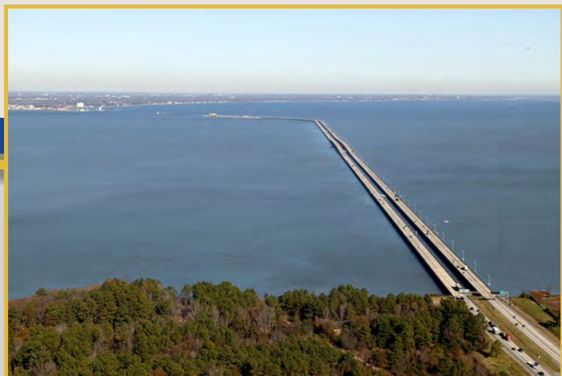
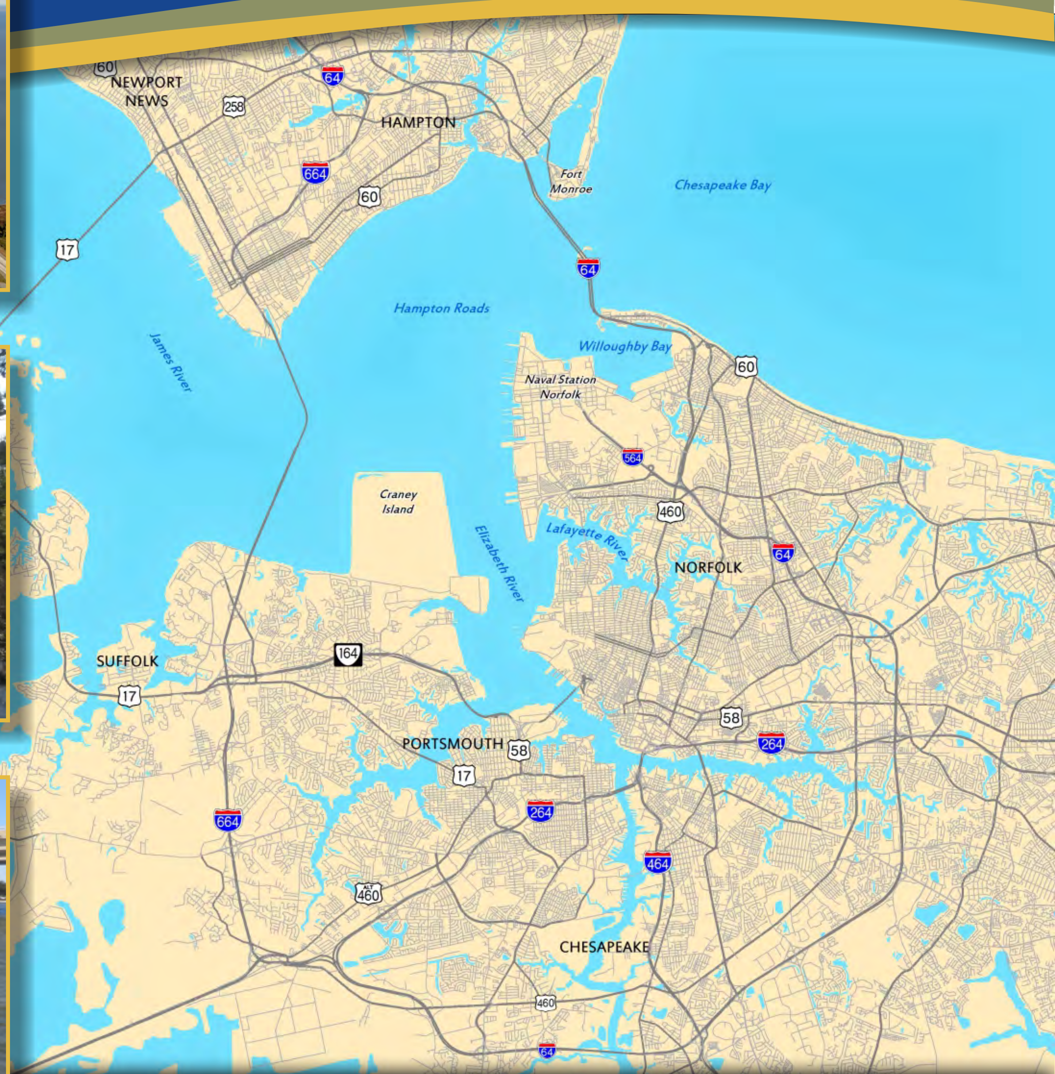
HRCS SEIS
Hampton Roads Crossing Study SEIS

Natural Resources Technical Report

Prepared in Support of the Supplemental Environmental Impact Statement





VDOT
Virginia Department of Transportation

U.S. Department of Transportation
Federal Highway Administration

July 2016

NATURAL RESOURCES TECHNICAL REPORT

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VDOT Project #: 0064-965-081, P101

