U	0.97 U	0.96 U	0.96 U	0.97 U	0.95 U
PCB 183 (BZ)	NG/L	3.07	0.94 U	0.94 U	0.97 U	0.97 U	0.96 U	0.96 U	0.97 U	0.95 U
PCB 184 (BZ)	NG/L	3.07	0.94 U	0.94 U	0.97 U	0.97 U	0.96 U	0.96 U	0.97 U	0.95 U
PCB 187 (BZ)*	NG/L	3.07	0.94 U	**0.47 J P**	0.97 U	0.97 U	0.96 U	0.96 U	0.97 U	0.95 U
PCB 195 (BZ)	NG/L	3.07	**0.29 J P**	0.94 U	0.97 U	0.97 U	0.96 U	0.96 U	0.97 U	0.95 U
PCB 206 (BZ)	NG/L	3.07	0.94 U	0.94 U	0.97 U	0.97 U	0.96 U	0.96 U	0.97 U	0.95 U
PCB 209 (BZ)	NG/L	3.07	0.94 U	0.94 U	0.97 U	0.97 U	0.96 U	0.96 U	0.97 U	0.95 U
TOTAL NOAA PCBs (ND=0)	NG/L	--	**1.7**	**14.9**	**0.9**	**8.0**	**0.2**	**0.2**	**6.2**	**0.0**
TOTAL NOAA PCBs (ND=1/2RL)	NG/L	--	**15.8**	**26.2**	**16.4**	**22.6**	**16.5**	**16.5**	**22.7**	**17.1**
TOTAL NOAA PCBs (ND=RL)	NG/L	--	**29.9**	**37.5**	**31.9**	**37.1**	**32.9**	**32.8**	**39.2**	**34.2**
TOTAL REGION 4 PCBs (ND=0)**	NG/L	--	**3.2**	**14.9**	**0.9**	**8.0**	**0.2**	**0.2**	**6.2**	**0.0**
TOTAL REGION 4 PCBs (ND=1/2RL)**	NG/L	--	**22.9**	**33.7**	**24.2**	**30.3**	**24.2**	**24.2**	**30.5**	**24.7**
TOTAL REGION 4 PCBs (ND=RL)**	NG/L	--	**42.7**	**52.5**	**47.5**	**52.6**	**48.2**	**48.2**	**54.7**	**49.4**

*PCB congeners used for Total NOAA PCB summation (SERIM 2008)

** Total Region 4 PCBs represents the sum of all PCBs in table 6-7 (SERIM2008)

There are no USEPA saltwater acute criteria for aquatic life for the tested PCB congeners or total PCB concentrations.

NOTES: Bold values represent detected concentrations. RL is reported for non-detected constituents.

RL = average detection limit

J = compound was detected, but below the reporting limit (value is estimated)

P = the percent difference between the original and confirmation analysis is greater than 40%

U = compound was analyzed, but not detected

TABLE 5-6. DIOXIN AND FURAN CONGENER CONCENTRATIONS (NG/L) IN RECEIVING WATER, SITE WATER, AND STANDARD ELUTRIATES

JBLE BACK RIVER CHANNEL, HAMPTON, VIRGINIA (DECEMBER 2015)

ANALYTE	UNITS	Average RL	TEF*	Receiving Water	Site Water	Standard Elutriates					
				NODS-WAT	BRC-WAT	BRC-01/02	BRC-03/04	BRC-05/06	BRC-07/08	BRC-09/10	BRC-11/12
2,3,7,8-TCDD	PG/L	10.0	1	9.2 U	9.3 U	11 U	11 U	11 U	9.9 U	**0.16 Q J**	9.9 U
1,2,3,7,8-PECDD	PG/L	49.9	1	46 U	46 U	54 U	53 U	53 U	49 U	**0.48 Q J**	49 U
1,2,3,4,7,8-HXCDD	PG/L	49.9	0.1	46 U	46 U	**0.92 Q J**	53 U	53 U	49 U	50 U	**0.46 J**
1,2,3,6,7,8-HXCDD	PG/L	49.9	0.1	46 U	46 U	**1.3 Q B J**	**0.73 Q B J**	53 U	**0.4 Q B J**	50 U	**0.55 B J**
1,2,3,7,8,9-HXCDD	PG/L	49.9	0.1	46 U	46 U	**3.5 C B J**	**1.6 B J**	**0.74 Q B J**	**0.85 B J**	**1.1 C B J**	**1.2 C B J**
1,2,3,4,6,7,8-HPCDD	PG/L	49.9	0.01	**0.48 Q B J**	**1.1 Q B J**	**44 B J**	**24 B J**	**8.5 B J**	**11 B J**	**16 B J**	**12 B J**
OCDD	PG/L	100.2	0.0003	**2.8 B J**	**22 B J**	**810 B**	**400 B**	**140 B**	**310 B**	**300 B**	**200 B**
2,3,7,8-TCDF	PG/L	10.0	0.1	9.2 U	9.3 U	11 U	11 U	11 U	9.9 U	9.9 U	9.9 U
1,2,3,7,8-PECDF	PG/L	49.9	0.03	46 U	46 U	54 U	53 U	53 U	49 U	50 U	**0.34 B J**
2,3,4,7,8-PECDF	PG/L	49.9	0.3	46 U	46 U	54 U	53 U	53 U	49 U	**0.29 Q B J**	**0.29 B J**
1,2,3,4,7,8-HXCDF	PG/L	49.9	0.1	46 U	46 U	54 U	53 U	53 U	49 U	50 U	49 U
1,2,3,6,7,8-HXCDF	PG/L	49.9	0.1	46 U	46 U	54 U	53 U	53 U	**0.27 Q B J**	50 U	**0.24 B J**
1,2,3,7,8,9-HXCDF	PG/L	49.9	0.1	46 U	46 U	54 U	53 U	53 U	49 U	50 U	49 U
2,3,4,6,7,8-HXCDF	PG/L	49.9	0.1	46 U	46 U	54 U	53 U	53 U	49 U	50 U	**0.22 Q B J**
1,2,3,4,6,7,8-HPCDF	PG/L	49.9	0.01	46 U	46 U	**1.5 Q B J**	**1.2 B J**	**0.53 Q B J**	**0.31 Q B J**	**0.56 Q B J**	**0.73 Q B J**
1,2,3,4,7,8,9-HPCDF	PG/L	49.9	0.01	46 U	46 U	54 U	53 U	53 U	49 U	50 U	**0.31 B J**
OCDF	PG/L	100.2	0.0003	**0.74 Q B J**	**1.4 Q B J**	**1.5 B J**	**1.7 B J**	**0.77 B J**	**0.65 B J**	**1.8 Q B J**	**1.4 B J**
DIOXIN TEQ (ND=0)	PG/L	--	--	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
DIOXIN TEQ (ND=1/2RL)	PG/L	--	--	**52.2**	**52.3**	**53.0**	**54.8**	**57.5**	**48.1**	**16.5**	**34.8**
DIOXIN TEQ (ND=RL)	PG/L	--	--	**104.4**	**104.5**	**106.1**	**109.6**	**114.9**	**96.2**	**33.0**	**69.7**

**Source*: The 2005 World Health Organization Re-evaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-like Compounds.

Toxicological Sciences 2006 93(2):223-241.

There are no USEPA saltwater acute criteria for the tested dioxin and furan congeners.

NOTES: Bold values represent detected concentrations.

RL is reported for non-detected constituents.

RL = average reporting limit

TEF = toxicity equivalency factor

TEQ = toxicity equivalency quotient

B = detected in the laboratory method blank

J = compound was detected, but below the reporting limit (value is estimated)

Q = estimated maximum possible concentration

U = compound was analyzed, but not detected

TABLE 5-7. CHLORINATED AND ORGANOPHOSPHORUS PESTICIDE CONCENTRATIONS (UG/L) IN RECEIVING WATER, SITE WATER, AND STANDARD ELUTRIATES

JBLE BACK RIVER CHANNEL, HAMPTON, VIRGINIA (DECEMBER 2015)

ANALYTE	UNITS	Average RL	USEPA ACUTE CRITERIA *	Receiving Water	Site Water	Standard Elutriates					
				NODS-WAT	BRC-WAT	BRC-01/02	BRC-03/04	BRC-05/06	BRC-07/08	BRC-09/10	BRC-11/12
2,4'-DDD	UG/L	0.0013	NSL	0.0012 U	0.0012 U	0.0013 U	0.0013 U	0.0013 U	0.0012 U	0.0013 U	0.0013 U
2,4'-DDE	UG/L	0.0013	NSL	0.0012 U	0.0012 U	**0.00045 J P**	**0.00015 J P**	0.0013 U	0.0012 U	**0.00055 J**	0.0013 U
2,4'-DDT	UG/L	0.0013	NSL	0.0012 U	0.0012 U	0.0013 U	0.0013 U	0.0013 U	0.0012 U	0.0013 U	0.0013 U
4,4'-DDD	UG/L	0.0012	NSL	0.0012 U	0.0012 U	0.0013 U	0.0013 U	**0.00079 J**	0.0012 U	**0.0012 J b**	**0.00097 J P**
4,4'-DDE	UG/L	0.0012	NSL	0.0012 U	0.0012 U	0.0013 U	0.0013 U	0.0013 U	0.0012 U	0.0013 U	0.0013 U
4,4'-DDT	UG/L	0.0012	0.13	0.0012 U	0.0012 U	0.0013 U	0.0013 U	0.0013 U	0.0012 U	0.0013 U	0.0013 U
TOTAL DDT (ND=RL)	UG/L	--	NSL	**0.0036**	**0.0036**	**0.0039**	**0.0039**	**0.0034**	**0.0036**	**0.0038**	**0.0036**
ALDRIN	UG/L	0.0013	1.3	0.0012 U	0.0012 U	0.0013 U	0.0013 U	0.0013 U	0.0012 U	0.0013 U	0.0013 U
ALPHA-BHC	UG/L	0.0013	NSL	0.0012 U	0.0012 U	**0.001 J**	0.0013 U	0.0013 U	**0.00087 J**	**0.00089 J P**	0.0013 U
BETA-BHC	UG/L	0.0013	NSL	0.0012 U	0.0012 U	0.0013 U	0.0013 U	**0.0012 J P**	**0.0017 P**	**0.0018 P**	**0.001 J P**
CHLORDANE (TECHNICAL)	UG/L	0.0130	0.09	0.012 U	0.012 U	0.013 U	0.013 U	0.013 U	0.012 U	0.012 U	0.012 U
CHLOROBENSIDE	UG/L	0.0033	NSL	0.003 U	0.003 U	0.0032 U	0.0032 U	0.0032 U	0.003 U	0.0031 U	0.0031 U
DCPA	UG/L	0.0026	NSL	0.0024 U	0.0024 U	**0.0004 J P**	**0.001 J**	**0.0013 J**	**0.00036 J P**	0.0025 U	**0.00047 J P**
DELTA-BHC	UG/L	0.0013	NSL	0.0012 U	**0.0008 J P**	**0.0027**	**0.0023**	**0.0029 P**	**0.0021 P**	**0.005**	**0.0023 P**
DIELDRIN	UG/L	0.0012	0.71	0.0012 U	0.0012 U	0.0013 U	0.0013 U	0.0013 U	0.0012 U	0.0013 U	0.0013 U
ENDOSULFAN I	UG/L	0.0013	0.034	0.0012 U	0.0012 U	0.0013 U	0.0013 U	0.0013 U	0.0012 U	0.0013 U	0.0013 U
ENDOSULFAN II	UG/L	0.0013	0.034	0.0012 U	0.0012 U	0.0013 U	0.0013 U	0.0013 U	0.0012 U	0.0013 U	0.0013 U
ENDOSULFAN SULFATE	UG/L	0.0013	0.034	0.0012 U	0.0012 U	0.0013 U	0.0013 U	0.0013 U	0.0012 U	0.0013 U	0.0013 U
ENDRIN	UG/L	0.0013	0.037	0.0012 U	0.0012 U	0.0013 U	0.0013 U	0.0013 U	0.0012 U	0.0013 U	0.0013 U
ENDRIN ALDEHYDE	UG/L	0.0013	0.037	0.0012 U	0.0012 U	0.0013 U	0.0013 U	0.0013 U	0.0012 U	0.0013 U	0.0013 U
GAMMA-BHC (LINDANE)	UG/L	0.0012	0.16	0.0012 U	0.0012 U	0.0013 U	0.0013 U	0.0013 U	**0.00077 J P**	**0.0013**	**0.0015**
HEPTACHLOR	UG/L	0.0012	0.053	0.0012 U	0.0012 U	0.0013 U	0.0013 U	0.0013 U	0.0012 U	**0.00098 J P**	0.0013 U
HEPTACHLOR EPOXIDE	UG/L	0.0012	0.053	0.0012 U	0.0012 U	0.0013 U	0.0013 U	0.0013 U	0.0012 U	0.0013 U	0.0013 U
METHOXYCHLOR	UG/L	0.0026	NSL	0.0024 U	0.0024 U	0.0025 U	0.0025 U	0.0025 U	0.0024 U	0.0025 U	0.0025 U
MIREX	UG/L	0.0012	NSL	0.0012 U	0.0012 U	**0.00076 J**	**0.00055 J P**	0.0013 U	0.0012 U	**0.00082 J**	0.0013 U
TOXAPHENE	UG/L	0.10	0.21	0.094 U	0.094 U	0.1 U	0.1 U	0.1 U	0.095 U	0.098 U	0.098 U
ORGANOPHOSPHORUS PESTICIDES											
AZINPHOS-METHYL	UG/L	0.95	NSL	0.94 U	0.94 U	0.95 U	1 U	0.99 U	0.95 U	0.96 U	0.94 U
DEMETON, TOTAL	UG/L	1.91	NSL	1.9 U	1.9 U	1.9 U	2 U	2 U	1.9 U	1.9 U	1.9 U
MALATHION	UG/L	0.95	NSL	0.94 U	0.94 U	0.95 U	1 U	0.99 U	0.95 U	0.96 U	0.94 U
METHYL PARATHION	UG/L	0.95	NSL	0.94 U	0.94 U	0.95 U	1 U	0.99 U	0.95 U	0.96 U	0.94 U
PARATHION	UG/L	0.95	NSL	0.94 U	0.94 U	0.95 U	1 U	0.99 U	0.95 U	0.96 U	0.94 U

**Sources* : USEPA 2016. *National Recommended Water Quality Criteria.*

NOTES: Bold values represent detected concentrations. Shaded values represent concentrations that exceed water quality criteria.

RL is reported for non-detected constituents.

RL = average detection limit

NSL = No screening level

J = compound was detected, but below the reporting limit (value is estimated)

P = the percent difference between the original and confirmation analysis is greater than 40%

U = compound was analyzed, but not detected

TABLE 5-8. SEMIVOLATILE ORGANIC COMPOUND (SVOC) CONCENTRATIONS (UG/L) IN RECEIVING WATER, SITE WATER, AND STANDARD ELUTRIATES
JBLE BACK RIVER CHANNEL, HAMPTON, VIRGINIA (DECEMBER 2015)

ANALYTE	UNITS	Average RL	USEPA ACUTE CRITERIA *	Receiving Water	Site Water	Standard Elutriates					
				NODS-WAT	BRC-WAT	BRC-01/02	BRC-03/04	BRC-05/06	BRC-07/08	BRC-09/10	BRC-11/12
1,2,4-TRICHLOROBENZENE	UG/L	0.98	NSL	0.93 U	0.93 U	1 U	0.96 U	1.1 U	0.96 U	0.93 U	0.93 U
1,2-DICHLOROBENZENE	UG/L	0.98	NSL	0.93 U	0.93 U	1 U	0.96 U	1.1 U	0.96 U	0.93 U	0.93 U
1,2-DIPHENYLHYDRAZINE(AS AZOBENZENE)	UG/L	0.98	NSL	0.93 U	0.93 U	1 U	0.96 U	1.1 U	0.96 U	0.93 U	0.93 U
1,3-DICHLOROBENZENE	UG/L	0.98	NSL	0.93 U	0.93 U	1 U	0.96 U	1.1 U	0.96 U	0.93 U	0.93 U
1,4-DICHLOROBENZENE	UG/L	0.98	NSL	0.93 U	0.93 U	1 U	0.96 U	1.1 U	0.96 U	0.93 U	0.93 U
2,2'-OXYBIS[1-CHLOROPROPANE]	UG/L	0.87	NSL	0.93 U	0.93 U	1 U	0.96 U	1.1 U	0.96 U	0.93 U	0.93 U
2,4,6-TRICHLOROPHENOL	UG/L	0.98	NSL	0.93 U	0.93 U	1 U	0.96 U	1.1 U	0.96 U	0.93 U	0.93 U
2,4-DICHLOROPHENOL	UG/L	0.87	NSL	0.93 U	0.93 U	1 U	0.96 U	1.1 U	0.96 U	0.93 U	0.93 U
2,4-DIMETHYLPHENOL	UG/L	0.98	NSL	0.93 U	0.93 U	1 U	0.96 U	1.1 U	0.96 U	0.93 U	0.93 U
2,4-DINITROPHENOL	UG/L	4.85	NSL	4.6 U	4.6 U	5 U	4.8 U	5.4 U	4.8 U	4.6 U	4.6 U
2,4-DINITROTOLUENE	UG/L	0.98	NSL	0.93 U	0.93 U	1 U	0.96 U	1.1 U	0.96 U	0.93 U	0.93 U
2,6-DINITROTOLUENE	UG/L	0.98	NSL	0.93 U	0.93 U	1 U	0.96 U	1.1 U	0.96 U	0.93 U	0.93 U
2-CHLORONAPHTHALENE	UG/L	0.20	NSL	0.19 U	0.19 U	0.2 U	0.19 U	0.22 U	0.19 U	0.19 U	0.19 U
2-CHLOROPHENOL	UG/L	0.98	NSL	0.93 U	0.93 U	1 U	0.96 U	1.1 U	0.96 U	0.93 U	0.93 U
2-METHYLPHENOL	UG/L	0.98	NSL	0.93 U	0.93 U	1 U	0.96 U	1.1 U	0.96 U	0.93 U	0.93 U
2-NITROPHENOL	UG/L	0.98	NSL	0.93 U	0.93 U	1 U	0.96 U	1.1 U	0.96 U	0.93 U	0.93 U
3,3'-DICHLOROBENZIDINE	UG/L	0.98	NSL	0.93 U	0.93 U	1 U	0.96 U	1.1 U	0.96 U	0.93 U	0.93 U
4,6-DINITRO-2-METHYLPHENOL	UG/L	4.85	NSL	4.6 U	4.6 U	5 U	4.8 U	5.4 U	4.8 U	4.6 U	4.6 U
4-BROMOPHENYL PHENYL ETHER	UG/L	0.98	NSL	0.93 U	0.93 U	1 U	0.96 U	1.1 U	0.96 U	0.93 U	0.93 U
4-CHLORO-3-METHYLPHENOL	UG/L	0.98	NSL	0.93 U	0.93 U	1 U	0.96 U	1.1 U	0.96 U	0.93 U	0.93 U
4-CHLOROPHENYL PHENYL ETHER	UG/L	0.98	NSL	0.93 U	0.93 U	1 U	0.96 U	1.1 U	0.96 U	0.93 U	0.93 U
4-NITROPHENOL	UG/L	4.85	NSL	4.6 U	4.6 U	5 U	4.8 U	5.4 U	4.8 U	4.6 U	4.6 U
BENZIDINE	UG/L	19.63	NSL	19 U	19 U F1	20 U	19 U	22 U	19 U	19 U	19 U
BENZOIC ACID	UG/L	4.85	NSL	4.6 U	4.6 U	5 U	4.8 U	5.4 U	4.8 U	4.6 U	4.6 U
BENZYL ALCOHOL	UG/L	0.98	NSL	0.93 U	0.93 U	1 U	0.96 U	1.1 U	0.96 U	0.93 U	0.93 U
BIS(2-CHLOROETHOXY)METHANE	UG/L	0.98	NSL	0.93 U	0.93 U	1 U	0.96 U	1.1 U	0.96 U	0.93 U	0.93 U
BIS(2-CHLOROETHYL)ETHER	UG/L	0.87	NSL	0.93 U	0.93 U	1 U	0.96 U	1.1 U	0.96 U	0.93 U	0.93 U
BIS(2-ETHYLHEXYL) PHTHALATE	UG/L	1.96	NSL	1.9 U	1.9 U	**0.68 J**	**0.5 J**	**0.67 J**	1.9 U	1.9 U	**0.82 J**
BUTYL BENZYL PHTHALATE	UG/L	0.98	NSL	0.93 U	0.93 U	1 U	**0.23 J**	**0.4 J**	**0.23 J**	**0.25 J**	0.93 U
DIBENZOFURAN	UG/L	0.98	NSL	0.93 U	0.93 U	1 U	0.96 U	1.1 U	0.96 U	0.93 U	0.93 U
DIETHYL PHTHALATE	UG/L	0.98	NSL	0.93 U	0.93 U	1 U	0.96 U	1.1 U	0.96 U	0.93 U	0.93 U
DIMETHYL PHTHALATE	UG/L	0.98	NSL	0.93 U	0.93 U	1 U	0.96 U	1.1 U	0.96 U	0.93 U	0.93 U
DI-N-BUTYL PHTHALATE	UG/L	0.98	NSL	0.93 U	0.93 U	1 U	0.96 U	1.1 U	0.96 U	0.93 U	0.93 U
DI-N-OCTYL PHTHALATE	UG/L	0.98	NSL	0.93 U	0.93 U	1 U	0.96 U	1.1 U	0.96 U	0.93 U	0.93 U
HEXACHLOROBENZENE	UG/L	0.87	NSL	0.93 U	0.93 U	1 U	0.96 U	1.1 U	0.96 U	0.93 U	0.93 U
HEXACHLOROBUTADIENE	UG/L	0.87	NSL	0.93 U	0.93 U	1 U	0.96 U	1.1 U	0.96 U	0.93 U	0.93 U
HEXACHLOROCYCLOPENTADIENE	UG/L	0.98	NSL	0.93 U	0.93 U	1 U	0.96 U	1.1 U	0.96 U	0.93 U	0.93 U
HEXACHLOROETHANE	UG/L	0.98	NSL	0.93 U	0.93 U	1 U	0.96 U	1.1 U	0.96 U	0.93 U	0.93 U
ISOPHORONE	UG/L	0.98	NSL	0.93 U	0.93 U	1 U	0.96 U	1.1 U	0.96 U	0.93 U	0.93 U
METHYLPHENOL, 3 & 4	UG/L	0.98	NSL	0.93 U	0.93 U	1 U	0.96 U	1.1 U	0.96 U	0.93 U	0.93 U
NITROBENZENE	UG/L	1.96	NSL	1.9 U	1.9 U	2 U	1.9 U	2.2 U	1.9 U	1.9 U	1.9 U
N-NITROSODIMETHYLAMINE	UG/L	0.98	NSL	0.93 U	0.93 U	1 U	0.96 U	1.1 U	0.96 U	0.93 U	0.93 U
N-NITROSODI-N-PROPYLAMINE	UG/L	0.87	NSL	0.93 U	0.93 U	1 U	0.96 U	1.1 U	0.96 U	0.93 U	0.93 U
N-NITROSODIPHENYLAMINE	UG/L	0.98	NSL	0.93 U	0.93 U	1 U	0.96 U	1.1 U	0.96 U	0.93 U	0.93 U
PENTACHLOROPHENOL	UG/L	0.98	13	0.93 U	0.93 U	1 U	0.96 U	1.1 U	0.96 U	0.93 U	0.93 U
PHENOL	UG/L	0.87	NSL	0.93 U	0.93 U	1 U	0.96 U	1.1 U	0.96 U	0.93 U	0.93 U