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July 2016

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AA	Assessment area
AVM	Chesapeake Bay Aquaculture Vulnerability Model
BMP	Best Management Practice
CBPA	Chesapeake Bay Preservation Act
CBP	Chesapeake Bay Program
CBSAC	Chesapeake Bay Stock Assessment Committee
CCB	Center for Conservation Biology
CDF	Confined Disposal Facility
CFR	Code of Federal Regulation
CGP	Construction General Permit
CIDMMA	Craney Island Dredge Material Management Area
CIEE	Craney Island Eastward Expansion project
CMECS SC	Coastal and Marine Ecological Classification Standard Substrate Component
CRAM	California Rapid Assessment Method
CZMP	Coastal Zone Management Program
EFH	Essential Fish Habitat
FEIS	2001 Hampton Roads Crossing Study Final Environmental Impact Statement
FEMA	Federal Emergency Management Agency
FGDC	Federal Geographic Data Committee
FHWA	Federal Highway Administration
FIRM	Flood Insurance Rate Map

FQAI	Floristic Quality Assessment Index
FT	Federally Threatened
GWMA	Groundwater Management Areas
HAPC	Habitat Area of Particular Concern
HGM	Hydrogeomorphic
HRBT	Hampton Roads Bridge-Tunnel
HRCS	Hampton Roads Crossing Study
HUC	Hydrologic Unit Codes
IPaC	Infrared Processing and Analysis Center
LEDPA	Least Environmentally Damaging Practicable Alternative
LOD	Limits of Disturbance
MBTA	Migratory Bird Treaty Act
MidTRAM	Mid-Atlantic Tidal Rapid Assessment Method Version 3.0
MLLW	Mean Lowest Low Water
MLRC	Multi-Resolution Land Characteristics Consortium
MMMBT	Monitor-Merrimac Memorial Bridge-Tunnel
MPRSA	Marine Protection Research and Sanctuaries Act
NERAM	New England Rapid Assessment Method
NFIP	National Flood Insurance Program
NHD	National Hydrography Dataset
NLCD	National Land Cover Database
NLEB	Northern long-eared bat
NMFS	National Marine Fisheries Service (NOAA Fisheries)
NOAA	National Oceanic and Atmospheric Administration
NODMDS	Norfolk Ocean Dredged Material Disposal Site
NPS	National Park Service
NWI	National Wetland Inventory
OIS	Operationally Independent Sections
PCB	Polychlorinated biphenyls
PSU	Practical Salinity Unit
RCI	Reach Condition Index

RMA	Resources Management Area
RPA	Resource Protection Area
SC	Substrate Component
SDWA	Safe Drinking Water Act of 1974, amended and reauthorized in 1986 and 1996
SE	State Endangered
SEIS	Supplemental Environmental Impact Statement
SPL	Sound Pressure Level
SSA	Sole Source Aquifer
SSURGO	Soil Survey Geographic Database
ST	State Threatened
SVOC	Semivolatile Organic Compound
SWAP	Source Water Assessment Program
SWPPP	Stormwater Pollution Prevention Plan
TMDL	Total Maximum Daily Load
TOYR	Time of Year Restriction
USM	Unified Stream Methodology
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish & Wildlife Service
USGS	U.S. Geological Survey
VaFWIS	Virginia Fish and Wildlife Information Service
VDACS	Virginia Department of Agriculture and Consumer Services
VDCR	Virginia Department of Conservation and Recreation
VDCR-DNH	Virginia Department of Conservation and Recreation – Division of Natural Heritage
VDEQ	Virginia Department of Environmental Quality
VDGIF	Virginia Department of Game and Inland Fisheries
VDH	Virginia Department of Health
VDOT	Virginia Department of Transportation
VESCH	Virginia Erosion and Sediment Control Handbook

VIMS	Virginia Institute of Marine Science
VMRC	Virginia Marine Resources Commission
VOSARA	Virginia Oyster Stock Assessment and Replenishment Archive
VRRM	Virginia Runoff Reduction Method
VSMP	Virginia Stormwater Management Program
VWPP	Virginia Water Protection Permit
WIP	Watershed Implementation Plan
WLA	Waste Load Allocations
WTAPS	Wolf Trap Alternate Placement Site

1. INTRODUCTION

1.1 PROJECT DESCRIPTION

The Virginia Department of Transportation (VDOT), in cooperation with the Federal Highway Administration (FHWA) as the lead federal agency, is preparing a Supplemental Environmental Impact Statement (SEIS) for the Hampton Roads Crossing Study (HRCS) located in the cities of Chesapeake, Hampton, Newport News, Norfolk, Portsmouth, and Suffolk, Virginia. The SEIS re-evaluates the findings of the 2001 HRCS Final Environmental Impact Statement (FEIS) and Record of Decision (ROD). The three alternatives retained for analysis in the 2001 FEIS, as well as input received from the public during initial scoping for the SEIS, were used to establish the Study Area Corridors shown in **Figure 1-1**. The purpose and need of the SEIS is summarized below.