**Sources* : USEPA 2016. *National Recommended Water Quality Criteria* .

NOTES: Bold values represent detected concentrations. Shaded values represent concentrations that exceed water quality criteria.

RL is reported for non-detected constituents.

RL = average reporting limit

NSL = No screening level

J = compound was detected, but below the reporting limit (value is estimated)

U = compound was analyzed, but not detected

TABLE 5-9. SUMMARY OF STFATE MODEL RESULTS TO MEET THE TIER II WATER QUALITY CRITERIA LIMITING PERMISSIBLE CONCENTRATION

JBLE BACK RIVER CHANNEL, HAMPTON, VIRGINIA (DECEMBER 2015)

Dredging Unit	Constituent[(a)]	Dilution Required [(b,c)]	Dilution Achieved [(d)]	Within Placement Boundaries [(d)]
DU1	Cyanide	9	99	YES
DU2	Cyanide	9	100	YES
DU3	Cyanide	9	100	YES
DU4	Cyanide	9	100	YES
DU5	Cyanide	9	101	YES
DU6	Cyanide	9	100	YES

(a) Cyanide was modeled as a conservative estimate because the RL>WQC.

(b) Dilution calculated by STFATE model using receiving water concentrations as background inputs.

(c) Calculated using the formula: $D_{a\text{-}wq} = (C_s - C_{max}) / (C_{max} - C_{ds})$; where $D_{a\text{-}wq}$ = Dilution Concentration Outside Disposal Site, C_s = Elutriate Concentration, C_{max} = Maximum Contaminant Concentration, and C_{ds} = Background .

(d) After 4 hours following placement event.

6. WATER COLUMN AND WHOLE SEDIMENT BIOASSAYS

EA's Ecotoxicology Laboratory performed water column and whole sediment bioassays on six composite sediment samples collected from the JBLE Back River Channel dredging footprint. The bioassay program consisted of acute water column bioassays with *M. galloprovincialis* (blue mussel), *A. bahia* (opossum shrimp), and *M. beryllina* (inland silverside), and 10-day whole sediment bioassays with *A. abdita* and *L. plumulosus* (estuarine amphipods). The acute water column bioassays and the whole sediment bioassays evaluated the effects of exposure to the sediment elutriates and sediment samples on survival or normal embryo development of the test organisms.

6.1 MATERIALS AND METHODS

Methodology for the water column and whole-sediment bioassays followed EA's SOPs (EA 2013) which are in accordance with guidance in USEPA/USACE (1991), USEPA Region 3 (2001), USEPA/USACE (1998), and USEPA (2001). The project SAP (EA 2015d) included a comprehensive Ecotoxicology QAPP for the ecotoxicological testing program.

6.1.1 Sample Receipt and Preparation

Compositing and homogenization of sediment followed procedures described in Chapters 1 and 2. After compositing and homogenization, samples were delivered to EA's Ecotoxicology Laboratory in Hunt Valley, Maryland on 15 December 2015. Surficial sediment samples from the Chesapeake Bay control site, Willoughby Bank, and Atlantic Ocean reference sites were composited in the field and submitted directly to EA's Ecotoxicology Laboratory on 15 December 2015. Upon receipt at EA, the sediment samples were logged in and assigned EA laboratory accession numbers. The sediment samples were stored in the dark in a secured walk-in cooler at 4°C) until used for testing. Prior to use in testing, each sediment sample was homogenized and large rocks and debris were manually removed and discarded from the sample. Table 6-1 summarizes the sample IDs, accession numbers, collection, and receipt information for the JBLE Back River Channel sediments. Copies of COC records for the ecotoxicology samples are provided in Appendix G.

6.1.2 Standard Elutriate Generation for Water Column Testing

For the water column bioassays, standard elutriates were prepared using composite sediment samples and one site water sample (BRC-WAT) collected from within the dredging footprint. A subsample of homogenized sediment was combined with site water in a 1:4 sediment to water ratio. The sediment/water combination was vigorously mixed by aeration and manual stirring for 30 minutes, and was then allowed to settle for a minimum of 1 hour. After settling, the supernatant was siphoned off and adjusted, if necessary, to 30 ppt salinity using Crystal Sea Bioassay Grade synthetic sea salts. The elutriates were used for the water column bioassay testing within 24 hours of preparation.

Test concentrations of 100, 50, 10, and 1 percent elutriate were prepared by measuring aliquots of elutriate in a graduated cylinder and bringing to final volume with 30 ppt artificial sea water. A dilution water control of artificial seawater and a secondary control of undiluted site water were also prepared. The artificial seawater was prepared by mixing Crystal Sea synthetic sea salts with laboratory water to a final salinity of 30 ppt. The source of the laboratory water was the City of Baltimore municipal tap water that was passed through a high-capacity, activated carbon filtration system. This synthetic seawater formulation has proven acceptable for aquatic toxicological studies, and has been used successfully at EA for maintaining multigeneration cultures of *A. bahia*, and for holding healthy populations of estuarine and marine species. Batches of artificial seawater were aerated and aged at least 24 hours prior to use in testing.

Static, non-renewal bioassays were conducted on the prepared elutriates using *A. bahia* (opossum shrimp), *M. beryllina* (inland silverside), and *M. galloprovincialis* (west coast blue mussel) as the test species. The test organisms were acquired from outside vendors. Acquired lots of organisms were gradually acclimated to test temperature and salinity prior to use in testing.

Ammonia was measured in the water used for the *M. galloprovincialis* tests prior to test initiation because of observed sensitivity of *M. galloprovincialis* to ammonia in previous bioassay testing (EA 2014abc; EA 2015c; EA 2016a). The standard elutriates had ammonia concentrations that ranged from 0.3 to 4.1 mg/L (Table 6-2).

6.1.3 *Mytilus galloprovincialis* Water Column Testing

Larval development tests were conducted with the west coast blue mussel (*M. galloprovincialis*). Adult mussels were acquired from Carlsbad Aquafarm (Carlsbad, California). The supplier divided Lot ME-052 in two batches and shipped each batch separately. Lot ME-052a was received at EA on 12 January 2016. Lot ME-051b was received on 13 January 2016.

Upon receipt at EA, the adult mussels were visually inspected, were scrubbed clean (e.g., barnacles removed), and were placed in 30 ppt artificial seawater at 4°C. The collection of mussel eggs and sperm, and preparation of gamete suspension were performed according to EA's SOPs (EA 2013) which follow guidelines in USEPA/USACE (1998). Spawning was temperature induced by placing the mussels into individual 200-milliliter (mL) cups containing 30 ppt artificial seawater and raising the temperature of the water from 12°C to 20°C. Care was taken to keep male and female gametes completely separate, to avoid accidental fertilization during gamete preparation. Gametes were microscopically inspected to determine normality of eggs and motility of sperm. Gametes that were determined to be acceptable for testing were pooled from a minimum of three males and three females, and were used to prepare the sperm and egg suspensions for the fertilization procedures. Only combined gamete preparations that had achieved a minimum of 90 percent fertilization were used in testing. Toxicity tests were initiated within 4 hours of egg fertilization.

Test chambers were 30-mL scintillation vials with screw caps. Each test concentration and control had five replicate test chambers containing 10 mL of test solution. At test initiation, 100 microliters (μL) of fertilized gamete preparation was delivered into each test chamber containing test dilution. Extra replicates of controls were prepared to monitor embryo counts at test initiation and termination. The tests were maintained at a target temperature of 16±1°C with a 16-hour light/8-hour dark photoperiod. Water quality parameters (temperature, pH, DO, and salinity) were measured in separate water quality cups at test initiation and daily during the 48-hour exposure period. Summaries of water quality parameters can be found in Appendix G.

The bioassays were terminated by adding 250 µL of 37 percent buffered formaldehyde to each test chamber. The preserved samples were then observed microscopically to determine the percent survival of control organisms, and the percentage of embryos in each test treatment and control that had normally developed (C-shaped, hinged, prodissoconch larvae) shells. Copies of the data sheets from the mussel bioassays are included in Appendix G.

In order to evaluate the toxicity of ammonia to *M. galloprovincialis*, a separate toxicity test was conducted in which the *M. galloprovincialis* embryos were exposed to a graded concentration of ammonia, administered as ammonium chloride (NH_4Cl), results are presented in Table 6-3. Copies of the data sheets from all mussel toxicity tests are included in Appendix G.

6.1.4 *Americamysis bahia* and *Menidia beryllina* Water Column Testing

Opossum shrimp, *A. bahia* and inland silversides, *M. beryllina* used in the water column toxicity tests were acquired from Aquatic BioSystems (Fort Collins, Colorado). The acute toxicity tests were initiated on 12 January 2016 using *A. bahia* lot AB-886 and *M. beryllina* lot MS-195, respectively. The opossum shrimp and silverside minnows were fed *Artemia* sp. nauplii (<24 hours old) during holding, prior to use in testing.

The *A. bahia* and *M. beryllina* testing was conducted in 1-liter (L) beakers. Each beaker contained 200 mL of test solution, with five replicate beakers per test concentration. Ten organisms were randomly introduced into each replicate for a total of 50 organisms per concentration. The test chambers were maintained at 20±1°C with a 16-hour light/8-hour dark photoperiod. The *A. bahia* and *M. beryllina* were fed a small ration of brine shrimp nauplii (*Artemia* sp.) daily to prevent starvation and cannibalism (*A. bahia*). Temperature, pH, DO, and salinity were measured daily in one replicate of each concentration of the *A. bahia* and *M. beryllina* toxicity tests during the 96-hour exposure period. Summaries of water quality parameters measured during the toxicity tests are provided in Appendix G. The number of live organisms in each test chamber were counted daily and recorded on the test data sheets. Copies of the *A. bahia* and *M. beryllina* acute toxicity test data sheets are included in Appendix G.

6.1.5 Whole Sediment Bioassays

Whole sediment toxicity testing was conducted with two estuarine species, *L. plumulosus* (amphipod) and *A. abdita* (amphipod). The *L. plumulosus* were acquired from Chesapeake Cultures, (Hayes, Virginia). Lot LP-078 was received at EA on 15 January 2016 and was used to initiate the toxicity test on the same day. The *A. abdita* were acquired from Aquatic Research Organsims (Hampton, New Hampshire). Lot AA-024 was received at EA on 9 January 2016 and was used to initiate the toxicity test on the same day. During the holding period, the organisms were gradually acclimated to laboratory water at 20ºC and to the appropriate test salinity.

For whole sediment bioassays, USEPA guidance (Davies et. al. 1993) specifies the reduction of pore water (NH_3-N) concentrations to less than or equal to 20 mg/L NH_3-N prior to testing. Initial interstitial total ammonia concentrations in the composited sediments ranged from 1.9 to 136.2 mg/L NH_3-N. Therefore, prior to initiating solid phase testing, the ammonia reduction procedures described in Davies et. al. (1993) were implemented for the samples that had ammonia concentrations >20 mg/L NH_3-N (Table 6-4). The sediments were loaded into the test beakers and overlying sea water was added. The five replicate beakers per sediment were loaded, and additional beakers were set up for each sediment to monitor the progress of the ammonia reduction. The overlying water was replaced two times per day. After one week of purging, pore water for analysis was extracted from each of the purged sediment samples by centrifugation. Interstitial ammonia was measured the day before each test was run for each of the ammonia-purged sediments; values are presented in Table 6-4.

The whole sediment bioassays were conducted as static, non-renewal tests with 10 days of exposure to the composite sediments and overlying water. Artificial seawater (Crystal Sea artificial sea salts) at 20 ppt salinity (*L. plumulosus*) or 30 ppt salinity (*A. abdita*) was used as the overlying water.

The *A. abdita* and *L. plumulosus* tests utilized 1-L beakers as the exposure chambers, with each beaker containing 200 mL of sediment and 700 mL of overlying water. There were five replicate chambers for each sediment sample and control. Test organisms were randomly assigned to the test chambers, 20 per replicate, for a total of 100 organisms exposed per sample.

The tests were maintained at a target of 20±1°C, with a 24-hour light photoperiod. The test chambers were visually inspected daily for abnormal organism behavior or lack of burrowing. The test organisms were not fed during the 10-day exposure period.

The overlying water in each test chamber was gently aerated (100 bubbles per minute) for the duration of the tests. Water quality measurements of temperature, pH, DO, and salinity were recorded daily on one replicate of each sample and control. The water quality parameters measured during the *A. abdita* and *L. plumulosus* bioassays are provided in Appendix G.

After 10 days of exposure, the test organisms were retrieved from the samples and the number of live organisms per replicate was recorded. Copies of the original data sheets for the *A. abdita* and *L. plumulosus* bioassays are included in Appendix G.

6.1.6 Reference Toxicant Testing

In conformance with EA's QA/QC program requirements, reference toxicant testing was performed by EA on the acquired lot of *M. galloprovincialis*, *A. abdita*, and *L. plumulosus* utilized in the testing program. Reference toxicant data for the *A. bahia* and *M. beryllina*, acquired from Aquatic BioSystems, were obtained from the organism supplier. The reference toxicant tests consisted of a graded concentration series of a specific toxicant in water only tests, with no sediment present in the test chambers. The results of the reference toxicant tests were compared to established control chart limits. Table 6-5 presents the results of the reference toxicant testing. Each of the reference toxicant tests fell within the established laboratory control limits.

6.1.7 Statistical Analyses

6.1.7.1 Water Column Bioassays

Statistical analyses were performed on the water column test data according to USEPA/USACE (1998) guidance and using the ToxCalc statistical software package (Version 5.0, Tidepool Scientific Software). For the elutriate testing, an EC_{50} or LC_{50} was calculated for each test species using the linear interpolation, Spearman-Karber, Trimmed Spearman-Karber, or probit method. Additionally, if normal development or survival in the 100 percent elutriate concentration was at least 10 percent lower than the dilution water control, then a statistical comparison (t-test) was performed between the 100 percent elutriate concentration and the control. The t-test was based on the assumptions that the observations were independent and normally distributed as determined by the Shapiro-Wilk's test. The F-test was used to test for homogeneity of variance. When the data did not meet the normality assumption, the nonparametric test, Wilcoxon's two-sample test, was used to analyze the data. An arc sine (square root [Y]) transformation was performed on the survival percentages.

6.1.7.2 Whole Sediment Bioassays

Statistical analyses were performed on the whole sediment test data according to USEPA/USACE (1998) guidance, using the ToxCalc statistical software package (Version 5.0, Tidepool Scientific Software). If survival in a JBLE Back River Channel sediment was greater than the allowable percent difference (20 percent) from a reference, then a t-test or Wilcoxon's two-sample test (depending on normal or non-normal data distribution) was performed on that sediment sample. The statistical analyses were performed to determine if exposure to any of the JBLE Back River Channel sediment samples resulted in significantly lower survival ($p=0.05$) as compared to the organisms exposed to the corresponding reference sediment.

Based on the results of previous testing at the Willoughby Bank and Atlantic Ocean reference sites (WBREF and OCREF, respectively, EA 2014abc; EA 2015ab; EA 2015a), and the anticipated heterogeneity in the grain size of the sediments within the JBLE Back River Channel dredging footprint, two reference samples were tested: WBREF and OCREF. It is important that the reference site be comprised of materials similar to the project sediments to provide a technically appropriate comparison for the results of the analytical and ecotoxicological testing conducted with the JBLE Back River Channel project sediments. The sample WBREF is a composite surficial sediment sample that represents silty-sand sediments and OCREF is a composite surficial sediment sample that represents sandy sediments. Based on the physical characteristics of the reference sediments and the grain size of samples from each location (Table 4-5), samples from DU1, DU2, DU3, and DU4 were statistically compared to reference sample WBREF; samples from DU5 and DU6 were statistically compared to reference sample OCREF.