Pursuant to the National Environmental Policy Act (NEPA) of 1969, as amended, FHWA is preparing an SEIS because of the time that has lapsed since the 2001 FEIS and new information indicating significant environmental impacts not previously considered. The SEIS, prepared in accordance with the implementing regulations of NEPA (23 CFR §771.130), is intended to aid in ensuring sound decision-making moving forward by providing a comparative understanding of the potential effects of the various options. The purpose of this *HRCS Technical Report* is to inventory the presence of natural resources, summarize the existing conditions, and provide a comparison of the potential impacts to these resources for the different alternatives. Information in this report, described below, will support discussions presented in the SEIS.

- **Section 1** provides an overview of the study and outlines the methods used to inventory the natural resources.
- **Section 2** provides an overview of the regulations governing each natural resource, identifies natural resources located within the Study Area Corridors and describes existing conditions (affected environment), and assesses the potential impacts to these natural resources associated with the alternatives retained for analysis in the Draft SEIS.
- **Section 3** provides references from which information for this report was obtained.

1.1.1 Purpose and Need

The purpose of the HRCS is to relieve congestion at the I-64 Hampton Roads Bridge-Tunnel (HRBT) in a manner that improves accessibility, transit, emergency evacuation, and military and goods movement along the primary transportation corridors in the Hampton Roads region, including the I-64, I-664, I-564, and Route 164 corridors. The HRCS will address the following needs (in the order of presentation in Chapter 1 of the Draft SEIS):

- Accommodate travel demand – capacity is inadequate on the Study Area Corridors, contributing to congestion at the HRBT;
- Improve transit access – the lack of transit access across the Hampton Roads waterway;
- Increase regional accessibility – limited number of water crossings and inadequate highway capacity and severe congestion decrease accessibility;
- Address geometric deficiencies – insufficient vertical and horizontal clearance at the HRBT contribute to congestion;

Figure 1-1: HRCS Study Area Corridors

- Enhance emergency evacuation capability – increase capacity for emergency evacuation, particularly at the HRBT;
- Improve strategic military connectivity – congestion impedes military movement missions; and
- Increase access to port facilities – inadequate access to interstate highway travel in the Study Area Corridors impacts regional commerce.

1.1.2 Alternatives

Five alternatives, including the No-Build Alternative, are under consideration for the Draft SEIS and are assessed in this Technical Report. The proposed limits of the four Build Alternatives are shown on **Figure 1-2**. Each Technical Report and Memorandum prepared in support of the Draft SEIS assesses existing conditions and environmental impacts along the Study Area Corridors (**Figure 1-1**) for each alternative. Each alternative is comprised of various roadway alignments, used to describe the alternatives and proposed improvements, shown on **Figure 1-3**.

<u>The No-Build Alternative</u>

This alternative includes continued routine maintenance and repairs of existing transportation infrastructure within the Study Area Corridors, but there would be no major improvements.

<u>Alternative A</u>

Alternative A begins at the I-64/I-664 interchange in Hampton and creates a consistent six-lane facility by widening I-64 to the I-564 interchange in Norfolk. A parallel bridge-tunnel would be constructed west of the existing I-64 HRBT. During the public review of the HRBT DEIS, there was a clear lack of public or political support for the level of impacts associated with any of the build alternatives. Specifically, potential impacts to the historic district at Hampton University, Hampton National Cemetery, and the high number of displacements were key issues identified by the public, elected officials, and University and Veterans Affairs officials. Given this public opposition, a Preferred Alternative was not identified and the study did not advance. On August 20, 2015, FHWA rescinded its Notice of Intent to prepare the HRBT DEIS, citing public and agency comments and concerns over the magnitude of potential environmental impacts to a variety of resources, such as impacts to historic resources as well as communities and neighborhoods. Consequently, VDOT and FHWA have committed that improvements proposed in the HRCS SEIS to the I-64 corridor would be largely confined to existing right-of-way. To meet this commitment, Alternative A considers a six-lane facility. Alternative A lane configurations are summarized in **Table 1-1**.

Table 1-1: Alternative A Lane Configurations

Roadway Alignments	Existing Lanes	Proposed Lanes
I-64 (Hampton)	4-6	6
I-64 (HRBT and Norfolk)	4	6

Figure 1-2: Build Alternatives

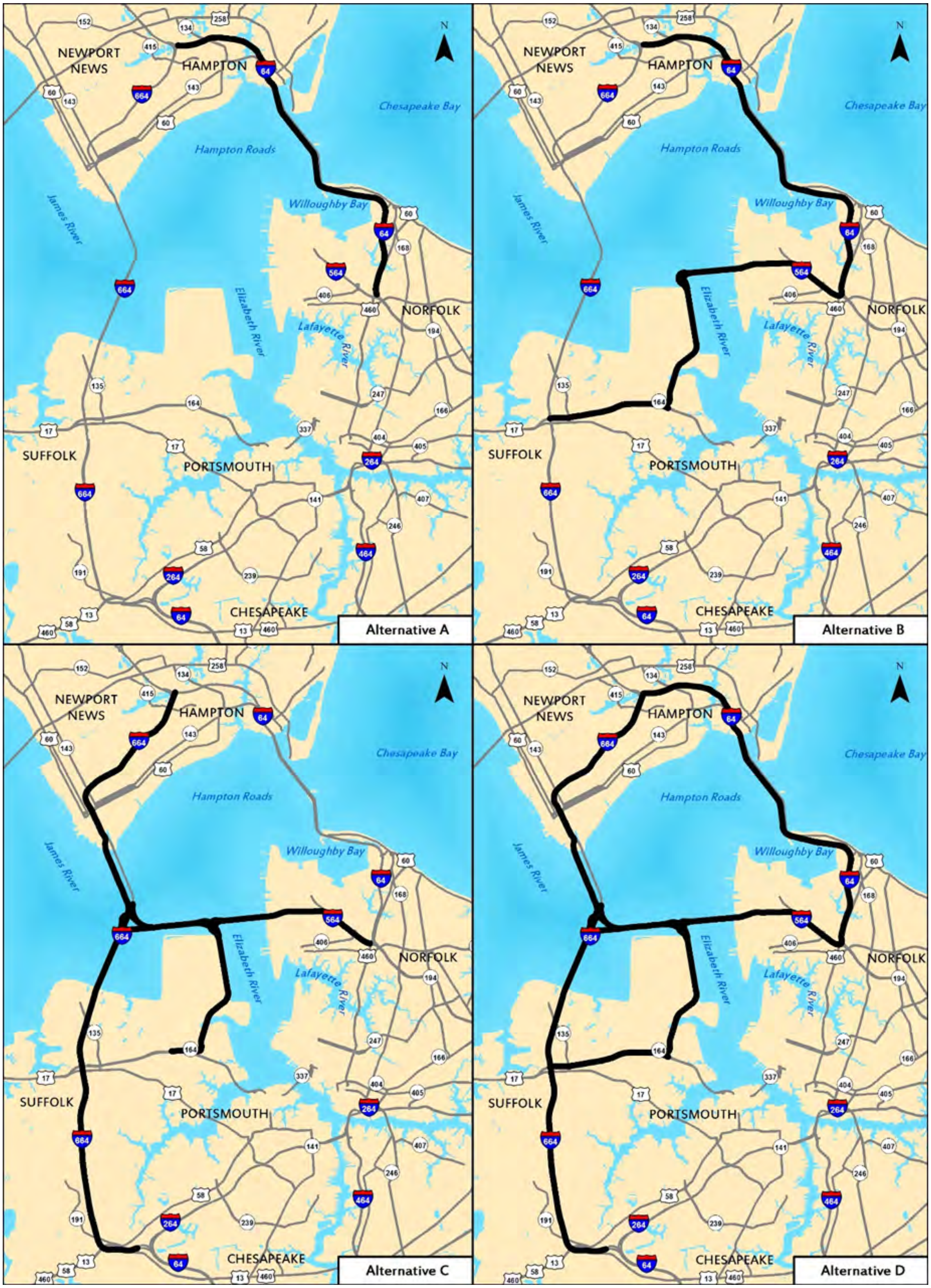
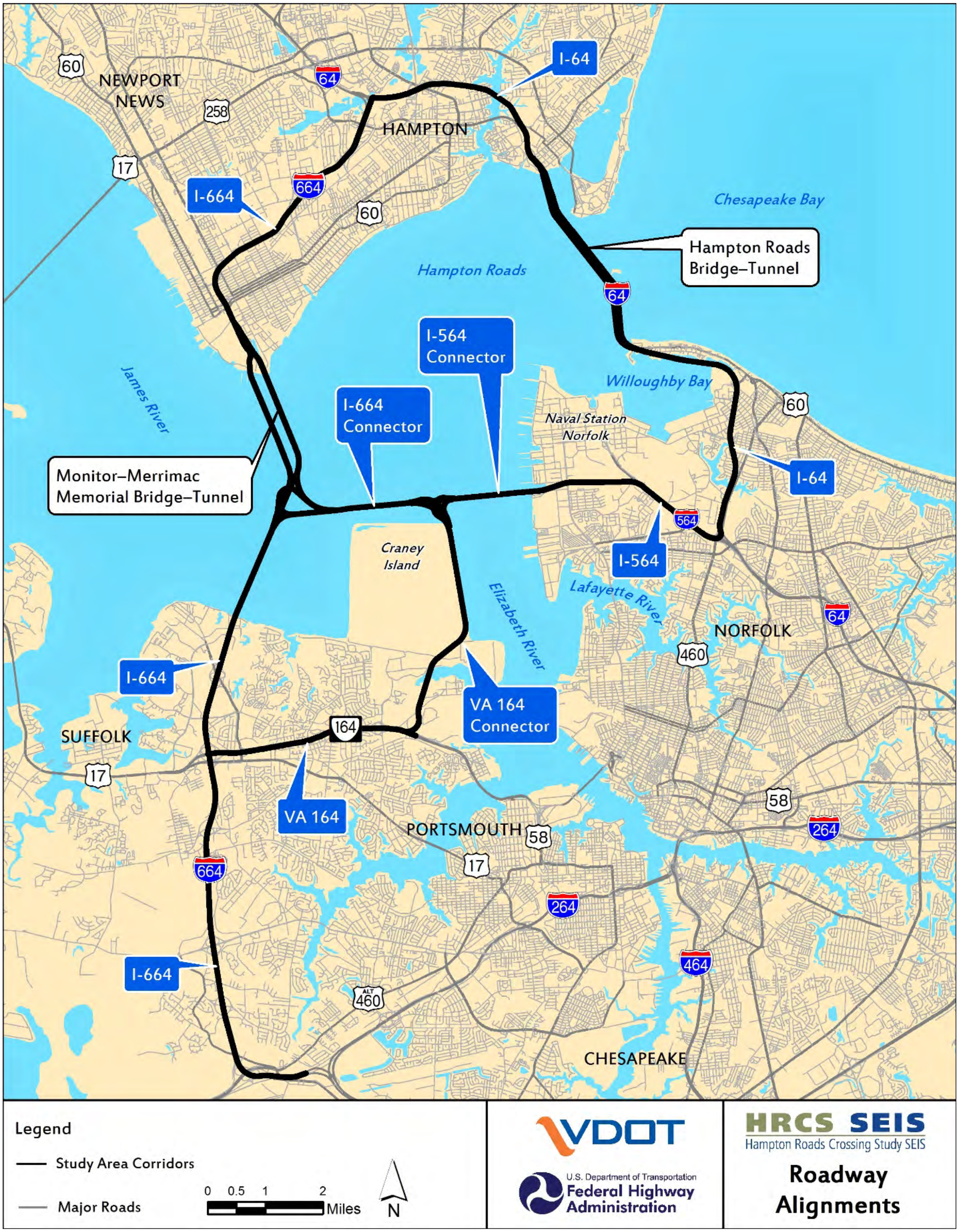