6.2 OCEAN TESTING MANUAL EVALUATION PROTOCOLS

6.2.1 Water Column Bioassays

As per Ocean Testing Manual guidance, three species of organisms—*M. galloprovincialis* (west coast blue mussel), *A. bahia* (opossum shrimp), and *M. beryllina* (inland silverside)—were tested in the water column bioassays for JBLE Back River Channel standard elutriates. The three species chosen represent different phyla and cover a range of differing species sensitivities (USEPA/USACE 1991 and 1998). According to the Ocean Testing Manual (USEPA/USACE 1991), after considering water column bioassay test results and expected mixing at the placement site, one of the following conclusions is reached:

- The 100 percent dredged material elutriate bioassay is not statistically different from the dilution water (laboratory control). Therefore, the dredged material is not predicted to be acutely toxic to water column organisms. Benthic impact must also be evaluated.

- The concentration of dissolved plus suspended contaminants, after allowance for mixing, does not exceed 0.01 (1 percent) of the LC_{50} or EC_{50} concentration beyond the boundaries of the placement site within the first 4 hours after placement or at any point in the marine environment after the first 4 hours. Therefore, the dredged material is not predicted to be acutely toxic to water column organisms. Benthic impact must also be evaluated.

- The concentration of dissolved plus suspended contaminants, after allowance for mixing, exceeds 0.01 (1 percent) of the LC_{50} or EC_{50} concentration beyond the boundaries of the placement site at any time and/or within the placement site after the 4-hour initial mixing period. Therefore, the dredged material may have the potential to be acutely toxic to water column organisms.

In the water column tests, survival was the endpoint for the *A. bahia* and *M. beryllina* tests. The endpoint of the *M. galloprovincialis* test was normal embryo development. As a worst case assessment, all water column tests were conducted with larval or juvenile test organisms, which are considered the most sensitive life stage. The age ranges as specified by the USEPA/USACE (1991 and 1998) testing guidelines were: *M. galloprovincialis* (less than 4-hour embryos), *A. bahia* (1 to 5 days old), and *M. beryllina* (9 to 14 days old). In water column tests, results for 100 percent test elutriates were statistically compared (single-point comparison) to results of the laboratory controls as per Ocean Testing Manual evaluation protocols, not to the results for the placement site or reference area.

6.2.2 Whole Sediment Bioassays

Bioassays with whole sediment are designed to determine whether the dredged material is likely to produce unacceptable adverse effects on benthic organisms by exposing the organisms to the whole sediment for 10 days. As per Ocean Testing Manual/ITM guidance, organisms for the whole sediment bioassays for the JBLE Back River Channel sediment were chosen to cover the range of differing species sensitivities and to be environmentally protective (USEPA/USACE 1991 and 1998). As per USEPA Region 3's request, *L. plumulosus* (estuarine amphipod) and *A. abdita* (marine amphipod) were used for the whole sediment bioassays for the JBLE Back River Channel sediment.

Dredged material is predicted to be acutely toxic to benthic organisms when mean test organism mortality:

- Is statistically greater than in the reference sediment, **AND**

- Exceeds mortality (or other appropriate end point) in the reference sediment by at least 10 percent (or 20 percentage points for amphipods).

In the whole sediment tests, survival was the endpoint for the *L. plumulosus* and *A. abdita* tests. As a worst case assessment, whole sediment bioassays were conducted with test organisms at sensitive life stages. The age ranges as specified by the USEPA/USACE (1991 and 1998) testing guidelines were: *L. plumulosus* (mature 3 to 5 millimeter, mixed sexes) and *A. abdita* (immature amphipods, or mature females only). In whole sediment bioassays, results were statistically compared (single-point comparison) to results of the reference sediment as per Ocean Testing Manual/Inland Testing Manual evaluation protocols. Whole sediment benthic bioassays of contaminants in the dredged material will result in one of the following possible conclusions:

- Mean test organism mortality in the dredged material is not statistically greater than in the reference sediment, or does not exceed mean mortality in the reference sediment by at least 10 percentage points (or 20 percentage points for amphipods). Therefore, the dredged material is predicted not to be acutely toxic to benthic organisms. Bioaccumulation of contaminants must also be considered.

- Mean test organism mortality in the dredged material is statistically greater than in the reference sediment *and* exceeds mortality in the reference sediment by at least 10 percentage points (or 20 percentage points for amphipods). In this case, the dredged material has the potential to be acutely toxic to benthic organisms and does not meet the LPC for benthic toxicity.

6.3 RESULTS

6.3.1 Water Column Bioassays

6.3.1.a Mytilus galloprovincialis

The results of the *M. galloprovincialis* toxicity tests conducted on the elutriate samples are presented in Table 6-6. The 48-hour EC_{50} values for each of the elutriates prepared from the JBLE Back River Channel samples were greater than 100 percent. The percent normal embryo development in the 100 percent concentration of each of the samples ranged from 52 to 90 percent. Two sediment samples, BRC-03/04-SED (DU2) and BRC-05/06-SED (DU3), had embryo development in the 100 percent elutriate treatment that was significantly different from the laboratory controls. The site water sample had normal embryo development ranging from 85 to 99 percent, which was not significantly different than the combined controls.

6.3.1.b Americamysis bahia
The results of the *A. bahia* toxicity tests conducted on the elutriate samples are presented in Table 6-7. Each of the bioassays prepared from the JBLE Back River Channel elutriate samples had a 96-hour LC_{50} value of greater than 100 percent elutriate (Table 6-7). Survival in the 100 percent elutriate ranged from 96 to 100 percent and was not significantly different from the laboratory controls, indicating that the elutriate was not acutely toxic to *A. bahia*. There was a minimum of 96 percent survival in the laboratory controls and 92 percent survival in the site water at test termination.

6.3.1.c Menidia beryllina
The results of the *M. beryllina* toxicity tests are presented in Table 6-8. Each of the *M. beryllina* bioassays prepared from the JBLE Back River Channel elutriate samples had LC_{50} values greater than 100 percent elutriate. Survival in the 100 percent elutriate ranged from 96 to 100 percent and was not significantly different from the laboratory controls (Table 6-8), indicating that the elutriates were not acutely toxic to *M. beryllina*. There was a minimum of 96 percent survival in the laboratory controls, and the site water had 98 percent survival at test termination.

6.3.2 Whole Sediment Bioassays

Table 6-9 summarizes the results of the 10-day whole sediment toxicity testing with *A. abdita*. Survival in the six JBLE Back River Channel sediment samples ranged from 86 to 95 percent, compared to 89 and 85 percent survival in the Willoughby Bank and Atlantic Ocean reference sediments, respectively. The Chesapeake Bay control sediment (CBCON-SED) had 89 percent survival after 10 days of exposure. The laboratory control had 95 percent survival.

The results of the *L. plumulosus* whole sediment toxicity testing are presented in Table 6-9. Survival in the six JBLE Back River Channel sediments ranged from 95 to 99 percent, compared to 98 and 97 percent survival in the Willoughby Bank and Atlantic Ocean reference sediments. The Chesapeake Bay control sediment (CBCON-SED) and laboratory control had 97 and 98 percent survival, respectively, after 10 days of exposure.

6.4 SUMMARY OF RESULTS AND LIMITING PERMISSIBLE CONCENTRATION COMPLIANCE

The water column toxicity LPC for ocean placement is equivalent to 0.01 of the EC_{50}/LC_{50} within a 4-hour dilution period inside the boundary of the placement site (USEPA/USACE 1991). To determine whether the elutriates from the JBLE Back River Channel meet the water column toxicity LPC requirements, STFATE modeling was conducted. Multiple modeling scenarios were conducted to determine to maximum placement volume per single placement event that would meet the LPC. Grain size and other physical characteristics of the sediment were used as input parameters and receiving water concentrations were used as background parameters. STFATE modeling calculated the dilution factor of the plume 1 and 4 hours after placement, and the distance the leading edge of the plume would travel within 4 hours after placement to verify that that the plume stayed within the boundaries of the placement site.

6.4.1 Water Column Bioassays

Results of the *M. galloprovincialis*, *A. bahia*, and *M. beryllina* water column bioassay tests are presented in Table 6-10. Since results of the *A. bahia* and *M. beryllina* tests were based on survival of test organisms, and results indicated that survival was not statistically less than the control, the maximum dilution required to achieve the LPC during dredged material placement was based upon the results for *M. galloprovincialis.* The water column LPC for ocean placement is equivalent to 0.01 of the EC_{50}/LC_{50} within a 4-hour dilution period inside the boundary of the placement site (USEPA/USACE 1991).

The 48-hour EC_{50}s for *M. galloprovincialis* was greater than 100 for each of the samples and required a 99-fold dilution to achieve LPC compliance (Table 6-10).

Based on the overall results of the STFATE modeling of water column toxicity, the JBLE Back River Channel project elutriates meet the LPC for water column toxicity for placement volumes ranging from 32,000-62,000 cy (Table 6-11).

6.4.2 Whole Sediment Bioassays

The evaluation of benthic-effects for whole sediment bioassays is based on the LPC. The LPC is defined as "…that concentration which will not cause unreasonable acute or chronic toxicity or sublethal adverse effects based on bioassay results using…appropriate sensitive marine organisms…" (USEPA/USACE 1991 and 1998). The dredged material proposed for placement does not meet the LPC if the mortality of the test organisms (1) is statistically greater than mortality in the reference sediment, and (2) exceeds the reference sediment mortality by at least 10 percent (or 20 percent for amphipod tests).

Results of the *A. abdita* and *L. plumulosus* whole sediment testing are presented in Table 6-9. None of the JBLE Back River Channel sediment samples was acutely toxic to either of the tested species. ***Therefore, the sediments from the JBLE Back River Channel project meet the whole sediment toxicity LPC for ocean placement.***

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TABLE 6-1. SUMMARY OF COLLECTION AND RECEIPT INFORMATION FOR SEDIMENT AND SITE WATER SAMPLES JBLE BACK RIVER CHANNEL, HAMPTON, VIRGINIA, DECEMBER 2015

Sample Identification	EA Accession Number	Composite Time and Date	Receipt Time and Date
Sediment:			
BRC-01/02-SED	AT5-576	1515, 14 December 2015	1048, 15 December 2015
BRC-03/04-SED	AT5-577	1400, 14 December 2015	1048, 15 December 2015
BRC-05/06-SED	AT5-578	1200, 14 December 2015	1048, 15 December 2015
BRC-07/08-SED	AT5-579	1040, 14 December 2015	1048, 15 December 2015
BRC-09/10-SED	AT5-580	1330, 8 December 2015	1048, 15 December 2015
BRC-11/12-SED	AT5-581	1115, 8 December 2015	1048, 15 December 2015
WBREF-SED	AT5-582	1315, 10 December 2015	1048, 15 December 2015
CBCON-SED[(a)]	AT5-583	1000, 10 December 2015	1048, 15 December 2015
OCREF-SED	AT5-584	1200, 7 December 2015	1048, 15 December 2015
Sitewater:			
BRC-WAT	AT5-585	1430, 8 December 2015	1048, 15 December 2015

(a) Sediment control for amphipod tests.

TABLE 6-2 AMMONIA CONCENTRATIONS MEASURED IN ELUTRIATES PRIOR TO WATER COLUMN TOXICITY TESTING JBLE BACK RIVER CHANNEL, HAMPTON, VIRGINIA, DECEMBER 2015

		Ammonia ($mg/L\ NH_3$-N)		
Sediment Identification	**EA Accession Number**	***A. bahia***	***M. beryllina***	***M. galloprovincialis***
BRC-01/02-SED	AT5-576	1.7	1.7	1.3
BRC-03/04-SED	AT5-577	5.1	5.1	4.1
BRC-05/06-SED	AT5-578	3.9	3.9	2.9
BRC-07/08-SED	AT5-579	2.3	2.3	2.1
BRC-09/10-SED	AT5-580	1.0	1.0	0.6
BRC-11/12-SED	AT5-581	0.5	0.5	0.3

TABLE 6-3. RESULTS OF AMMONIA (NH_4Cl) TOXICITY TESTING WITH *Mytilus galloprovincialis* - JBLE BACK RIVER CHANNEL, HAMPTON, VIRGINIA (DECEMBER 2015)

Organism Lot #	Testing Date	Test Number	48-Hour Normal Development (%)						48-hour EC50 ($mg/L NH_3$-N)
				mg/L NH_3-N					
			Lab Control	50 mg/L	10 mg/L	3.7 mg/L	1.5 mg/L	0.65 mg/L	
ME-052	1/13/2016	TN-15-552	87	0	0	87	84	88	4.3 (4.2-4.4)[a]

(a) Values in parentheses represent the 95 percent confidence limits.

TABLE 6-4. AMMONIA (NH_3-N) CONCENTRATIONS MEASURED ON SEDIMENT PORE WATER PRIOR TO WHOLE SEDIMENT BIOASSAY TESTING JBLE BACK RIVER CHANNEL, HAMPTON, VIRGINIA (DECEMBER 2015)

Sediment Sample ID	Ammonia (mg/L NH_3-N)		
	Initial Pore Water	Final Pore Water	
		A. abdita	*L. plumulosus*
BRC-01/02-SED	38.9	19.5	9
BRC-03/04-SED	136.2	16.8	8.6
BRC-05/06-SED	115	14.7	8
BRC-07/08-SED	63.8	15.9	8.3
BRC-09/10-SED	13.3	15.8	8.7
BRC-11/12-SED	3	4	2
Reference Sites			
Willoughby Bank Reference Site	2.4	4	3.1
Atlantic Ocean Reference Site	1.9	11.1	7.3
Control Samples			
Chesapeake Bay Control Site	23.7	3	2.1
Laboratory Control	N/A	13.1	8.4

TABLE 6-5. REFERENCE TOXICANT TESTING ON ACQUIRED LOTS OF TEST ORGANISMS FOR WATER COLUMN AND WHOLE SEDIMENT BIOASSAYS
JBLE BACK RIVER CHANNEL, HAMPTON, VIRGINIA (DECEMBER 2015)

Test Species	Reference Toxicant	Test Endpoint	Acceptable Control Chart Limits
Mytilus galloprovincialis	Copper chloride ($CuCl_2$)	48-Hour EC50: 7.7 µg/L Cu	2.4 – 11.0 µg/L Cu
Americamysis bahia	Potassium chloride (KCl)	96-Hour LC50: 707 mg/L KCl[(a)]	379 – 842 mg/L KCl[(a)]
Menidia beryllina	Potassium chloride (KCl)	96-Hour LC50: 1,320 mg/L KCl[(a)]	1,117 – 1,512 mg/L KCl[(a)]
Leptocheirus plumulosus	Cadmium chloride ($CdCl_2$)	48-Hour LC50: 7.6 mg/L Cd	2.5 – 22.0 mg/L Cd
Nereis virens	Potassium chloride (KCl)	48-Hour LC50: 1,439 mg/L KCl	575 – 1,605 mg/L KCl

(a) Reference toxicant test information provided by organism supplier.

µg/L = Microgram(s) per liter.
EC50 = Median effective concentration.
LC50 = Median lethal concentration.

TABLE 6-6. RESULTS OF WATER COLUMN BIOASSAYS WITH *Mytilus galloprovincialis*
JBLE BACK RIVER CHANNEL, HAMPTON, VIRGINIA (DECEMBER 2015)

Dredging Unit	Sample Identification	48-Hour Normal Embryo Development						
		Site Water	Lab Control	Percent Elutriate				48-hour EC50 (% elutriate)
				100%	50%	10%	1%	
DU1	BRC-01/02-SED	89	88	81	91	93	84	>100
DU2	BRC-03/04-SED	92	98	52[(a)]	73[(a)]	96	97	>100
DU3	BRC-05/06-SED	90	89	71[(a)]	86	91	94	>100
DU4	BRC-07/08-SED	88	89	90	88	88	85	>100
DU5	BRC-09/10-SED	99	91	90	93	96	96	>100
DU6	BRC-11/12-SED	85	87	81	87	89	94	>100

(a) Percent elutriate treatment is significantly different (p=0.05) from the combined laboratory controls

TABLE 6-7. RESULTS OF WATER COLUMN BIOASSAYS WITH *Americamysis bahia*

JBLE BACK RIVER CHANNEL, HAMPTON, VIRGINIA (DECEMBER 2015)

Dredging Unit	Sample Identification	96-Hour Survival (%)						
		Site Water[a]	Lab Control	Percent Elutriate				96-hour LC50 (% elutriate)
				100%	50%	10%	1%	
DU1	BRC-01/02-SED	92	96	96	90	94	94	>100
DU2	BRC-03/04-SED	---	96	98	100	96	96	>100
DU3	BRC-05/06-SED	---	98	96	100	98	96	>100
DU4	BRC-07/08-SED	---	96	96	92	92	90	>100
DU5	BRC-09/10-SED	---	96	96	88	98	92	>100
DU6	BRC-11/12-SED	---	100	100	98	94	94	>100

(a) Site water was included with all tests.

TABLE 6-8. RESULTS OF WATER COLUMN BIOASSAYS WITH *Menidia beryllina*
JBLE BACK RIVER CHANNEL, HAMPTON, VIRGINIA (DECEMBER 2015)

Dredging Unit	Sample Identification	96-Hour Survival (%)						
		Site Water[(a)]	Lab Control	Percent Elutriate				96-hour LC50 (% elutriate)
				100%	50%	10%	1%	
DU1	BRC-01/02-SED	98	98	96	98	98	100	>100
DU2	BRC-03/04-SED	---	96	98	100	98	96	>100
DU3	BRC-05/06-SED	---	98	100	100	98	100	>100
DU4	BRC-07/08-SED	---	98	98	100	98	100	>100
DU5	BRC-09/10-SED	---	96	98	96	98	96	>100
DU6	BRC-11/12-SED	---	96	96	98	98	98	>100

(a) Site water was included with all tests.

TABLE 6-9. RESULTS OF 10-DAY WHOLE SEDIMENT BIOASSAYS

JBLE BACK RIVER CHANNEL, HAMPTON, VIRGINIA (DECEMBER 2015)

Dredging Unit	Sample Identification	*Ampelisca abdita*			*Leptocheirus plumulosus*		
		No. Alive/No. Exposed[(a)]	10-Day Mean Percent Survival	Statistical Difference vs. Reference [(c)]	No. Alive/No. Exposed[(b)]	10-Day Mean Percent Survival	Statistical Difference vs. Reference [(c)]
--	Willoughby Bank Reference	89 / 100	89	NO	98 / 100	98	NO
--	Atlantic Ocean Reference	85 / 100	85	NO	97 / 100	97	NO
DU1	BRC-01/02-SED	87 / 100	87	NO	100 / 101	99	NO
DU2	BRC-03/04-SED	88 / 100	88	NO	95 / 100	95	NO
DU3	BRC-05/06-SED	86 / 100	86	NO	98 / 100	98	NO
DU4	BRC-07/08-SED	87 / 100	87	NO	101 / 102	99	NO
DU5	BRC-09/10-SED	95 / 100	95	NO	99 / 100	99	NO
DU6	BRC-11/12-SED	89 / 100	89	NO	99 / 100	99	NO
--	Chesapeake Bay Control*	89 / 100	89	NA	97 / 100	97	NA
--	Lab Control	95 / 100	95	NA	98 / 100	98	NA

(a) Total for five replicates of five animals, unless otherwise stated.