Figure 1-3: Roadway Alignments



Alternative B

Alternative B includes all of the improvements included under Alternative A, and the existing I-564 corridor that extends from its intersection with I-64 west towards the Elizabeth River. I-564 would be extended to connect to a new bridge-tunnel across the Elizabeth River (I-564 Connector). A new roadway (VA 164 Connector) would extend south from the I-564 Connector, along the east side of the Craney Island Dredged Material Management Area (CIDMMA), and connect to existing VA 164. VA 164 would be widened from this intersection west to I-664. Alternative B lane configurations are summarized in **Table 1-2**.

Table 1-2: Alternative B Lane Configurations

Roadway Alignments	Existing Lanes	Proposed Lanes
I-64 (Hampton)	4-6	6
I-64 (HRBT and Norfolk)	4	6
I-564	6	6
I-564 Connector	none	4
VA 164 Connector	none	4
VA 164	4	6

Note: The I-564 Intermodal Connector (IC) project is a separate project from HRCS that lies between the I-564 Connector and I-564. It would be constructed regardless of whether the HRCS improvements are made and therefore is included under the No-Build Alternative and is not listed with other proposed improvements.

Alternative C

Alternative C includes the same improvements along I-564, the I-564 Connector, and the VA 164 Connector that are considered in Alternative B. This alternative would not propose improvements to I-64 or VA 164 beyond the VA 164 Connector. Alternative C includes dedicated transit facilities in specific locations. DRPT completed a study in November 2015 that recommended high frequency bus rapid transit (BRT) service in a fixed guideway or in a shared high occupancy vehicle (HOV) or high occupancy toll (HOT) lanes (DRPT, 2015). Based on that recommendation, for the purposes of this Draft SEIS, transit assumes Bus Rapid Transit (BRT). In the Final SEIS, transit could be redefined or these lanes may be used as managed lanes. Alternative C converts one existing HOV lane in each direction on I-564 in Norfolk to transit only. The I-564 Connector and the I-664 Connector would be constructed with transit only lanes. This alternative also includes widening along I-664 beginning at I-664/I-64 in Hampton and continuing south to the I-264 interchange in Chesapeake. One new transit lane is included along I-664 between I-664/I-64 in Hampton and the new interchange with the I-664 Connector. Alternative C lane configurations are summarized in **Table 1-3**.

Table 1-3: Alternative C Lane Configurations

Roadway Alignments	Existing Lanes	Proposed Lanes
I-664 (from I-64 to the proposed I-664 Connector)	4-6	8 + 2 Transit Only
I-664 (from the proposed I-664 Connector to VA 164)	4	8
I-664 (from VA 164 to I-264)	4	6
I-564	6	4 + 2 Transit Only
I-564 Connector	none	4 + 2 Transit Only
VA 164 Connector	none	4
I-664 Connector	none	4 + 2 Transit Only

Note: The I-564 IC project is a separate project from HRCS that lies between the I-564 Connector and I-564. It would be constructed regardless of whether the HRCS improvements are made and therefore is included under the No-Build Alternative and is not listed with other proposed improvements.

Alternative D

Alternative D is a combination of the sections that comprise Alternatives B and C. Alternative D lane configurations are summarized in **Table 1-4**.

Table 1-4: Alternative D Lane Configurations

Roadway Alignments	Existing Lanes	Proposed Lanes
I-64 (Hampton)	4-6	6
I-64 (HRBT and Norfolk)	4	6
I-664 (from I-64 to VA 164)	4-6	8
I-664 (from VA 164 to I-264)	4	6
I-664 Connector	None	4
I-564	6	6
I-564 Connector	none	4
VA 164 Connector	none	4
VA 164	4	6

Note: The I-564 IC project is a separate project from HRCS that lies between the I-564 Connector and I-564. It would be constructed regardless of whether the HRCS improvements are made and therefore is included under the No-Build Alternative and is not listed with other proposed improvements.

1.1.3 Operationally Independent Sections

Given the magnitude and scope of the alternatives, it is expected that a Preferred Alternative would be constructed in stages or operationally independent sections (OIS). An OIS is a portion of an alternative that could be built and function as a viable transportation facility even if other portions of the alternative are not advanced. The OIS are comprised of various roadway alignments and were developed by identifying sections of roadway improvements that if constructed, could function independently. In order to facilitate the identification of a Preferred Alternative, the alternative impacts are quantified, as appropriate, based on roadway alignment sections and are presented in **Appendix A**.

1.2 METHODOLOGY

For the purposes of this natural resources analysis, the Study Area Corridors for detailed evaluation are generally defined as 250 feet on either side of the centerline of I-64, I-564, I-664, Route 164 and proposed new alignments (see **Figure 1-1**). Areas around the interchanges included in the Study Area Corridors vary based on the footprint of proposed modifications. For example, where proposed modifications would mainly consist of tying into existing ramps, the footprint of the interchange would be smaller and therefore the surrounding area around the interchange included for study would be smaller. The surrounding area included for study would be larger around the footprints of more extensively modified or newly proposed interchanges.

Natural resources within the 500-foot wide corridor were identified based on agency input through the scoping process, review of existing available scientific literature, Geographic Information System (GIS) databases and mapping, personal communication with regulators and researchers, and field reconnaissance of the study area conducted in late 2015 and early 2016. The following federal and state agencies were consulted for information regarding natural resources within the study area:

- Federal Emergency Management Agency (FEMA)
- National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service

- United States Army Corps of Engineers (USACE)
- Federal Transit Administration (FTA)
- United States Department of Transportation (USDOT)
- United States Environmental Protection Agency (USEPA)
- United States Fish and Wildlife Service (USFWS)
- Virginia Department of Conservation and Recreation (VDCR)
- Virginia Department of Environmental Quality (VDEQ)
- Virginia Department of Game and Inland Fisheries (VDGIF)
- Virginia Department of Health (VDH)
- Virginia Institute of Marine Science (VIMS)
- Virginia Marine Resources Commission (VMRC)

More specific information regarding data gathering sources and approach are presented within the discussion of each resource in Section 2, and references are listed in Section 3.

Potential impacts have been calculated using the limit of disturbance (LOD) for the proposed alternatives. The LOD was developed using the proposed pavement width of the mainline alternatives and the selected roadside design option (open section, guardrail section, retaining wall, or sound wall) based on the existing roadside conditions and constraints. The LOD accounts for an additional 30 feet beyond the improvements to accommodate drainage, utilities, stormwater management, and construction easements. Additional information on the LOD is included in the *HRCS Alternatives Technical Report*.

2. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

2.1 WATER RESOURCES

2.1.1 Tidal Waterways and Non-tidal Streams

Regulatory Context

Water resources are federally regulated by the USEPA and the USACE under the Federal Water Pollution Control Act (i.e. 1972 Clean Water Act amended in 1977, or CWA). The USEPA and USACE share responsibility for implementing Section 404 of the CWA. Section 404 of the CWA specifically regulates dredge and fill activities affecting Waters of the United States (WOUS), which can be defined as all navigable waters and waters that have been used for interstate or foreign commerce, their tributaries and associated wetlands, and any waters that if impacted could affect the former. By definition, all waterbodies subject to the ebb and flood of tides are considered navigable waterways (33 CFR 329.4). WOUS include surface waters such as streams, lakes, bays, as well as their associated wetlands, which are discussed in more detail in the Wetlands section. Additionally, water resources are regulated under other federal and state statutes. Work within navigable waterbodies is federally regulated under Section 10 of the Rivers and Harbors Act of 1899, as amended. Construction of bridges or causeways across navigable waterbodies is federally regulated by the U.S. Coast Guard (USCG) by authority derived under the Rivers and Harbors Act of 1899, as amended; the Bridge Act of March 23, 1906, as amended; and the General Bridge Act of 1946, as amended, for the purpose of preserving the public right of navigation and to prevent interference with interstate and foreign commerce.