(b) Total for five replicates of twenty animals, unless otherwise stated.

(c) Statistical significance analyzed at p=0.05; channel sediments statistically compared to Willoughby Bank reference site.

NA = not applicable; reference is not compared to itself

*Chesapeake Bay control sediment only applicable to evaluate amphipod bioassays

TABLE 6-10. SUMMARY OF WATER COLUMN BIOASSAYS

JBLE BACK RIVER CHANNEL, HAMPTON, VIRGINIA (DECEMBER 2015)

Dredging Unit	Sample Identification	*Mytilus galloprovincialis*			*Americamysis bahia*			*Menidia beryllina*		
		48-hour EC_{50} (% elutriate)	Statistical Difference 100% vs. Control[a]	Dilution Required to Achieve 0.01 EC_{50}[b]	96-hour LC_{50} (% elutriate)	Statistical Difference 100% vs. Control[a]	Dilution Required to Achieve 0.01 LC_{50}[b]	96-hour LC_{50} (% elutriate)	Statistical Difference 100% vs. Control[a]	Dilution Required to Achieve 0.01 LC_{50}[b]
DU1	BRC-01/02-SED	>100	No	--	>100	No	--	>100	No	--
DU2	BRC-03/04-SED	>100	YES	99	>100	No	--	>100	No	--
DU3	BRC-05/06-SED	>100	YES	99	>100	No	--	>100	No	--
DU4	BRC-07/08-SED	>100	No	--	>100	No	--	>100	No	--
DU5	BRC-09/10-SED	>100	No	--	>100	No	--	>100	No	--
DU6	BRC-11/12-SED	>100	No	--	>100	No	--	>100	No	--

(a) Statistical significance analyzed at p=0.05; survival (LC_{50}) or effect (EC_{50}) in 100% elutriate concentration significantly lower than the control.

(b) $D_{a\text{-}tox}$ = (100 - Ctox) / Ctox

Ctox = (0.01)*(EC_{50} or LC_{50})

TABLE 6-11. SUMMARY OF STFATE MODEL RESULTS TO MEET THE TIER III LIMITING PERMISSIBLE CONCENTRATION FOR WATER COLUMN TOXICITY

JBLE BACK RIVER CHANNEL, HAMPTON, VIRGINIA (DECEMBER 2015)

Dredging Unit	Sediment Sample ID	48-hour EC50* (% elutriate)	Dilution Required to Achieve 0.01 EC50 (a)	4 Hours After Placement		Maximum Dredged Material Volume (cubic yards) [(b)]
				Predicted Dilution	Predicted Distance Traveled of Leading Edge of Plume (feet)	
DU1	**BRC-01/02**	>100	99	99	4,810	37,000
DU2	**BRC-03/04**	>100	99	100	4,810	32,000
DU3	**BRC-05/06**	>100	99	100	4,810	32,000
DU4	**BRC-07/08**	>100	99	100	4,810	36,000
DU5	**BRC-09/10**	>100	99	101	4,810	41,000
DU6	**BRC-11/12**	>100	99	100	4,810	62,000

* Based on the median effective concentration (EC_{50}) value of *Mytilus galloprovincialis* (blue mussel) testing for each DU composite, the most restrictive of all three species tested in water column bioassays (Table 6-10).

(a) Calculated using the formula $D_{a\text{-}tox} = (100-C_{tox})/C_{tox}$

where $D_{a\text{-}tox}$ = Dilution Outside Disposal Site and C_{tox} = Maximum Contaminant Concentration

(b) limiting volume for entire DU; see Attachment III.

7. BIOACCUMULATION TESTING

The potential for substances to be absorbed in the tissue of aquatic organisms (i.e., bioaccumulated) at concentrations that have the potential to cause adverse effects was investigated. Those chemical constituents with the ability to biomagnify in the food chain are of particular concern because of the potential impact to higher trophic levels. Twenty-eight-day bioaccumulation tests with *M. nasuta* (blunt-nosed clam) and *N. virens* (sand worm) were conducted on six composite sediment samples collected from within the JBLE Back River Channel dredging footprint. In addition, reference sediment samples from the Willoughby Bank and Atlantic Ocean reference sites were tested. The effects of exposure to the sediment samples on survival of the test organisms during the bioaccumulation testing were evaluated. At the completion of the bioaccumulation testing, the organism tissues were frozen and submitted for chemical analyses following determination of target analytes.

7.1 BIOACCUMULATION TEST METHODS

Methodology for the bioaccumulation exposures followed EA's SOPs (EA 2013) which are in accordance with guidance in USEPA/USACE (1991), USEPA Region 3 (2001), USEPA/USACE (1998), and USEPA (2001). The project SAP included a comprehensive Ecotoxicology QAPP for the ecotoxicological testing program (Attachment III of the SAP, EA 2015d).

7.1.1 Sample Receipt and Preparation

N. virens and *M. nasuta* were chosen for the 28-day bioaccumulation tests for the sediments from the JBLE Back River Channel dredging footprint based on the recommendation in the Ocean Testing Manual and Inland Testing Manual (USEPA/USACE 1991 and 1998) identifying these species as the primary benchmark species for near coastal marine waters that can also be used in estuarine waters down to appropriate low levels of salinity. Aquatic organisms used in the bioaccumulation tests were selected because they ingest sediments and survive equally well in dredged material and control and reference sediments.

The number of organisms used in the bioaccumulation tests were dictated by the minimum amount (wet weight) of tissue required for chemical analysis, the potential target analytes, and the TDL.

7.1.2 Test Setup and Procedures

Bioaccumulation testing was conducted using the blunt-nose clam (*M. nasuta*) and the sand worm (*N. virens*). The adult clams (lot number MA-047) and the adult worms (NV-056) were received from Aquatic Research Organisms (Hampton, New Hampshire) on 30 December 2015. Upon receipt at EA, the clams were placed in clean seawater and allowed to depurate accumulated waste products for several hours, prior to use in testing. The *N. virens* were loaded into the test immediately to minimize cannibalism/holding stress.

The sediment samples and overlying water were added to the test chambers a minimum of one day prior to test initiation to allow time for the suspended sediments to settle overnight. The overlying water was 30 ppt artificial seawater (Crystal Sea artificial sea salts). Natural sediments from the organism collection sites were used as laboratory controls in the bioaccumulation testing. Control sediment used in the *N. virens* test was collected from the Damariscotta River, Booth Bay Harbor, Maine. The sediment used in the clam bioaccumulation test was collected from Tomales Bay, California. The bioaccumulation tests were 28 days in duration and were conducted as static renewal assays. The overlying water was replaced three times a week by siphoning approximately 80 percent of the overlying water from the aquaria and replacing with new overlying water taking care not to disturb the sediment surface.

The bioaccumulation tests were conducted in 10-gallon aquaria with 5 L of sediment and 22 L of overlying water per aquarium. There were five replicates per reference and test sediment, and three replicates per control sediment. Based on the analytical tissue biomass requirements, 24 organisms were randomly introduced into each replicate chamber for the *N. virens* testing, while the *M. nasuta* testing utilized 50 organisms per chamber. Copies of the original data sheets from the *N. virens* and *M. nasuta* testing are included in Appendix G.

During the 28-day exposure period, the test chambers were maintained at a target temperature of 20±1°C for *N. virens* and 12±1°C for *M. nasuta* with a 16-hour light/8-hour dark photoperiod. Gentle aeration was provided to each aquarium throughout the test period. Observations of mortality and abnormal organism behavior were recorded daily, and dead organisms were removed and recorded, as observed, from the test chambers. Measurements of temperature, pH, DO, and salinity of the overlying water were recorded on one replicate of each sample and control at test initiation, termination, and three times a week, just prior to replacement of the overlying water. The water quality measurements are provided in Appendix G. The organisms were not fed during the 28-day exposure period.

The bioaccumulation tests were initiated on 30 December (*N. virens*) and 31 December (*M. nasuta*) 2016. After 28 days of exposure, the organisms were recovered from the samples and placed into clean artificial sea water for 24 hours to purge their digestive tracts. After the depuration period, the organism tissues were collected and submitted for chemical analyses. Copies of the original data sheets from the *N. virens* and *M. nasuta* testing are included in Appendix G.

7.1.3 Reference Toxicant Testing

In conformance with EA's QA/QC program requirements, reference toxicant testing was performed by EA on the acquired lots of *N. virens* and *M. nasuta* utilized in the testing program. The reference toxicant tests consisted of a graded concentration series of a specific toxicant in water only tests, with no sediment present in the test chambers. All of the reference toxicant test results fell within the established laboratory control chart limits (Table 7-1), indicating that the acquired organisms were of acceptable quality (Appendix G).

7.2 TISSUE TESTING METHODS

7.2.1 Tissue Preparation, Homogenization, and Compositing

After 28 days of exposure, surviving organisms were recovered and placed in holding tanks containing clean artificial sea water and no sediment to purge their digestive tracts. The organisms were not fed during this period. At the end of the 24-hour purging period, the shells of the clams were rinsed with DI water, the clams were shucked, and the soft tissues and liquids inside the shell were placed into pre-cleaned glass jars. Worms were rinsed with DI water to remove the external salts (originating from the purge chambers) and were placed directly into pre-cleaned glass jars. Tissues for each replicate were placed into separate jars, labeled, and frozen until delivered to the analytical laboratory. Required holding times, preservation techniques, and sample containers for tissue samples are provided in Table 7-2.

In addition to test tissues from the JBLE Back River Channel, tissues exposed to reference site (Willoughby Bank and Atlantic Ocean) sediments, pre-test tissue, and tissue from control organisms were also submitted for analysis. Pre-test tissue represents organism tissue upon receipt at the ecotoxicology laboratory (prior to test initiation). These tissues originate from organisms that are sacrificed from each shipment and subsequently frozen. These organisms are not exposed to test sediments, but contaminants in their tissues would represent baseline contaminants that accumulated in their natural environment. Control tissue originates from organisms exposed to natural sediment (that they were shipped in) after a 28-day exposure period. These organisms are exposed to the same laboratory environment as the test sediments.

Following a 28-day exposure period, tissues were held frozen at TestAmerica-Pittsburgh until determination of project target analytes. Tissues for each replicate were then separately thawed, homogenized, and weighed to the nearest gram. Aliquots from each replicate were removed for analysis of target fractions.

7.3 ANALYTICAL METHODS

Chemical constituents tested in the organism tissues were determined based on an evaluation of the results of the sediment chemistry and consultation with USEPA Region 3 and USACE Norfolk District. Tissue samples were analyzed for the following analyte fractions: PAHs, PCBs, dioxin/furan congeners, metals (including mercury), chlorinated pesticides (DDT series, beta-BHC, dachtal, endrin, endrin aldehyde, methoxychlor, and mirex only), lipids, and moisture content. The sample-specific target analytes are provided in Table 7-3.

Details of the analytical testing program for the tissues are provided in Chapter 3 and in the project EcoQAPP (Attachment III of the SAP EA 2015c). The project-specific analytical methods for tissue analysis are provided in Table 3-1.

7.4 SURVIVAL STATISTICAL ANALYSIS

Statistical analyses were performed on the survival data from the bioaccumulation tests according to USEPA/USACE (1998) guidance and using the ToxCalc statistical software package (Version 5.0, Tidepool Scientific Software). For the survival data from the bioaccumulation tests, statistical analyses were performed to determine if exposure to any of the sediment samples resulted in significantly lower survival ($p<0.05$) of the test organisms as compared to the reference sediment.

If survival in a test sample was lower than the percent allowable difference (10 percent) for the reference, then a t-test or Wilcoxon's two-sample test (depending on normal or non-normal data distribution) was performed to compare the single test sample to the reference to determine if the difference was statistically significant.

7.5 DATA ANALYSIS FOR LPC COMPLIANCE

Results of the analytical testing for tissue samples were statistically compared to reference site concentrations. Reference site comparisons are conducted for the protection of aquatic life because bioaccumulation is an indicator of bioavailability. To determine whether or not the dredged material from the JBLE Back River Channel footprint meets the LPC for benthic bioaccumulation, the results of the tissue testing were evaluated using the following protocols:

- The 95% upper confidence limits of the mean (95% UCLM) concentrations of target analytes in the worm and clam tissues were compared to USFDA Action/Guidance/Tolerance Levels.

- Mean chemical concentrations in organisms exposed to sediments from the JBLE Back River Channel were statistically compared to chemical concentrations in organisms exposed to the reference sediment (Table 7-3) and to pre-test tissue concentrations.

- Analytes that statistically exceeded both reference site and pre-test tissue concentrations were statistically compared to USEPA Region 4 background concentrations for South Atlantic Bight (USACE/USEPA 2008).

When tissue concentrations statistically exceed reference, ocean placement regulations require consideration of the following:

- Number of test species in which concentrations exceeds reference

- Number of contaminants that exceed reference

- Magnitude by which concentrations exceed reference

- Toxicological importance

- Phylogenic diversity of the affected species

- Propensity of contaminants to biomagnify

- Magnitude of toxicity, number, and phylogenic diversity of species with mortality greater than reference

- Magnitude by which concentrations in test tissue exceed concentrations in species living at the placement site.

After consideration of these factors for the analytes that statistically exceed the reference site concentration, one of the following conclusions is reached:

- Discharge of dredged material is not predicted to result in above-reference toxicity or benthic bioaccumulation of contaminant.
- Discharge of dredged material is predicted to result in above-reference toxicity or benthic bioaccumulation of contaminant.
- Further information is needed to make factual determinations.

The detailed evaluation of the statistical methods used to evaluate the aquatic organism tissue concentrations and the LPC compliance for benthic bioaccumulation for each of the DUs in the JBLE Back River Channel is described in the following sections.

7.6 STATSITICAL ANALYSIS OF TISSUE CHEMISTRY DATA

Before performing the statistical protocols to evaluate whether organisms exposed to sediment from the JBLE Back River Channel accumulated higher concentrations of analytes in tissue than those exposed to reference site sediment, steps were taken to prepare the tissue data for evaluation. After laboratory analytical testing of tissue samples, the raw tissue data were prepared and analyzed as follows. Statistical analyses of tissue chemistry data were performed according to procedures outlined in the SERIM (USEPA/USACE 2008), Ocean Testing Manual (USEPA/USACE 1991) and the Inland Testing Manual (USEPA/USACE 1998). The statistical methods used are described in detail below.

- Based on USEPA guidance, the laboratory RL was substituted for non-detected constituents as a conservative estimate of potential uptake. Estimated concentrations (i.e., J-qualified) were treated as non-detects censored to the RL for the statistical evaluations.
- The data set for each analyte was examined to evaluate assumptions of normality and homogeneity of variances among DUs/reference samples.
- Individual replicates were statistically analyzed to determine if there were potential outliers (Section 7.6.1).
- Data for organic constituents were statistically lipid-normalized to account for the variability in lipid concentrations of individual organisms (Section 7.6.2).
- Total LPAH, HPAH, and total PAH concentrations were determined for each sample by summing the concentrations of the individual PAHs (Section 7.6.3).

- Two total PCB concentrations were determined for each sample by summing the concentrations of the individual PCB congeners from two lists (NOAA and USEPA Region 4) (Section 7.6.4).

- Dioxin and furan TEQs were calculated according to WHO guidelines (Section 7.6.5).

- Mean chemical concentrations in organisms exposed to sediments from the JBLE Back River Channel were calculated and statistically compared to chemical concentrations in organisms exposed to the appropriate reference sediment sample (Table 7-3) to determine if uptake of contaminants was significantly higher in organisms exposed to sediment from the JBLE Back River Channel (Section 7.6.6).

- Goodness-of-fit tests were conducted for each analyte by combining tissue-residue concentrations from all sites and computing the Shapiro Wilk's *W* statistic for the residuals of a one-way linear effects model as described in Conover (1980) (Section 7.6.7).

- Analytes that statistically exceeded reference site tissue concentrations and pre-test concentrations were statistically compared USEPA Region 4 background concentrations (Section 7.6.8).

- The 95 percent Upper Confidence Level of the Mean (UCLM) concentrations of target analytes in the worm and clam tissues were statistically compared to USFDA Action/Guidance/Tolerance Levels to determine if analyte concentrations in tissue were significantly higher than the USFDA Action/Guidance/Tolerance Levels (Section 7.6.9).

Detailed methods for data preparation, data analysis, and evaluation of mean sample concentrations that statistically exceed mean reference site concentrations are described in the following sections.

7.6.1 Statistical Determination of Outliers in Replicate Data

Data from replicates were analyzed to determine if there were any outliers using Dixon's Extreme Value Test (USEPA 2000). Dixon's Extreme Value test can be used to identify potential outliers in sample data sets with at least three replicates. This test was conducted at the 99 percent confidence level. Identified potential outliers were further evaluated to determine if there was compelling scientific rationale (e.g., documentation of laboratory error) for removing the sample result from the data set.

Although several of the sample data points were identified as potential outliers, there was no scientific rationale identified to remove the potential outliers from the data set. At the request of EPA, clam tissue from Replicate B of BRC-03/04, DU2 (Table E-1.2, Appendix E) was reanalyzed in triplicate for lead. The results are provided in Table E-1.2.1, Appendix E. The results of the re-analysis were not used in the statistical analysis. Statistical analysis was conducted on the original replicate data sets (which included potential outliers) using nonparametric or robust statistical methods insensitive to extreme values.

7.6.2 Lipid Normalization of Organic Constituents

Nonpolar organic constituents preferentially partition into the lipid fraction of organism tissue. Generally, organisms with higher concentrations of lipids will tend to naturally accumulate higher concentrations of organic constituents, in proportion to the lipid fraction of the organism. In order to account for variation in lipid content among DU/reference samples, the following equation was used normalize replicate tissue concentration data to unit lipid content prior to conducting statistical evaluations:

$$X_{ln} = \frac{X}{L}$$

where:

- X_{ln} = the lipid normalized organic tissue concentration
- X = the tissue concentration (wet weight) of the organic constituent for the specific replicate
- L = the percent lipid concentration for the specific replicate.

7.6.3 Calculation of Total PAHs

Total PAH concentrations were determined for each sample by summing the concentrations of the individual PAHs to compute total LPAHs and HPAHs as defined in SERIM (USEPA/USACE 2008).

For the total PAH concentrations, concentrations below the analytical detection limit were reported as the reporting limit (ND=RL) and as one-half of the reporting limit (ND=½RL). Substituting each of these for each non-detect provides a conservative estimate of the concentration. This method, however, tends to produce results that are biased high, especially in data sets where the majority of samples are non-detects. This overestimation is important to consider when comparing the calculated total values to criteria values.

7.6.4 Calculation of Total PCBs

Two total PCB concentrations were determined for each sample by summing the concentrations of the individual PCBs in the NOAA and the USEPA Region 4 list (USEPA/USACE 2008).

For each of the total PCB concentrations, concentrations below the analytical detection limit were reported as the reporting limit (ND=RL) and as one-half of the reporting limit (ND=½RL). Substituting each of these for each non-detect provides a conservative estimate of the concentration. This method, however, tends to produce results that are biased high, especially in data sets where the majority of samples are non-detects. This overestimation is important to consider when comparing the calculated total values to criteria values.

7.6.5 Calculation of Dioxin Toxicity Equivalency Quotients

The TEQs for dioxin and furan congeners were calculated following the approach recommended by WHO (Van den Berg et al. 2006). Each congener was multiplied by a WHO recommended TEF, relating it to the human health effects of 2,3,7,8 TCDD, which is the most toxic congener (Van den Berg et al. 2006). The adjusted congener concentrations were then summed. Concentrations that were flagged with a "Q" (estimated maximum possible concentration) were not included in the TEQ calculation as per the USEPA dioxin validation guidance (USEPA 2005). Concentrations that were flagged with a "B" (detected in the blank) were included in the TEQ calculation because the increased sensitivity of the instrumentation detected dioxin congeners in the blank at ultra-low concentrations just above the detection limit. Including the "B" flagged values allowed for direct comparison to results from previous regional sampling programs. The dioxin TEQs were calculated using ND=RL.

7.6.6 Calculation of Sample Means

Mean tissue concentrations were calculated for each sample group (DU, reference sample, and pre-test).

7.6.7 Goodness-of-Fit Test of Normal Distribution and Homogeneity of Variances

Goodness-of-fit tests were conducted for each analyte by combining tissue-residue concentrations from all sites and computing the Shapiro Wilk's W statistic for the residuals of a one-way linear effects model as described in Conover (1980), summarized in Figure 7-1. Following USEPA 1998 guidance for balanced designs with $N > 20$, a normal distribution was rejected if $W < W_{crit}$ at the 99 percent confidence level.

Levene's F test was used to tests the assumption of homogeneity of variances (HOV) among sample groups (DU, reference sample, and pre-test) at the 90 percent significance level (USEPA/USACE 1998 for $n = 2$ to 9).

7.6.8 Comparison of Bioaccumulation Data to Reference and Pre-Test Concentrations

The effects of the sediment from the JBLE Back River Channel dredging footprint on chemical accumulation in tissues were evaluated by statistical comparison of chemical concentrations in tissues exposed to sediment from the JBLE Back River Channel dredging footprint to chemical concentrations in tissues exposed to sediment from the reference areas. The same statistical method was used to compare the test tissue concentrations to pre-test tissue concentrations. The tested null hypothesis (H_0) and alternative hypothesis (H_1) were as follows:

H_0: Mean from DU ≤ Mean from Reference
H_1: Mean from DU > Mean from Reference.

As summarized in Figure 7-1, the statistical test used to conducted comparison to reference was determined from the data distribution and homogeneity of variances as described Section 7.6.7. For analyte data sets consisting of only detected results above the RL that could be approximated with a normal distribution and for which the HOV assumption was not rejected, the comparisons to reference tests were conducted using Dunnett's multiple comparison procedure with an overall (i.e., familywise) alpha of 5%. A nonparametric procedure was used for analytes containing <RL results, or for which either the normal distribution or HOV assumptions were rejected. The nonparametric procedure consisted of Steel's Many One Rank test (sample sizes equal) with overall alpha of 5%, or pairwise Wilcoxon Rank Sum tests (sample sizes unequal) with overall alpha of 5% using Hochberg's step-up Bonferroni procedure (Hochberg 1988).

7.6.9 Comparison to USFDA Action/Guidance/Tolerance Levels

The purpose of the bioaccumulation testing is to predict the potential for uptake of chemical contaminants in the dredged material by aquatic organisms. The USFDA Action/Guidance/Tolerance Levels are derived from risk assessment evaluations for application as critical limits for determining the acceptability of aquatic organisms as food sources to humans. Food that exceeds the USFDA Action/Guidance/Tolerance Levels are removed from the market place, and are not considered safe for human consumption. The USFDA Action/Guidance/Tolerance Levels are generally applicable to shellfish, as well as finfish.

The USFDA levels do not indicate the potential for environmental impact on the contaminated organisms or the potential for biomagnification. However, because contamination of food in excess of USFDA levels is considered a threat to human health, USEPA and USACE consider concentrations in excess of such levels in any test species to be predictive of benthic bioaccumulation of contaminants (USEPA/USACE 1998). According to guidance in the Ocean Testing Manual, dredged material is suitable for open-water or ocean placement if the 95 percent lower confidence level of the mean is less than the USFDA Action Level. According to the Inland Testing Manual, dredged material is not suitable for placement if the mean exceeds the USFDA Action Level, is suitable for placement if the 95 percent UCLM is less than the USFDA Action Level, and the test is inconclusive if the mean and 95 percent UCLM straddle the USFDA Action Level.

For normally distributed analytes, the UCLM was then was calculated as

$$\text{UCLM} = \bar{x} + t_{[.95,df]}\sqrt{s^2 / n}$$ Sokal and Rohlf (1981),

where

$\bar{x}$ = sample mean of replicate data

s^2 = sample variance of replicate data

n = number of sample replicates

$t_{[0.95,df]}$ = 95 percent quantile of the *t* distribution with *df* degrees of freedom

If variances were not significantly different, then the pooled variance was used in place of the sample variance s^2, and the t was then evaluated for $df = N - k$ degrees of freedom, where N is the total number of observations ($\sum_{i=1}^{k} n_i$) and k is the number of sample groups. If variances were unequal, then the sample variance was used for s^2 and t was evaluated for $df = n - 1$ degrees of freedom.

For analytes with results below the RL, or for which a normal distribution was rejected, a robust UCLM was calculated based on the sample median, MD, as an estimate for the population mean and the median absolute deviation from the sample median, MAD, as an estimate for the population standard deviation. Robust confidence intervals are more resistant to both departures from normality and the presence of outliers, and therefore are better able to retain the desired coverage probability than confidence intervals computed using the classical mean and variance that are adversely influenced by the presence of non-detects, non-normal data distributions, or outliers. Robust UCLMs were calculated as follows:

$$\text{Robust UCLM} = MD + t_{[.95,df]} b_n \frac{MAD}{\sqrt{n}}$$ Abu-Shawiesh *et al.* (2009),

where

MD = sample mean of replicate data,
MAD = median absolute deviation from sample median,
b_n = correction factor needed to make b_n MAD an unbiased estimator of the population standard deviation ($b_n = 1.206$ for $n = 5$),
n = number of sample replicates, and
$t_{[0.95,n-1]}$ = 95 percent quantile of the t distribution with $n-1$ degrees of freedom.

The computed UCLMs are provided in Table 7-5. For the majority of organics, tissue concentrations are not expected to reach steady-state within the 28-day exposure duration of a standard bioaccumulation test. Prior to comparisons to USFDA Action levels, steady-state factors provided in the SERIM (USACE/USEPA 2008) were applied (multiplied) to the 28-day bioaccumulation tissue concentration to estimate the concentration that would be reached if sufficient exposure time was allowed for the tissue concentrations to reach steady-state.

With respect to the target analytes for the JBLE Back River Channel project, there are USFDA levels for arsenic, cadmium, chromium, lead, mercury, nickel, total Region 4 PCBs (ND=RL), and 4,4'-DDT. For substances with USFDA Action/Guidance/Tolerance Levels, the criteria values were compared to the 95 percent UCLM tissue-residue concentrations for each sample. If the UCLM was below the criterion value, it was concluded that the dredged material is suitable for open-water or ocean placement. In accordance to SERIM (USEPA/USACE 2008), any sample results for which the 95 percent UCLM exceeded the USFDA Action/Guidance/Tolerance Levels were identified.

7.6.10 Evaluation of Statistical Exceedances

Several data analysis techniques were used for the weight-of-evidence assessment to evaluate the mean tissue concentrations that statistically exceeded mean reference site concentrations:

- **Uncertainty in Estimated Total PAHs, Total PCBs, and Dioxin TEFs**: In data sets with a large proportion of non-detected constituents (such as this data set), laboratory reporting limits substituted for individual non-detected constituents can lead to estimates of summed concentrations (e.g., total PAHs, total PCBs, and dioxin TEFs) that are biased high. In cases where few or no individual constituents are actually detected, statistical exceedances may be attributable to the replacement of RLs for non-detected constituents, and may not be ecologically significant.

- **Statistical Comparison to Pre-Test Tissue:** Analytes that statistically exceeded reference site tissue concentrations were compared to pre-test tissue concentrations to determine if the test sample concentrations were comparable to or statistically higher than baseline contaminant concentrations that had accumulated in the organisms' natural environment. When mean tissue concentrations statistically exceed pre-test tissue mean concentrations, there is stronger weight-of-evidence that uptake may be occurring from exposure to project sediment.

- **Comparison to USACE/USEPA Region 4 Background Concentrations**: Because USEPA Region 3 has not developed region-specific background concentrations, in this study, mean concentrations of analytes that statistically exceeded mean reference site concentrations and mean pre-test concentrations were numerically compared to USEPA Region 4 background concentrations for the South Atlantic Bight (northeast Florida to southern North Carolina) (USACE/ USEPA 2008). If the bioaccumulation tissue concentrations are less than background concentrations, then the placement of material would not be expected to result in bioaccumulation above background conditions. If the bioaccumulation results are higher than background tissue concentrations, then it may or may not be predictive of adverse effects (USACE/USEPA 2008).

7.7 SURVIVAL RESULTS

The *N. virens* bioaccumulation test survival results are summarized in Table 7-2. Reference sediment WBREF-SED had 93 percent survival, reference OCREF-SED had 97 percent survival, and the lab control had 99 percent survival. The 28-day survival values for the DU sediment samples ranged from 94 to 98 percent, within 10 percent of the survival in the reference site sediments.

The *M. nasuta* bioaccumulation test results are also presented in Table 7-2. Reference sediment WBREF-SED had 96 percent survival, reference OCREF-SED had 97 percent survival, and the lab control had 95 percent survival. Survival in DU sediment samples ranged from 92 to 98 percent, within 10 percent of the survival in the reference site sediments.

7.8 TISSUE RESIDUE ANALYSIS

UCLM tissue-residue concentrations for arsenic, cadmium, chromium, lead, mercury, nickel, total PCBs (ND=RL) and 4,4-DDT in worm and clam tissues exposed to sediment from the JBLE Back River Channel project samples were compared to USFDA Action/Guidance/Tolerance Levels.

None of the UCLM values for JBLE Back River Channel tissues exceeded the USFDA Action/Guidance/Tolerance Levels for metals, total PCBs, or 4,4'-DDT (Table 7-5).

Mean tissue contaminant concentrations in *N. virens* (sand worm) and *M. nasuta* (blunt-nose clam) exposed to sediment from the JBLE Back River channel project sediments were compared to mean tissue contaminant concentrations in organisms exposed to sediment from the assigned reference site (Table 7-3). Results of these comparisons are discussed in the following subsections.

Results of the statistical analysis for *N. virens* (sand worm) and *M. nasuta* (blunt-nose clam) are presented in Tables 7-6 through 7-10. The raw data for each tissue replicate, analytical detection limits, and definitions of inorganic, organic, and dioxin/furan data qualifiers are provided in Appendix E. Values shaded green on the tables indicate that the mean tissue value statistically exceeds the reference site tissue mean, and values shaded blue indicate that the mean tissue concentration statistically exceeds the reference site mean tissue concentration and the pre-test mean tissue concentration. Project samples with mean tissue concentrations that statistically exceeds the reference site mean tissue concentration and the pre-test tissue concentration were then compared to the USACE/USEPA Region 4 background ranges (Table 7-12). As discussed in Section 7.3 and detailed in Table 7-3, not all analytes were analyzed for each DU.

7.8.1 Lipids

Mean lipid values for organisms exposed the sediment from the JBLE Back River Channel dredging footprint and the reference site are presented in Table 7-11. Mean lipid values ranged from 0.53 to 0.95 percent of total wet body weight for *N. virens* (worms) and 0.42 to 0.75 percent of total wet body weight for *M. nasuta* (clams) (Table 7-11).

7.8.2 DU1, DU2, DU3, and DU4

Concentrations in tissues from four of the six composites (DU1, DU2, DU3, and DU4) exposed to sediment from these composite samples were compared to concentrations in tissues for the Willoughby Bank reference site. Metals, PAHs, PCBs (DU1 and DU2 only), dioxin/furans, and select pesticides were analyzed for tissues exposed to sediment from these DUs. The tissue assessment indicated that:

- None of the UCLM values for JBLE Back River Channel tissues exposed to sediment from DU1, DU2, DU3, or DU4 samples exceeded the USFDA Action/Guidance/Tolerance Levels for metals, total PCBs (ND=RL), or 4,4'-DDT (Table 7-4).

- None of the mean concentrations of metals, PAHs, or PCBs in the tissues exposed to sediment from DU1, DU2, DU3, or DU4 samples statistically exceeded mean concentrations detected in tissues exposed to the sediment from the Willoughby Bank reference site (Tables 7-6, 7-7, and 7-8, respectively).

- Mean octachlorodibenzodioxin (OCDD) concentrations in the worm tissue for DU2 and DU4 statistically exceeded the mean concentration detected in tissues exposed to the sediment from the Willoughby Bank reference site and the mean pre-test tissue concentrations. The mean OCDD concentration in the clam tissue exposed to sediment for DU4 statistically exceeded the mean concentration detected in tissues exposed to the sediment from the Willoughby Bank reference site but did not statistically exceed the pre-test concentration (Table 7-9).

- There are no USEPA/USACE Region 4 background concentrations for OCDD in worm or clam tissues. With a TEF of 0.0003, it is the least toxic dioxin congener; approximately 3,000 times less toxic than the next congener, 1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin (HPCDD) with a TEF of 0.01. It therefore contributes a very low proportion to the dioxin TEQ value.

- The mean 1,2,3,4,6,7,8,-HPCDD concentration in the worm tissue for DU3 statistically exceeded the mean concentration detected in tissues exposed to the sediment from the Willoughby Bank reference site (Table 7-9), however, mean 1,2,3,4,6,7,8-HPCDD concentration did not statistically exceed the pre-test concentration in the worm tissue exposed to DU3.

- The mean beta-BHC concentration in the worm tissue for DU4 statistically exceeded the mean concentration detected in tissues exposed to the sediment from the Willoughby Bank reference site (Table 7-10), however, mean beta-BHC concentrations did not statistically exceed the pre-test concentration in the worm tissue for DU4.

LPC Compliance

For DU1, DU2, DU3, and DU4, none of the mean concentrations of metals, PAHs, or PCBs statistically exceeded mean reference site concentrations. Although mean concentrations of 1,2,3,4,6,7,8-HPCDD in the worm tissue exposed to sediment from DU3 and mean concentrations of OCDD in the clam tissue exposed to sediment from DU4 statistically exceeded the mean concentrations detected in tissues exposed to the sediment from the Willoughby Bank reference site, they did not also exceed the mean pre-test tissue concentrations. Mean OCDD concentrations in the worm tissue exposed to the Back River channel samples from DU2 and DU4 statistically exceeded mean reference and mean pre-test tissue concentrations. There are no USEPA Region 4 background concentrations for OCDD; however, this dioxin congener is the least toxic with a TEF value of 0.0003. In addition, none of the dioxin TEQs statistically exceeded the reference site TEQs. None of the UCLM values for JBLE Back River Channel tissues exposed to sediment from DU1, DU2, DU3, or DU4 samples exceeded the USFDA Action/Guidance/Tolerance Levels for metals, total PCBs (ND=RL) or 4’4’-DDT.

Based on the assessment of chemical analyses performed on tissues exposed to sediment from DU1, DU2, DU3, and DU4 and reference site sediment, it is anticipated that ***ocean placement of the dredged material from DU1 through DU4 at the NODS will not result in ecologically significant bioaccumulation of contaminants*** and that the dredged material complies with the benthic bioaccumulation criteria of 40 CFR 227.13 (c) (3).

7.8.3 DU5 and DU6

Concentrations in tissues from two of the six composites (DU5 and DU6) were compared to concentrations in tissues for the Atlantic Ocean reference site. Metals, dioxin/furans, and select pesticides (DU5 only) were analyzed for tissues exposed to sediment from these DUs. The tissue assessment indicated that:

- None of the UCLM values for JBLE Back River Channel tissues exposed to sediment from the DU5 or DU6 samples exceeded the USFDA Action/Guidance/Tolerance Levels for metals, total PCBs, or 4,4'-DDT (Table 7-4).

- The mean cadmium concentration in the worm tissue exposed to sediment from DU5 statistically exceeded the mean concentration detected in tissues exposed to the sediment from the Atlantic Ocean reference site, but did not statistically exceed the mean concentration for pre-test tissue (Table 7-6).

- Mean lead and nickel concentrations in the clam tissue for DU5 statistically exceeded the mean concentration detected in tissues for the Atlantic Ocean reference site and the mean pre-test tissue concentrations (Table 7-6).

- The mean OCDD concentration in the clam tissue for DU5 statistically exceeded the mean concentration detected in tissues for the Atlantic Ocean reference site, but did not statistically exceed the mean concentration in tissue for the pre-test tissue (Table 7-9).

LPC Compliance

Although mean concentrations of cadmium and OCDD for DU5 statistically exceeded the mean concentrations detected in tissues exposed to the sediment from the Atlantic Ocean reference site, they did not exceed the mean pre-test tissue concentrations. Mean concentrations of lead and nickel in clam tissue from DU5 statistically exceeded the mean concentration of tissue for both mean reference and pre-test tissue. The UCLM values for these metals were compared to the USEPA Region 4 background concentrations for South Atlantic Bight, and the UCLMs did not exceed the background ranges (Table 7-12).

Based on the assessment of chemical analyses performed on tissues for DU5 and DU6 and reference site sediment, it is anticipated that ***ocean placement of the dredged material from DU5 and DU6 at the NODS will not result in ecologically significant bioaccumulation of contaminants*** and that the dredged material complies with the benthic bioaccumulation criteria of 40 CFR 227.13 (c) (3).

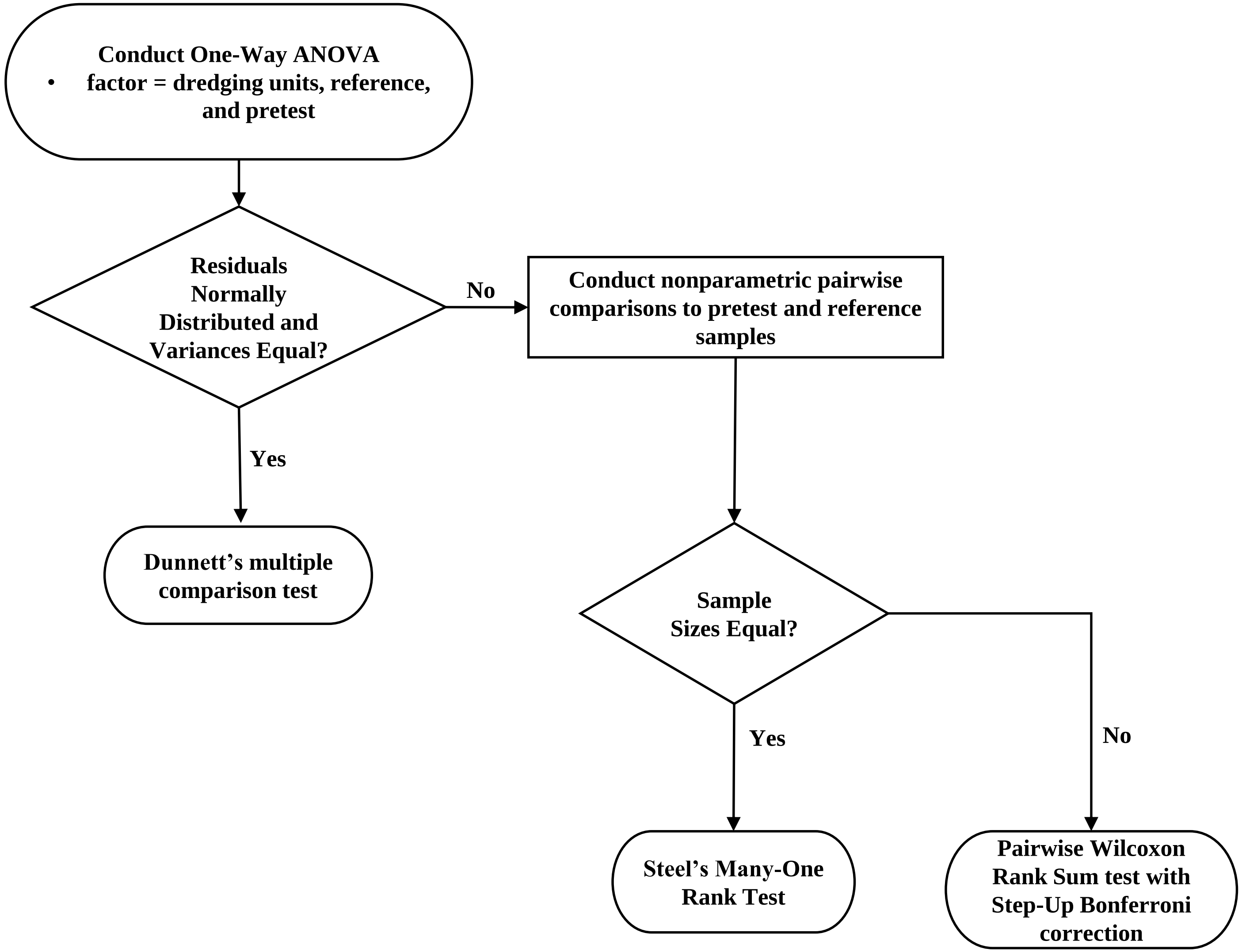

Figure 7-1. Flow Chart of Procedure Used to Statistically Compare Tissue Chemistry Data to Reference/Pretest Tissue.