Before the USACE issues a permit to impact WOUS under Section 404, the state must certify that state water quality standards would not be violated by the proposed work (Section 401 of CWA). In Virginia, the VDEQ is the authority that provides the Section 401 certification through its Virginia Water Protection Permit (VWPP) Program (9 VAC 25-210) which gets its statutory authority from 62.1-44.15 of the Code of Virginia. State law requires that a VWP permit be obtained before disturbing a stream or wetland by clearing, filling, excavating, draining, or ditching. The issuance of a state VWP permit does not depend on the issuance of a federal Section 404 permit.

Work within tidal waterbodies and non-tidal streams with drainage areas greater than five square miles also require a permit from the VMRC, under the authority of Chapter 12 of Title 28.2 of the Code of Virginia. Tidal waterbodies are generally defined as the beds of the bays, rivers, creeks, or shores of the sea channelward of the mean low-water mark within the jurisdiction of the Commonwealth. Shallow water habitat is a component of tidal waterbodies generally defined as the subaqueous bottom channelward of the mean low-water mark out to a depth of 6.6 feet.

The VMRC serves as the clearinghouse for all Virginia permit applications in jurisdictional waters. The USACE, the USCG, the VDEQ, and the VMRC all issue permits for various activities in, under and over WOUS.

Methods

Tidal waterbodies and non-tidal streams were identified within the Study Area Corridors using the National Hydrography Dataset (NHD) from the U.S. Geological Survey (USGS) and the same photo interpretation method described for wetlands in the Wetlands section (USGS, 2016b). Tidal waterbodies were identified using the NHD in combination with the polygons that were assigned an estuarine unconsolidated bottom Cowardin classification. Hydrologic Unit Codes (HUCs) were obtained from the Virginia Department of Conservation and Recreation (VDCR) (VDCR, 2015a).

Shallow water habitat composed of water depths less than 6.6 feet within vicinity of the Study Area Corridors were identified using topography and bathymetry from the Digital Elevation Model developed by the U.S. Army Engineer Research and Development Center – Coastal & Hydraulics Laboratory for FEMA Region III as part of a study to update coastal storm surge elevations (USACE, 2011). All streams designated as intermittent (R3) and perennial (R4) during the photo interpretation analysis were assessed using the Unified Stream Methodology (USM). USM was developed collaboratively by the USACE and the VDEQ for determining relative stream quality of non-tidal wadeable streams and used for stream compensation requirements for unavoidable impacts to streams. USM Form 1 is used to assess perennial (R3) and intermittent (R4) streams.

The quantity of streams, navigable waterways, and shallow water habitat within the Study Area Corridors was determined by performing GIS overlays of the Study Area Corridors onto the resource information referenced above. Potential impacts were calculated by performing GIS overlays of the limits of disturbance (LOD), which is based on roadway engineering completed to date, onto the resource information referenced above.

<u>Affected Environment</u>

The Study Area Corridors are primarily located within the Hampton Roads Basin (HUC 02080208), while portions are located within the Lynnhaven-Poquoson (HUC 02080108) and Lower James River (HUC 02080206) basins. The subwatersheds crossed by the Study Area Corridors are highly developed. Residential, industrial, commercial, and institutional land uses dominate the subwatersheds. The Study Area Corridors cross the following subwatersheds (**Figure 2-1**):

- Southwest Branch Back River (HUC 020801080103)
- Hampton Roads – Hampton River (HUC 020802080303)
- Hampton Roads Channel (HUC 020802080304)
- Willoughby Bay (HUC 020802080302)
- Hampton Roads – Streeter Creek (HUC 020802080301)
- Elizabeth River (HUC 020802080206)
- Western Branch Elizabeth River (HUC 020802080205)
- Nansemond River – Bennett Creek (HUC 020802080106)
- James River – Cooper Creek (HUC 020802060906)

The central waterbody within the Study Area Corridors is Hampton Roads, which is the interface between the James River and the Chesapeake Bay. With the exception of Newmarket Creek, which discharges to the Back River, all waterbodies in the Study Area Corridors ultimately discharge to Hampton Roads. Named waterbodies in the vicinity of the Study Area Corridors are shown and labeled on **Figure 2-2**. No waterbodies in the Study Area Corridors have been designated as Wild or Scenic Rivers under the Wild and Scenic Rivers Act (16 U.S.C. §1274). No waterbodies in the Study Area Corridors are on the Nationwide Rivers Inventory administered by the National Park Service (NPS) (NPS, 2016). No National Marine Sanctuaries administered by NOAA are located in the Study Area Corridors (NOAA, 2016a). No State Scenic Rivers are present; however, the VDCR has identified the James River, including Hampton Roads, as a potential State Scenic River segment for future study (VDCR, 2016b). Within the Study Area Corridors, there are no Exceptional State Waters as outlined in 9 VAC 25-260-30.