TABLE 7-1. RESULTS OF REFERENCE TOXICANT TESTING ON ACQUIRED LOTS OF TEST ORGANISMS FOR BIOACCUMULATION EXPOSURES JBLE BACK RIVER CHANNEL, HAMPTON, VIRGINIA (DECEMBER 2015)

Test Species	Organism Lot Number	Reference Toxicant	Test Endpoint	Acceptable Control Chart Limits
Nereis virens	NV-054	Potassium chloride (KCl)	48-Hour LC50: 1,439 mg/L KCl	575 – 1,605 mg/L KCl
Macoma nasuta	MA-046	Potassium chloride (KCl)	48-Hour LC50: 1,439 mg/L KCl	831 – 2,181 mg/L KCl

TABLE 7-2. REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES FOR TISSUE SAMPLES [(a)]

JBLE BACK RIVER CHANNEL, HAMPTON, VIRGINIA (DECEMBER 2015)

Parameter	Mass Required [(b)]	Container [(c)]	Preservative	Holding Time
Inorganics				
Metals (including Mercury)	8 ounces	P,G	0°C	6 months (28 days for mercury)
Physical Properties				
Percent Lipids	(d)	P,G	0°C	1 year
Percent Moisture	(d)	P,G	0°C	1 year
Organics				
Polycyclic Aromatic Hydrocarbons	(d)	G	0°C	1 year
Polychlorinated Biphenyl Congeners	(d)	G	0°C	1 year
Dioxins and Furans	(d)	G	0°C	1 year
Chlorinated Pesticides	(d)	G	0°C	1 year
Semivolatile Organic Compounds	(d)	G	0°C	1 year

(a) From time of sample collection.
(b) Additional volume provided for samples designated as matrix spike/matrix spike duplicates.
(c) P = plastic, G = glass.
(d) Can be taken from the 8oz. for metals.

TABLE 7-3. TISSUE TESTING SCHEME
JBLE BACK RIVER CHANNEL, HAMPTON, VIRGINIA (DECEMBER 2015)

ANALYTE GROUPS	References		DU1	DU2	DU3	DU4	DU5	DU6
	WBREF	OCREF	BRC-01/02	BRC-03/04	BRC-05/06	BRC-07/08	BRC-09/10	BRC-11/12
METALS	X	X	X	X	X	X	X	X
PAHs	X		X	X	X	X		
PCBs	X		X	X				
CHLORINATED PESTICIDES	X[(a)]	X[(a)]	X[(a)]	X[(a)]	X[(a)]	X[(a)]	X[(a)]	
DIOXINS/FURANS	X	X	X	X	X	X	X	X
a. Pesticides to be run for statistical analysis for each DU listed below corresponding column	a. DDT series, Beta-BHC, Dacthal, Endrin, Endrin Aldehyde, Methoxychlor, Mirex	a. DDT series	a. DDT series, Endrin, Mirex	a. DDT series, Endrin, Mirex	a. DDT series, Endrin	a. DDT series, Beta-BHC, Dacthal, Endrin, Endrin Aldehyde, Methoxychlor, Mirex	a. DDT Series	

Samples were statistically compared to the Willoughby Bank reference site (WBREF, BRC-01/02, BRC-03/04, BRC-05/06, BRC-07/08 columns shaded orange)

Samples were statistically compared to the Atlantic Ocean reference site (OCREF, BRC-09/10, BRC-11/12 columns shaded purple)

TABLE 7-4. BIOACCUMULATION SURVIVAL RESULTS

JBLE BACK RIVER CHANNEL, HAMPTON, VIRGINIA (DECEMBER 2015)

Dredging Unit	Sample Identification	*Nereis virens*		*Macoma nasuta*	
		No. Alive/No. Exposed[(a)]	28-Day Mean Percent Recovery[(b)]	No. Alive/No. Exposed[(a)]	28-Day Mean Percent Recovery[(b)]
DU1	BRC-01/02-SED	116 / 120	97	242 / 250	97
DU2	BRC-03/04-SED	114 / 120	95	231 / 250	92
DU3	BRC-05/06-SED	113 / 120	94	236 / 250	94
DU4	BRC-07/08-SED	117 / 120	98	240 / 250	96
DU5	BRC-09/10-SED	114 / 120	95	244 / 250	98
DU6	BRC-11/12-SED	115 / 120	96	244 / 250	98
--	WBREF-SED	110 / 120	93	240 / 250	96
--	OCREF-SED	116 / 120	97	242 / 250	97
	LAB CONTROL	71 / 72[(c)]	99	143 / 150	95

(a) Total for five replicates of 24 animals, unless otherwise stated.

(b) Statistically compared to reference, if percent recovery is ≥10 percent difference from reference.

(c) Laboratory Control had three replicates of 24 animals.

TABLE 7-5. COMPARISON OF UPPER 95% CONFIDENCE LEVELS OF THE MEAN STEADY STATE CORRECTED TISSUE CONCENTRATION TO UNITED STATES FOOD AND DRUG ADMINISTRATION ACTION/GUIDANCE/TOLERANCE LEVELS
JBLE BACK RIVER CHANNEL, HAMPTON, VIRGINIA (DECEMBER 2015)

												DU1		DU2		DU3		DU4				DU5		DU6	
		USFDA Action/Guidance/Tolerance Levels[(a)]		Steady State Correction Factor [(b)]		Control		Pre-Test Tissue		Willoughby Bank Reference		BRC-01/02		BRC-03/04		BRC-05/06		BRC-07/08		Atlantic Ocean Reference		BRC-09/010		BRC-11/12	
ANALYTE	UNITS	Worms	Clams	Worms	Clams	Worms	Clams	Worms	Clams	Worms	Clams	Worms	Clams	Worms	Clams	Worms	Clams	Worms	Clams	Worms	Clams	Worms	Clams	Worms	Clams
METALS																									
ARSENIC	MG/KG	76.0	86.0	1.0	1.0	**2.85**	**2.89**	**3.50**	**2.56**	**3.18**	**3.96**	**2.64**	**3.38**	**2.40**	**3.49**	**2.74**	**3.46**	**2.84**	**3.59**	**2.84**	**3.26**	**3.61**	**3.69**	**2.84**	**3.23**
CADMIUM	MG/KG	4.0	3.0	1.0	1.0	<0.097	<0.095	<0.099	<0.099	<0.098	<0.097	<0.1	<0.097	<0.099	<0.099	0.10	<0.095	<0.098	<0.099	<0.1	<0.1	**0.10**	<0.098	<0.1	<0.1
CHROMIUM	MG/KG	12.0	13.0	1.0	1.0	**1.96**	**0.24**	**0.43**	**0.21**	**2.15**	**0.54**	**0.72**	**0.31**	**0.84**	**0.46**	**0.77**	**0.33**	**1.74**	**0.39**	**1.11**	**0.39**	**1.09**	**0.51**	**1.05**	**0.21**
LEAD	MG/KG	1.5	1.7	1.0	1.0	**0.27**	**0.14**	**0.29**	**0.12**	**0.39**	**0.37**	**0.48**	**0.37**	**0.53**	**0.34**	**0.55**	**0.35**	**0.72**	**0.31**	**0.45**	**0.17**	**0.56**	**0.29**	**0.42**	**0.21**
MERCURY	MG/KG	1.0	1.0	1.0	1.0	<0.16	<0.15	<0.16	<0.17	<0.17	<0.17	<0.16	<0.16	<0.17	<0.16	<0.17	<0.15	<0.16	<0.15	<0.16	<0.16	<0.17	<0.15	<0.17	<0.17
NICKEL	MG/KG	70.0	80.0	1.0	1.0	**0.65**	**0.32**	**0.32**	**0.30**	**0.86**	**0.61**	**0.57**	**0.44**	**0.53**	**0.50**	**0.65**	**0.52**	**0.66**	**0.50**	**0.75**	**0.51**	**0.85**	**0.65**	**0.58**	**0.43**
PCBS																									
TOTAL REGION 4 PCBs (ND=RL)	UG/KG	2,000.0	2,000.0	1.7	1.0	**31.70**	<18	**31.20**	<18	**31.30**	<18	**31.50**	<18	**31.60**	<18	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PESTICIDES																									
4,4'-DDT	UG/KG	5,000.0	5,000.0	2.9	2.9	<0.42	<0.42	<0.42	<0.42	<0.42	<0.42	<0.42	<0.42	<0.42	<0.42	<0.42	**0.43**	<0.42	**0.42**	<0.42	<0.42	<0.42	<0.42	NA	NA

(a) *Source:* USEPA/USACE 2008. Southeast Implementation Manual (SERIM). Requirements and Procedures for Evaluation of the Ocean Disposal of Dredged Material in Southeastern U.S. Atlantic and Gulf Coast Waters.

(b) In some cases, contaminant concentrations are not expected to reach steady state within the 28-day exposure duration of a standard bioaccumulation test.

Steady-state factors represent the factor that must be applied (multiplied) to the 28-day bioaccumulation tissue concentration to estimate the contaminant concentration that would be reached if sufficient exposure time was allowed to the tissue concentrations to reach steady-state.

(C) EPA Total Region 4 PCBs represents the sum of all PCBs in table 6-7 (SERIM2008)

NOTES: Bold values represent detected concentrations.

Table only shows analytes for which there are FDA Limits

NA = not analyzed

ND = not detected

TABLE 7-6. MEAN METAL CONCENTRATIONS (MG/KG) IN TISSUES
JBLE BACK RIVER CHANNEL, HAMPTON, VIRGINIA (DECEMBER 2015)

						DU1		DU2		DU3		DU4				DU5		DU6	
		Pre-test		Willoughby Bank Reference Site		BRC-01/02		BRC-03/04		BRC-05/06		BRC-07/08		Atlantic Ocean Reference Site		BRC-09/10		BRC-11/12	
		Worms	Clams	Worms	Clams	Worms	Clams	Worms	Clams	Worms	Clams	Worms	Clams	Worms	Clams	Worms	Clams	Worms	Clams
ANALYTE	UNITS	Lipids = 0.95	Lipids = 0.51	Lipids = 0.76	Lipids = 0.42	Lipids = 0.78	Lipids = 0.68	Lipids = 0.75	Lipids = 0.65	Lipids = 0.75	Lipids = 0.74	Lipids = 0.72	Lipids = 0.65	Lipids = 0.53	Lipids = 0.64	Lipids = 0.85	Lipids = 0.69	Lipids = 0.69	Lipids = 0.56
ANTIMONY	MG/KG	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ARSENIC	MG/KG	**2.93**	**2.13**	**2.94**	**3.30**	**2.52**	**3.04**	**2.44**	**2.98**	**2.88**	**3.08**	**2.58**	**3.14**	**2.80**	**3.18**	**3.30**	**3.38**	**2.76**	**2.82**
BERYLLIUM	MG/KG	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
CADMIUM	MG/KG	ND	ND	ND	ND	ND	ND	ND	ND	**0.09**	ND	ND	ND	ND	ND	**0.10**	ND	ND	ND
CHROMIUM	MG/KG	**0.33**	**0.20**	**4.86**	**0.40**	**0.65**	**0.30**	**0.63**	**0.32**	**0.81**	**0.34**	**2.27**	**0.41**	**0.81**	**0.38**	**0.98**	**0.56**	**0.64**	**0.23**
COPPER	MG/KG	**1.30**	**2.33**	**1.44**	**2.48**	**1.24**	**2.48**	**1.36**	**2.36**	**1.58**	**2.44**	**1.44**	**3.30**	**1.46**	**3.26**	**1.68**	**2.64**	**1.62**	**2.54**
LEAD	MG/KG	**0.28**	**0.14**	**0.46**	**0.32**	**0.43**	**0.41**	**0.45**	**1.40**	**0.61**	**0.30**	**0.57**	**0.32**	**0.40**	**0.17**	**0.46**	**0.27**	**0.43**	**0.19**
MERCURY	MG/KG	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
NICKEL	MG/KG	**0.27**	**0.23**	**0.71**	**0.53**	**0.49**	**0.42**	**0.46**	**0.39**	**0.59**	**0.44**	**0.56**	**0.43**	**0.58**	**0.46**	**0.72**	**0.58**	**0.79**	**0.39**
SELENIUM	MG/KG	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SILVER	MG/KG	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**0.09**	ND	ND	ND	ND	ND	ND
THALLIUM	MG/KG	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ZINC	MG/KG	**9.73**	**11.30**	**16.70**	**15.40**	**23.50**	**15.00**	**21.90**	**14.60**	**17.10**	**15.20**	**22.70**	**14.60**	**17.20**	**15.60**	**29.10**	**16.20**	**20.70**	**15.00**

NOTE: For pre-test and control tissues n = 3 and for all other tissue tests n = 5.

Nereis virens species used for worm tissue tests and *Macoma nasuta* used for clam tissue tests.

ND = not detected or was detected below the reporting limit in each of the tested tissue replicates.

analyte concentration is significantly higher than the reference site concentration (p>0.05)

analyte concentration is significantly higher than the reference site concentration (p>0.05) and the pre-test tissue concentration (p>0.05)

TABLE 7-7. MEAN POLYCYCLIC AROMATIC HYDROCARBON (PAH) CONCENTRATIONS (UG/KG) IN TISSUES
JBLE BACK RIVER CHANNEL, HAMPTON, VIRGINIA (DECEMBER 2015)

						DU1		DU2		DU3		DU4				DU5		DU6	
		Pre-test		Willoughby Bank Reference Site		BRC-01/02		BRC-03/04		BRC-05/06		BRC-07/08		Atlantic Ocean Reference Site		BRC-09/10		BRC-11/12	
		Worms	Clams	Worms	Clams	Worms	Clams	Worms	Clams	Worms	Clams	Worms	Clams	Worms	Clams	Worms	Clams	Worms	Clams
ANALYTE	UNITS	Lipids = 0.95	Lipids = 0.51	Lipids = 0.76	Lipids = 0.42	Lipids = 0.78	Lipids = 0.68	Lipids = 0.75	Lipids = 0.65	Lipids = 0.75	Lipids = 0.74	Lipids = 0.72	Lipids = 0.65	Lipids = 0.76	Lipids = 0.40	Lipids = 0.85	Lipids = 0.69	Lipids = 0.69	Lipids = 0.56
ACENAPHTHENE	UG/KG	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
ACENAPHTHYLENE	UG/KG	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
ANTHRACENE	UG/KG	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
BENZO(A)ANTHRACENE	UG/KG	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
BENZO(A)PYRENE	UG/KG	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
BENZO(B)FLUORANTHENE	UG/KG	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
BENZO(GHI)PERYLENE	UG/KG	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
BENZO(K)FLUORANTHENE	UG/KG	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
CHRYSENE	UG/KG	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
DIBENZO(A,H)ANTHRACENE	UG/KG	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
FLUORANTHENE	UG/KG	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
FLUORENE	UG/KG	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
INDENO(1,2,3-CD)PYRENE	UG/KG	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
NAPHTHALENE	UG/KG	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
PHENANTHRENE	UG/KG	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
PYRENE	UG/KG	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
TOTAL HMW PAHs (ND=1/2RL)	UG/KG	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
TOTAL HMW PAHs (ND=RL)	UG/KG	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
TOTAL LMW PAHs (ND=1/2RL)	UG/KG	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
TOTAL LMW PAHs (ND=RL)	UG/KG	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA

NOTE: For pre-test and control tissues n = 3 and for all other tissue tests n = 5.

Nereis virens species used for worm tissue tests and *Macoma nasuta* used for clam tissue tests.

ND = not detected or was detected below the reporting limit in each of the tested tissue replicates.

NA = Not Analyzed

RL = Reporting Limit

analyte concentration is significantly higher than the reference site concentration (p>0.05)

analyte concentration is significantly higher than the reference site concentration (p>0.05) and the pre-test tissue concentration (p>0.05)

TABLE 7-8. MEAN POLYCHLORINATED BIPHENYL (PCB) CONGENER CONCENTRATIONS (UG/KG) IN TISSUES
JBLE BACK RIVER CHANNEL, HAMPTON, VIRGINIA (DECEMBER 2015)

						DU1		DU2		DU3		DU4				DU5		DU6	
		Pre-test		Willoughby Bank Reference Site		BRC-01/02		BRC-03/04		BRC-05/06		BRC-07/08		Atlantic Ocean Reference Site		BRC-09/10		BRC-11/12	
		Worms	Clams	Worms	Clams	Worms	Clams	Worms	Clams	Worms	Clams	Worms	Clams	Worms	Clams	Worms	Clams	Worms	Clams
ANALYTE	UNITS	Lipids = 0.95	Lipids = 0.51	Lipids = 0.76	Lipids = 0.42	Lipids = 0.78	Lipids = 0.68	Lipids = 0.75	Lipids = 0.65	Lipids = 0.75	Lipids = 0.74	Lipids = 0.72	Lipids = 0.65	Lipids = 0.76	Lipids = 0.40	Lipids = 0.85	Lipids = 0.69	Lipids = 0.69	Lipids = 0.56
PCB 8 (BZ) *	UG/KG	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB 18 (BZ) *	UG/KG	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB 28 (BZ) *	UG/KG	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB 44 (BZ) *	UG/KG	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB 49 (BZ)	UG/KG	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB 52 (BZ) *	UG/KG	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB 66 (BZ) *	UG/KG	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB 77 (BZ) *	UG/KG	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB 87 (BZ)	UG/KG	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB 101 (BZ) *	UG/KG	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB 105 (BZ) *	UG/KG	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB 118 (BZ) *	UG/KG	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB 126 (BZ) *	UG/KG	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB 128 (BZ) *	UG/KG	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB 138 (BZ) *	UG/KG	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB 153 (BZ) *	UG/KG	**1.1**	ND	**1.24**	ND	**1.3**	ND	**1.26**	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB 156 (BZ)	UG/KG	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB 169 (BZ) *	UG/KG	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB 170 (BZ) *	UG/KG	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB 180 (BZ) *	UG/KG	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB 183 (BZ)	UG/KG	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB 184 (BZ)	UG/KG	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB 187 (BZ) *	UG/KG	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB 195 (BZ)	UG/KG	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB 206 (BZ)	UG/KG	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB 209 (BZ)	UG/KG	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TOTAL REGION 4 PCBs (ND=1/2RL	UG/KG	**13.4**	ND	**13.6**	ND	**13.7**	ND	**13.6**	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TOTAL REGION 4 PCBs (ND=RL)	UG/KG	**18**	ND	**18.2**	ND	**18.3**	ND	**18.2**	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TOTAL NOAA PCBs (ND=1/2RL)**	UG/KG	**18.8**	ND	**19.3**	ND	**19.4**	ND	**19.2**	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TOTAL NOAA PCBs (ND=RL)**	UG/KG	**36.1**	ND	**36.5**	ND	**36.5**	ND	**36.4**	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

*PCB congeners used for Total NOAA PCB summation (SERIM 2008)

** Total Region 4 PCBs represents the sum of all PCBs in table 6-7 (SERIM2008)

NOTE: For pre-test and control tissues n = 3 and for all other tissue tests n = 5.

Nereis virens species used for worm tissue tests and *Macoma nasuta* used for clam tissue tests.

ND = not detected or was detected below the reporting limit in each of the tested tissue replicates.

NA = Not Analyzed

RL = Reporting Limit

analyte concentration is significantly higher than the reference site concentration (p>0.05)

analyte concentration is significantly higher than the reference site concentration (p>0.05) and the pre-test tissue concentration (p>0.05)

TABLE 7-9. MEAN DIOXIN CONGENER CONCENTRATIONS (NG/KG) IN TISSUES
JBLE BACK RIVER CHANNEL, HAMPTON, VIRGINIA (DECEMBER 2015)

							DU1		DU2		DU3		DU4				DU5		DU6	
			Pre-test		Willoughby Bank Reference Site		BRC-01/02		BRC-03/04		BRC-05/06		BRC-07/08		Atlantic Ocean Reference Site		BRC-09/10		BRC-11/12	
			Worms	Clams	Worms	Clams	Worms	Clams	Worms	Clams	Worms	Clams	Worms	Clams	Worms	Clams	Worms	Clams	Worms	Clams
ANALYTE	**UNITS**	**TEF***	Lipids = 0.95	Lipids = 0.51	Lipids = 0.76	Lipids = 0.42	Lipids = 0.78	Lipids = 0.68	Lipids = 0.75	Lipids = 0.65	Lipids = 0.75	Lipids = 0.74	Lipids = 0.72	Lipids = 0.65	Lipids = 0.53	Lipids = 0.64	Lipids = 0.85	Lipids = 0.69	Lipids = 0.69	Lipids = 0.56
2,3,7,8-TCDD	NG/KG	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,7,8-PECDD	NG/KG	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,4,7,8-HXCDD	NG/KG	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,6,7,8-HXCDD	NG/KG	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,7,8,9-HXCDD	NG/KG	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,4,6,7,8-HPCDD	NG/KG	0.01	ND	ND	ND	ND	**5.28**	ND	ND	ND	**6.3**	ND	**5.48**	ND	ND	ND	ND	ND	ND	ND
OCDD	NG/KG	0.0003	ND	ND	**14**	**11**	**33.8**	**12.8**	**28.6**	**15.8**	**43**	**16.6**	**71.8**	**47.8**	ND	ND	**26.4**	**23.6**	**12.2**	**10.7**
2,3,7,8-TCDF	NG/KG	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,7,8-PECDF	NG/KG	0.03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,3,4,7,8-PECDF	NG/KG	0.3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,4,7,8-HXCDF	NG/KG	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,6,7,8-HXCDF	NG/KG	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,3,4,6,7,8-HXCDF	NG/KG	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,7,8,9-HXCDF	NG/KG	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,4,6,7,8-HPCDF	NG/KG	0.01	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,4,7,8,9-HPCDF	NG/KG	0.01	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
OCDF	NG/KG	0.0003	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
DIOXIN TEQ (ND=1/2RL)	NG/KG	--	ND	ND	**3.4**	**4.7**	**1.3**	**5.7**	**1.4**	**5.1**	**1.3**	**4.3**	**1.4**	**4.3**	ND	ND	**1.2**	**5.5**	**2.2**	**3.7**
DIOXIN TEQ (ND=RL)	NG/KG	--	ND	ND	**6.0**	**8.4**	**2.4**	**10.2**	**2.7**	**9.0**	**2.4**	**7.8**	**2.6**	**7.5**	ND	ND	**2.1**	**9.9**	**4.0**	**6.3**

**Source*: Van den Berg, M, et al. 2006. *The 2005 World Health Organization Re-evaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-Like Compounds. Toxicological Sciences 93(2):223-241.*

NOTE: For pre-test and control tissues n = 3 and for all other tissue tests n = 5.

Nereis virens species used for worm tissue tests and *Macoma nasuta* used for clam tissue tests.

ND = not detected or was detected below the reporting limit in each of the tested tissue replicates.

TEF = toxicity equivalency factor

TEQ = toxicity equivalency quotient

RL = Reporting Limit

analyte concentration is significantly higher than the reference site concentration (p>0.05)

analyte concentration is significantly higher than the reference site concentration (p>0.05) and the pre-test tissue concentration (p>0.05)

TABLE 7-10. MEAN PESTICIDE CONCENTRATIONS (UG/KG) IN TISSUES
JBLE BACK RIVER CHANNEL, HAMPTON, VIRGINIA (DECEMBER 2015)

						DU1		DU2		DU3		DU4				DU5		DU6	
		Pre-test		Willoughby Bank Reference Site		BRC-01/02		BRC-03/04		BRC-05/06		BRC-07/08		Atlantic Ocean Reference Site		BRC-09/10		BRC-11/12	
		Worms	Clams	Worms	Clams	Worms	Clams	Worms	Clams	Worms	Clams	Worms	Clams	Worms	Clams	Worms	Clams	Worms	Clams
ANALYTE	**UNITS**	Lipids = 0.95	Lipids = 0.51	Lipids = 0.76	Lipids = 0.42	Lipids = 0.78	Lipids = 0.68	Lipids = 0.75	Lipids = 0.65	Lipids = 0.75	Lipids = 0.74	Lipids = 0.72	Lipids = 0.65	Lipids = 0.53	Lipids = 0.64	Lipids = 0.85	Lipids = 0.69	Lipids = 0.69	Lipids = 0.56
4,4'-DDD	UG/KG	**0.42**	ND	ND	**0.45**	ND	ND	ND	ND	ND	ND	**0.43**	**0.44**	ND	**0.49**	**0.43**	ND	NA	NA
4,4'-DDE	UG/KG	ND	ND	ND	ND	ND	**0.47**	ND	ND	ND	ND	ND	**0.63**	ND	ND	ND	ND	NA	NA
4,4'-DDT	UG/KG	**0.51**	ND	**0.43**	ND	**0.43**	ND	ND	ND	ND	ND	**0.46**	ND	**0.54**	ND	**0.47**	ND	NA	NA
BETA-BHC	UG/KG	ND	ND	**0.44**	**0.51**	**0.47**	ND	**0.47**	ND	ND	**0.48**	**0.62**	**0.57**	**0.53**	**0.53**	**0.66**	**0.60**	NA	NA
DACTHAL	UG/KG	ND	ND	ND	ND	ND	ND	ND	ND	ND	**0.51**	ND	**0.43**	ND	ND	ND	ND	NA	NA
ENDRIN	UG/KG	ND	ND	ND	ND	ND	**0.42**	ND	**0.42**	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
ENDRIN ALDEHYDE	UG/KG	**0.55**	ND	ND	**0.43**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
METHOXYCHLOR	UG/KG	**ND**	ND	ND	**0.85**	ND	ND	ND	**0.85**	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
MIREX	UG/KG	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA

*PCB congeners used for Total PCB summation, as per Table 9-3 of the *ITM* (USEPA/USACE 1998)

NOTE: For pre-test and control tissues n = 3 and for all other tissue tests n = 5.

Nereis virens species used for worm tissue tests and *Macoma nasuta* used for clam tissue tests.

ND = not detected or was detected below the reporting limit in each of the tested tissue replicates.

NA = Not Analyzed

analyte concentration is significantly higher than the reference site concentration (p>0.05)

analyte concentration is significantly higher than the reference site concentration (p>0.05) and the pre-test tissue concentration (p>0.05)

TABLE 7-11. MEAN LIPID CONCENTRATIONS (PERCENT OF TOTAL BODY WEIGHT) IN WORMS AND CLAMS
JBLE BACK RIVER CHANNEL, HAMPTON, VIRGINIA (DECEMBER 2015)

Dredging Unit (DU)	Sample ID	Worms	Clams
--	Pre-Test	0.96	0.52
--	Willoughby Bank Reference	0.77	0.42
--	Atlantic Ocean Reference	0.53	0.64
DU1	BRC-01/02	0.78	0.68
DU2	BRC-03/04	0.75	0.65
DU3	BRC-05/06	0.75	0.75
DU4	BRC-07/08	0.72	0.65
DU5	BRC-09/10	0.86	0.69
DU6	BRC-11/12	0.70	0.56

TABLE 7-12. COMPARISON OF UPPER 95% CONFIDENCE LEVELS OF THE MEAN STEADY STATE CORRECTED TISSUE CONCENTRATION TO SOUTH ATLANTIC BIGHT BACKGROUND RANGES
JBLE BACK RIVER CHANNEL, HAMPTON, VIRGINIA (DECEMBER 2015)

												DU1		DU2		DU3		DU4				DU5		DU6	
		South Atlantic Bight Background Concentration[(a)]		Steady State Correction Factor [(b)]		Control		Pre-Test Tissue		Willoughby Bank Reference		BRC-01/02		BRC-03/04		BRC-05/06		BRC-07/08		Atlantic Ocean Reference		BRC-09/010		BRC-11/12	
ANALYTE	UNITS	Worms	Clams	Worms	Clams	Worms	Clams	Worms	Clams	Worms	Clams	Worms	Clams	Worms	Clams	Worms	Clams	Worms	Clams	Worms	Clams	Worms	Clams	Worms	Clams
METALS																									
LEAD	MG/KG	0.36-0.60	0.05-0.77	1.0	1.0	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	**0.17**	NC	**0.29**	NC	NC
NICKEL	MG/KG	1.6-3.5	0.9-3.7	1.0	1.0	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	**0.51**	NC	**0.65**	NC	NC

(a) *Source:* SERIM 2008. Southeast Implementation Manual (SERIM). Requirements and Procedures for Evaluation of the Ocean Disposal of Dredged Material in Southeastern U.S. Atlantic and Gulf Coast Waters.

(b) In some cases, contaminant concentrations are not expected to reach steady state within the 28-day exposure duration of a standard bioaccumulation test.

Steady-state factors represent the factor that must be applied (multiplied) to the 28-day bioaccumulation tissue concentration to estimate the contaminant concentration that would be reached if sufficient exposure time was allowed to the tissue concentrations to reach steady-state.

NOTES: Bold values represent detected concentrations.

Table only shows analytes in which mean concentrations statstically exceeded mean pre-test and mean reference concentrations

NC = Not compared

8. SUMMARY AND CONCLUSIONS

Back River Channel is a Federally-maintained navigation channel located adjacent to JBLE in Hampton, Virginia. The channel provides for safe navigation from the Chesapeake Bay to JBLE. The channel is the primary access for fuel barges servicing the Langley Fuel Piers in support of JBLE mission requirements. The channel also provides access to the Messick Point Federal Navigation Channel. Sedimentation has reduced the channel depths from required dimensions. Maintenance dredging is necessary to restore full channel depth to ensure safe navigation for vessels utilizing the channel.

The purpose of this project was to collect data to characterize the physical, chemical, and ecotoxicological quality of the sediments from the JBLE Back River Channel project footprint and to determine if the material is suitable for ocean placement or other upland placement options. Specific dredged material placement options include: ocean placement at the NODS, upland placement at Port Tobacco at Weanack, and placement at other approved regional upland locations. Twelve discrete samples were submitted for upland placement analysis, and six composite samples were created and analyzed for ocean placement bulk sediment, standard elutriate analysis, and ecotoxicological testing and tissue exposures.

8.1 UPLAND PLACEMENT OPTIONS

8.1.1 Potential Suitability for Placement

The 12 discrete samples from JBLE Back River Channel were analyzed with respect to requirements for placement at Port Tobacco at Weanack and Virginia regulations for other upland placement options.

The data in this report are intended to be used to assess potential suitability for placement at Port Tobacco at Weanack and other regional upland locations. Facility-specific confirmatory sampling and testing may be required during the transport and placement process. Port Tobacco at Weanack requires minimum testing of one composite sample per 50,000 cy of *in situ* material. In addition, a minimum of three samples per material is required regardless of volume.

8.1.2 Summary of Results

In the 12 discrete samples, none of the tested constituents (metals, PAHs, PCBs, pesticides, or SVOCs) exceeded the Virginia Exclusion Criteria. The acid-base accounting values (soil suitability) in DU1 through DU4 indicate the material is considered suitable for placement at the Weanack facility and could support agricultural growth as is, without the addition of any soil amendments. The acid-base accounting values in DU5 and DU6 indicate that the material would require additional soil amendment (lime) to meet agricultural use requirements at the Weanack facility. Additional coordination with the Weanack facility would be required to determine material acceptability.

Additional analytical testing, including the paint filter test, EOX, BTEX, and TCLP was conducted to evaluate the feasibility of other upland placement options. Results indicated that five samples passed through the paint filter (BRC-08 through BRC-12 contained free liquid), that none of the samples were flammable, and that sediment pH was near neutral (ranging from 6.26 to 8.12). EOX was not detected, and BTEX constituents were either not detected or estimated below the laboratory reporting limit. In addition, TPH-GRO were not detected, and TPH-DRO concentrations ranged from 9.6 (BRC-12) to 230 (BRC-04) mg/kg.

For TCLP, of the 38 chemical constituents tested, only 5— arsenic, barium, cadmium, lead, and selenium—were detected at low concentrations and were each estimated below the laboratory reporting limit in the JBLE Back River Channel leachate. The concentrations of the detected chemical constituents were compared to the limiting concentration of contaminants for toxicity characteristics (40 CFR 261.24). Concentrations of detected constituents were well below the toxicity characteristic criteria. The results also indicate that the materials were not corrosive or ignitable. Therefore, the sediments from JBLE Back River Channel would not be considered characteristic of a hazardous waste per USEPA criteria and would not require management in accordance with Virginia Hazardous Waste Management regulations (9VAC20-60).

With the exception of BRC-04, TPH concentrations were less than 50 mg/kg and BTEX was less than 10 mg/kg, indicating that the material may be used as fill material as per 9VAC20-81-660 screening specifications. Based on the TPH-DRO concentration, material from BRC-04 would not be suitable as fill material, but could be approved for permitted landfills equipped with liners and leachate collection systems.

8.2 OCEAN PLACEMENT OPTIONS

8.2.1 Compliance With Section 103 of the MPRSA

A total of twelve discrete, six composite, and two field duplicate sediment samples were analyzed for ocean placement. The samples were evaluated with respect to the Ocean Dumping Regulations in 40 CFR 220-228.

Compliance with Section 103 of the MPRSA includes determining LPC compliance in four areas:

- WQC
- Water column toxicity
- Benthic toxicity
- Benthic bioaccumulation.

If LPC compliance is not met in one of more of these components, then ocean placement requirements are not met. Each of the above components involves a series of steps to determine whether the tested sediment meets LPC requirements (Figure 1-3).

To determine whether the sediments from the JBLE Back River Channel meet the acute WQC and water column toxicity LPC requirements, STFATE modeling was conducted using the specifications of the placement site (i.e., dimensions and water column properties) to determine if the standard elutriate concentrations would meet the LPC for ocean placement.

Water Quality Criteria

The LPC for the WQC is the concentration which:

- Does not exceed the WQC outside the site boundary during the first 4 hours, and
- Does not exceed the WQC *anywhere* in the marine environment after 4 hours.

STFATE modeling was conducted to confirm that sufficient dilution would be achieved to meet the water quality criteria LPC and to confirm that the sediment plume would stay within the boundary of the NODS placement site within the 4-hour period required by the MPRSA. STFATE modeling was conducted using the specifications of the NODS (i.e., dimensions and water column properties), physical characteristics of the sediment collected from the each DU within the JBLE Back River Channel footprint (i.e., grain size and specific gravity), and the concentrations of the chemical(s) in the elutriate that exceeded applicable water quality criteria. Multiple modeling scenarios were conducted for each DU to determine the maximum volume of material per single placement event that would meet the LPC.

Water Column Toxicity

The LPC for water column toxicity is the concentration that does not exceed 0.01 of the EC_{50}/LC_{50} within a 4-hour dilution period inside the boundary of the ocean placement site. STFATE modeling was conducted to confirm that sufficient dilution would be achieved to meet the water column toxicity LPC and to confirm that the sediment plume would stay within the boundary of the NODS placement site within the 4-hour period required by the MPRSA. STFATE modeling was conducted using the specifications of the NODS (i.e., dimensions and water column properties) and physical characteristics of the sediment collected from the each DU within the JBLE Back River Channel footprint (i.e., grain size and specific gravity). Multiple modeling scenarios were conducted for each DU to determine the maximum volume of material per single placement event that would meet the LPC.

Benthic Toxicity

Dredged material does not meet the benthic toxicity LPC when mean test organism mortality:

- Is statistically greater than in the reference sediment, **AND**

- Exceeds mortality (or other appropriate end point) in the reference sediment by at least 10 percent (or 20 percentage points for amphipods).

Benthic Bioaccumulation

Following exposure to sediments from the JBLE Back River Channel, tissue samples of *N. virens* and *M. nasuta* were analyzed for lipids, moisture content, metals (including mercury), PAHs (DU1, DU2, DU3, and DU4 only), PCBs (DU1 and DU2 only) dioxin and furan congeners, and select chlorinated pesticides (DU1, DU2, DU3, DU4, and DU5 only) (DDT series, beta-BHC, dacthal, endrin, endrin aldehyde, methoxychlor, and mirex only). Mean concentrations of analytes detected in the tissue samples exposed to sediment from the project footprint were statistically compared to the mean concentrations of analytes detected in the tissue exposed to sediment from applicable reference sites to evaluate the potential for adverse impacts.

If the mean tissue concentrations statistically exceeded mean reference site concentrations, then mean concentrations were:

- Statistically compared to pre-test tissue concentrations
- Evaluated for analytical variability within the data set (reporting limiting substitutions for non-detected data, outliers, and compliance with laboratory QA/QC requirements)
- Analytes that statistically exceeded both reference and pre-test concentrations were statistically compared to USEPA Region 4 background concentrations for the South Atlantic Bight (USACE/USEPA 2008).

Dredged material does not meet the benthic bioaccumulation LPC if the tissue concentrations are statistically greater than USFDA Action/Guidance/Tolerance Levels. When tissue concentrations of contaminants of concern in organisms exposed to dredged material statistically exceed those of organisms exposed to the reference material, the dredged material has the potential to result in benthic bioaccumulation of contaminants. If the tissue concentrations statistically exceed those of organisms exposed to the reference site, the tissue concentrations are further evaluated to determine if placement of dredged material is likely to cause adverse effects. The results of the benthic tissue analysis were reviewed in consultation with USEPA Region 3 and USACE Norfolk District to determine which constituents met the LPC for benthic bioaccumulation.

Results of the LPC compliance for each dredging area are summarized in Table 8-1 and discussed in the following sections.

8.2.2 Summary of Results

Bulk Sediment Analysis

The sediments from locations BRC-01 through BRC-09 in the JBLE Back River Channel were predominantly comprised of fine-grained material, ranging from 69 to 97.2 percent silt+clay. Sediments from BRC-10 through BRC-12 were predominantly comprised of sand, ranging from 61.3 to 95 percent sand. The DU composites indicated that DU1, DU2, DU3, and DU4 were predominantly comprised of fine-grained clays with some sand, DU 5 was predominantly sand with some silt/clay, and DU6 was predominantly sand. The Willoughby Bank reference site and the Atlantic Ocean reference site were each predominantly comprised of fine sand (77.5 and 84.7 percent, respectively).

Three metals (arsenic, mercury, and nickel), three individual PAHs (acenaphthene, acenaphthylene, and naphthalene); total PCBs; and three chlorinated pesticides (4’4-DDD, 4’4-DDE, and 4’4-DDT) were detected in at least one sample at concentrations between the TEL and PEL. One sample, the field duplicate for BRC-09, had a 4’4-DDT concentration that exceeded the PEL.

Water Quality Criteria (WQC) and Water Column Toxicity

Comparison of chemical concentrations detected in the standard elutriates created from site sediments and site water indicated that one constituent (ammonia) was detected in the full strength elutriates from four of the six DUs at concentrations that exceeded the USEPA saltwater acute WQC for the protection of aquatic life. The laboratory reporting limits for cyanide and silver also exceeded respective acute WQC. For the organic constituents, (PAHs, PCB congeners, dioxin and furan congeners, chlorinated pesticides, organophosphorus pesticides, SVOCs, and butyltins) few constituents were detected, and most of the concentrations were low and estimated below the laboratory reporting limit. Cyanide was used in the STFATE modeling to provide the most conservative dilution required for each DU. STFATE modeling indicated that sufficient dilution of the elutriates would occur to meet the acute WQC for cyanide within four hours following placement and the plume would stay within the site boundary (Table 8-1).

For water column toxicity, each of the water column bioassays for *M. galloprovincialis* had an EC_{50} of >100 percent elutriate, and the LC_{50} for the *A. bahia* and *M. beryllina* bioassays was also greater than 100 percent elutriate. Therefore, a dilution of approximately 99-fold is required for each of the elutriates from the JBLE Back River Channel to achieve the LPC for water column toxicity for ocean placement at the NODS (Table 8-1).

To maximize the dredged material volume that could be placed at the NODS during a single placement event and achieve compliance with the LPC for water column toxicity, STFATE model scenarios were conducted. Results of the STFATE modeling indicated that placement events ranging from 32,000 (DU2) to 62,000 (DU6) cy met the LPC for water column toxicity. Within 4 hours following placement, dilutions ranging from 99 to 101-fold would be achieved and the leading edge of the sediment plume would travel 4,810 ft for each of the DUs, remaining inside the NODS site boundary (Table 8-1).

Benthic Toxicity

Survival in the whole sediment bioassays was not statistically different from the reference sites for either *A. abdita* or *L. plumulosus.* Therefore, sediment from the JBLE Back River Channel meets the LPC requirement for benthic toxicity.

Benthic Bioaccumulation

For DU1, DU2, DU3, and DU4, none of the mean concentrations of metals, PAHs, or PCBs statistically exceeded mean Willoughby Bank reference site concentrations. Although mean concentrations of 1,2,3,4,6,7,8-HPCDD in the worm tissue exposed to sediment from DU3 and mean concentrations of OCDD in the clam tissue exposed to sediment from DU4 statistically exceeded the mean concentrations detected in tissues exposed to the sediment from the Willoughby Bank reference site, they did not exceed the mean pre-test tissue concentrations. Therefore, the mean concentration of these analytes was likely elevated prior to, not caused by, exposure to the

JBLE Back River Channel samples. Mean OCDD concentrations in the worm tissue exposed to the Back River channel samples from DU2 and DU4 statistically exceeded mean reference and mean pre-test tissue concentrations. There are no USEPA Region 4 background concentrations for OCDD, however, this dioxin congener is the least toxic with a TEF value of 0.0003. In addition, none of the dioxin TEQs statistically exceeded the reference site TEQs. None of the UCLM values for JBLE Back River Channel tissues exposed to sediment from DU1, DU2, DU3, or DU4 samples exceeded the USFDA Action/Guidance/Tolerance Levels for metals, total PCBs (ND=RL) or 4'4'-DDT.

For DU6, none of the mean concentrations of metals, PAHs, dioxins, or PCBs statistically exceeded mean Atlantic Ocean reference site concentrations. Although mean concentrations of cadmium and OCDD for DU5 statistically exceeded the mean concentrations detected in tissues exposed to the sediment from the Atlantic Ocean reference site, they did not exceed the mean pre-test tissue concentrations. Mean concentrations of lead and nickel in clam tissue from DU5 statistically exceeded the mean concentration of tissue for both mean reference and pre-test tissue. The UCLM values for these metals were compared to the USEPA Region 4 background concentrations for South Atlantic Bight, and the UCLMs did not exceed the background ranges.

Based on the assessment of chemical analyses performed on tissues exposed to sediment from the JBLE Back River Channel and reference site sediments, it is anticipated that ocean placement of the dredged material from the JBLE Back River Channel at the NODS is not expected to result in ecologically significant bioaccumulation of contaminants. Therefore, the dredged material from the JBLE Back River Channel meets the LPC for benthic bioaccumulation, and complies with the benthic criteria of 40 CFR 227.13 (c) (3).

Sediments from the JBLE Back River Channel meet the criteria for the LPC for WQC, water column toxicity, benthic toxicity, and benthic bioaccumulation, indicating that ocean placement of the dredged material at the NODS is a viable placement option. Based on the results of the STFATE modeling, placements ranging from 32,000-62,000 cy per placement event complies with the LPC for WQC and water column toxicity.

TABLE 8-1. SUMMARY OF RESULTS FOR BULK SEDIMENT, ELUTRIATE, AND ECOTOXICOLOGICAL TESTING

JBLE BACK RIVER CHANNEL, HAMPTON, VIRGINIA (DECEMBER 2015)

Dredging Unit (DU)	Sediment Sample ID	SEDIMENT		STANDARD ELUTRIATES		BIOASSAY TESTS								BIOACCUMULATION		MEETS LIMITING PREMISSIBLE CONCENTRATION?			
		COMPARISON TO REGIONAL SQGs [a]				WATER COLUMN						WHOLE SEDIMENT		TISSUE CONCENTRATIONS THAT STATISTICALLY EXCEEDED REFERENCE AND PRE-TEST CONCENTRATIONS					
						Mytilus galloprovincialis (Blue Mussel)		*Menidia beryllina* (Inland Silverside)		*Americamysis bahia* (Opossum Shrimp)		Statistical comparison between survival in test and reference sediment							
		Threshold Effects Level (TEL) Exceedances	Probable Effects Level (PEL) Exceedances	COMPARISON TO USEPA WQC FOR AQUATIC LIFE [b]	Maximum Dilution required for all constituents exceeding LPC to meet LPC[c]	48-hour EC_{50} (% elutriate)	dilution required to comply with 0.01 EC_{50} within 4-hr	96-hour LC_{50} (% elutriate)	dilution required to comply with 0.01 LC_{50} within 4-hr	96-hour LC_{50} (% elutriate)	dilution required to comply with 0.01 LC_{50} within 4-hr	*Ampelisca abdita* (Estuarine Amphipod)	*Leptocheirus plumulosus* (Estuarine Amphipod)	*Nereis virens* (Sand Worm)	*Macoma nasuta* (Blunt Nose Clam)	Water Quality Criteria	Water Column Toxicity	Benthic Toxicity	Benthic Bioaccumulation
DU1	BRC-01	Arsenic, Dibenzo(a,h)anthracene, Total PCBs (ND=RL)	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	BRC-02	Arsenic, Dibenzo(a,h)anthracene	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	BRC-01/02	Arsenic, Dibenzo(a,h)anthracene, Total PCBs (ND=RL), 4'4-DDT	None	Ammonia, Cyanide[e], Silver [e]	9	>100	99	>100	99	>100	99	No Statistical Difference	No Statistical Difference	No Exceedances	No Exceedances	Yes Placement volumes up to 37,000 cy	Yes Placement volumes up to 37,000 cy	Yes	Yes
DU2	BRC-03	Arsenic, Dibenzo(a,h)anthracene, Total PCBs (ND=RL)	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	BRC-04	Arsenic, Mercury, Nickel, Dibenzo(a,h)anthracene, Total PCBs (ND=RL)	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	BRC-03/04	Arsenic, Acenaphthylene, Acenaphthylene, Dibenzo(a,h)anthracene, Total PCBs (ND=RL)	None	Ammonia, Cyanide[e], Silver [e]	9	>100	99	>100	99	>100	99	No Statistical Difference	No Statistical Difference	OCDD	No Exceedances	Yes Placement volumes up to 32,000 cy	Yes Placement volumes up to 32,000 cy	Yes	Yes
DU3	BRC-05	Arsenic, Nickel, Dibenzo(a,h)anthracene, Total PCBs (ND=RL)	None	N/A	N/A	>100	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Yes
	BRC-06	Dibenzo(a,h)anthracene, Total PCBs (ND=RL)	None	N/A	N/A	>100	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Yes
	BRC-05/06	Arsenic, Dibenzo(a,h)anthracene, Total PCBs (ND=RL)	None	Ammonia, Cyanide[e], Silver [e]	9	>100	99	>100	99	>100	99	No Statistical Difference	No Statistical Difference	No Exceedances	No Exceedances	Yes Placement volumes up to 32,000 cy	Yes Placement volumes up to 32,000 cy	Yes	Yes
DU4	BRC-07	Arsenic, Dibenzo(a,h)anthracene, Total PCBs (ND=RL)	None	N/A	N/A	>100	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Yes
	BRC-08	Dibenzo(a,h)anthracene, Total PCBs (ND=RL)	None	N/A	N/A	>100	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Yes
	BRC-07/08	Total PCBs (ND=RL)	None	Ammonia, Cyanide[e], Silver [e]	9	>100	99	>100	99	>100	99	No Statistical Difference	No Statistical Difference	OCDD	No Exceedances	Yes Placement volumes up to 36,000 cy	Yes Placement volumes up to 36,000 cy	Yes	Yes
DU5	BRC-09	Total PCBs (ND=RL), 4,4'-DDT	None	N/A	N/A	>100	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Yes
	BRC-09-FD	Total PCBs (ND=RL), 4,4'-DDD, 4'4-DDE	4,4'-DDT	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	BRC-10	Total PCBs (ND=RL)	None	N/A	N/A	>100	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Yes
	BRC-10-FD	'Total PCBs (ND=RL)	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	BRC-09/10	Total PCBs (ND=RL)	None	Cyanide[e], Silver [e]	9	>100	99	>100	99	>100	99	No Statistical Difference	No Statistical Difference	No Exceedances	Lead, Nickel	Yes Placement volumes up to 41,000 cy	Yes Placement volumes up to 41,000 cy	Yes	Yes
DU6	BRC-11	Total PCBs (ND=RL)	None	N/A	N/A	>100	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Yes
	BRC-12	Total PCBs (ND=RL)	None	N/A	N/A	>100	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Yes
	BRC-11/12	Total PCBs (ND=RL)	None	Cyanide[e], Silver [e]	9	>100	99	>100	99	>100	99	No Statistical Difference	No Statistical Difference	No Exceedances	No Exceedances	Yes Placement volumes up to 62,000 cy	Yes Placement volumes up to 62,000 cy	Yes	Yes

(a) SQG = sediment quality guideline; ***Source:*** MacDonald et al. 1996 Ecotoxicology 5: 253-278., CCME 2001. Canadian Sediment Quality Guidelines for the Protection of Aquatic Life.

(b) WQC = water quality criteria; ***Source*** : USEPA 2015. *National Recommended Water Quality Criteria.*

(c) Dilution required is to to achieve acute WQC, which must occur within 4 hours inside placement boundary to meet LPC.

(d) Statistical significance analyzed at p=0.05; survival (LC_{50}) or effect (EC_{50}) in 100% elutriate concentration significantly lower than the control.

(e) Laboratory reporting limit exceeds acute water quality criterion.

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APPENDIX E

Clean Water Act 404 (b)(1)

Final Evaluation of 404(b)(1) Guidelines
Contained in Vol. 45 No. 249 of the
Federal Register dated 24 December 1980

Back River Federal Navigation Channel
May 2017

1. Technical Evaluation Factors

a. Physical and Chemical Characteristics of the Aquatic Ecosystem (230.20-230.25)(Subpart C)

	N/A	Not Significant	Significant
(1) Substrate impacts	☐	☒	☐
(2) Suspended particulates/turbidity impacts	☐	☒	☐
(3) Water Quality Control	☐	☒	☐
(4) Alteration of current patterns and water circulation	☐	☒	☐
(5) Alteration of normal water fluctuations/hydroperiod	☐	☒	☐
(6) Alteration of salinity gradients	☐	☒	☐

Dredging operations will increase turbidity at the dredging location, as well as the proposed overboard placement area, but this will be minor, short-term impacts that will dissipate once dredging has ceased.

b. Biological Characteristics of the Aquatic Ecosystem(230.30-230.32) (Subpart D)

	N/A	Not Significant	Significant
(1) Effect on threatened/endangered species and their habitat	☐	☒	☐
(2) Effect on the aquatic food web	☐	☒	☐
(3) Effect on other wildlife (mammals, birds, reptiles, and amphibians)	☐	☒	☐

Based on a search of VA's endangered species database and coordination with the U.S. Fish and Wildlife Service, the project will not affect any federally or state listed threatened or endangered species.

c. Special Aquatic Site (230.40-230.45) (Subpart E)

	N/A	Not Significant	Significant
(1) Sanctuaries and refuges	☒	☐	☐
(2) Wetlands	☒	☐	☐
(3) Mud flats	☒	☐	☐
(4) Vegetated shallows	☒	☐	☐
(5) Coral reefs	☒	☐	☐
(6) Riffle and pool complexes	☒	☐	☐

The proposed discharge of dredged material will not affect any special aquatic sites.

d. Human Use Characteristics (230.50-230.54) (Subpart F)

	N/A	Not Significant	Significant
(1) Effects on municipal and private water supplies	☒	☐	☐
(2) Recreational and Commercial fisheries impacts	☐	☒	☐
(3) Effects on water-related recreation	☐	☒	☐
(4) Aesthetic impacts	☐	☒	☐
(5) Effects on parks, national and historical monuments, national seashores, wilderness areas, research sites, and similar preserves	☒	☐	☐

2. Evaluation of Dredged or Fill Material (230.60) (Subpart G)

a. The following information has been considered in evaluating the biological availability of possible contaminants in dredged or fill material. **(Check only those appropriate)**

☒ (1) Physical characteristics
☐ (2) Hydrography in relation to known or anticipated sources of contaminants
☒ (3) Results from previous testing of the material in the vicinity of the project
☐ (4) Known, significant, sources of persistent pesticides from land runoff or percolation
☐ (5) Spill records for petroleum products or designated (Section 311 of CWA) hazardous substances
☒ (6) Other public records of significant introduction of contaminants from industries, municipalities or other sources
☐ (7) Known existence of substantial material deposits of substances which could be released in harmful quantities to the aquatic environment by man-induced discharge
☐ (8) Other sources (specify)

List appropriate references and a brief of supportive evidence.

While the proposed dredged material has not been tested, the Corps has no reason to suspect contamination.

b. An evaluation of the appropriate information in 3a above indicated that there is reason to believe the proposed dredged or fill material is not a carrier of contaminants, of that levels of contaminants are substantively similar at extraction and disposal sites and not likely to exceed constraints. The material meets the testing exclusion criteria.

YES ☒ NO ☐

3. Disposal Site Delineation (Section 230.11(f))

a. The following factors, as appropriate, have been considered in evaluating the disposal site.

☒ (1) Depth of water at disposal site
☒ (2) Current velocity, direction, and variability at disposal site
☐ (3) Degree of turbulence
☐ (4) Water volume stratification
☐ (5) Discharge vessel speed and direction

☒ (6) Rate of discharge
☒ (7) Dredged material characteristics (constituents, amount, and type of material, settling velocities)
☐ (8) Number of discharges per unit of time
☐ (9) Other factors affecting rates and patterns of mixing (specify)

List appropriate references.

b. An evaluation of the appropriate factors in 4a above indicates that the disposal site and/or size of mixing zone are acceptable.

YES ☒ NO ☐

4. Actions to Minimize Adverse Effects (Section 230.70-230.77)(Subpart H)

All appropriate and practicable steps have been taken, through application of recommendation of Section 230.70-230.77 to ensure minimal adverse effects of the proposed discharge. List actions taken.

YES ☒ NO ☐

5. Factual Determination (Section 230.11)

A review of appropriate information as identified in items 2-5 above indicates that there is minimal potential for short or long-term environmental effects of the proposed discharge as related to:

☒ a. Physical substrate at the disposal site (review sections 2a, 3, 4, & 5)

☒ b. Water circulation, fluctuation & salinity (review sections 2a 3, 4, & 5)

☒ c. Suspended particulates/turbidity (review sections 2a, 3, 4, & 5)

☒ d. Contaminant availability (review sections 2a, 3, & 4)

☒ e. Aquatic ecosystem structure and function (review sections 2b, c; 3, & 5)

☒ f. Disposal site (review sections 2, 4, & 5)

☒ g. Cumulative impact on the aquatic ecosystem

☒ h. Secondary impacts on the aquatic ecosystem

6. Review of Compliance (230.10(a)-(d) (Subpart B)

A review of the permit application indicates that:

a. The discharge represents the least environmentally damaging practicable alternative and if in a special aquatic site, the activity associated with the discharge must have direct access or proximity to, or be located in the aquatic ecosystem to fulfill its basic purpose (if no, see section 2 and information gathered for EA alternative);

YES ☒ NO ☐

b. The activity does not appear to 1) violate applicable state water quality standards or effluent standards prohibited under Section 307 of the CWA; 2) jeopardize the existence of Federally designated marine sanctuary(if no, see section 2b and check responses from resource and water quality certifying agencies;

YES ☒ NO ☐

c. The activity will not cause or contribute to significant degradation of waters of the U.S. including adverse effects on human health, life stages of organisms dependent on the aquatic ecosystem, ecosystem diversity, productivity and stability, and recreational, aesthetic, and economic values (if no, see section 2); YES ☒ NO ☐

d. Appropriate and practicable steps have been taken to minimize potential adverse impacts of the discharge on the aquatic ecosystem (if no, see section 5);

YES ☒ NO ☐

The proposed discharge of fill or dredged material is the least environmentally damaging practicable alternative and meets the Federal Standard.

7. Findings

☒ a. The proposed disposal site for discharge of dredged or fill material complies with the Section 404 (b)(1) guidelines

☐ b. The proposed disposal site for discharge of dredged or fill material complies with the Section 404(b)(1) guidelines with the inclusion of the following conditions:

c. The proposed disposal site for discharge of dredged or fill material does not comply with the Section 404(b)(1) guidelines for the following reason(s):

☐ (1) There is a less damaging practicable alternative

☐ (2) The proposed discharge will result in significant degradation of the aquatic ecosystem

☐ (3) The proposed discharge does not include all practicable and appropriate measures to minimize potential harm to the aquatic ecosystem

Jason R. Flowers, P.E.
For Keith Lockwood.

DATE

Keith Lockwood
Chief, Operations Branch