Designations of any special habitat areas within the Study Area Corridors are described in the Benthic Species, Essential Fish Habitat, and Anadromous Fish sections.

As previously noted, all tidal waterbodies are considered navigable waterways. Tidal waterbodies were identified as estuarine, subtidal, unconsolidated bottom (E1UB) or estuarine, subtidal, unconsolidated bottom, excavated (E1UBx) and are shown on the Photo Interpretation Maps (**Appendix B**). **Table 2-1** shows the area of tidal or navigable waterbodies present within the Study Area Corridors.

Portions of the tidal waterbodies within the Study Area Corridors that are deemed shallow water habitat (less than 6.6 feet deep) are shown on **Figure 2-3** and quantified at the bottom of **Table 2-6**. These areas provide forage, refuge, spawning, and rearing habitat for fish, their prey, and other aquatic organisms such as shellfish and benthos. Shallow water habitat can be suitable for submerged aquatic vegetation (SAV), perform nutrient cycling and removal, and sediment retention.

Table 2-1: Tidal or Navigable Waterbodies within Study Area Corridors

Waterbody	Alternative A (acres)	Alternative B (acres)	Alternative C (acres)	Alternative D (acres)
Bailey Creek	0	0	0.1	0.1
Brights Creek	0.6	0.6	0	0.6
Craney Island Creek	0	9	9	9
Elizabeth River	0	40	40	40
Goose Creek	0	0	2	2
Hampton River	11	11	0	11
Hampton Roads	203	396	850	1,065
James River	0	0	13	13
Johns Creek[1]	0.7	0.7	0	0.7
Mason Creek	5	5	0	5
Newmarket Creek	14	14	18	23
Newport News Creek[2]	0	0	0.3	0.3
Oastes Creek	1	1	0	1
Unnamed Tributary to Hampton River	2	2	0	2
Unnamed Tributary to Oastes Creek 1	0.3	0.3	0	0.3
Unnamed Tributary to Oastes Creek 2	0.3	0.3	0	0.3
Willoughby Bay	56	56	0	57
Total	**295**	**538**	**933**	**1,231**
Shallow Water Habitat[3]	103	139	69	177

Source and notes: USGS Quadrangles Hampton 1965 Rev1986, Newport News North 1965 Rev1986, Newport News South 2000, Norfolk North 1965 Rev1989, Bowers Hill 2000, Norfolk South 2000,and USGS National Hydrography Dataset (NHD) 2012. 1. Johns Creek is also known as Jones Creek. 2. Newport News Creek is also known as the Small Boat Harbor. 3. Shallow water habitat is a subset of the total tidal water acres.

The Norfolk District of the USACE maintains navigational channels within Hampton Roads, the James River, the Elizabeth River, and Hampton River. These navigational channels are discussed in Section 2.1.2. Other tidal waterways crossed by the Study Area Corridors may be navigated by smaller craft depending on the waterway depths. Many of the tidal waterways (e.g. Bailey Creek, Goose Creek, Craney Island Creek) are accessible only by motorized shallow draft vessels or paddle craft such as canoes and kayaks.

Non-tidal streams (R3 and R4) were assessed using USM and are shown on the Photo Interpretation Maps in **Appendix B**. A total of 183 linear feet of R3 streams are within the Study Area Corridor of Alternative B, and no R4 streams. A total of 2,890 linear feet of R3 streams and 169 linear feet of R4 streams are within the Study Area Corridors of Alternatives C and D. All of these streams are unnamed headwater systems except for Drum Point Creek along I-664 in Chesapeake. Intermittent streams have flow dependent on a number of factors including groundwater table and the discharge from feeder streams. Perennial streams generally have a larger watershed or are spring-fed. Most stream channels within the right-of-way and developed areas showed signs of historic alteration including ditching or straightening, as well as areas of rip-rap around the culvert outfalls. All streams were found to have a significant nexus to offsite navigable waters and are therefore jurisdictional. In heavily developed areas the nexus may be due to jurisdictional flow through underground pipes/culverts that discharge to the surface offsite. Alternative B crosses an unnamed tributary to Knotts Creek while Alternatives C and D cross the following non-navigable streams:

- Drum Point Creek and Unnamed Tributary
- Unnamed Tributaries to Goose Creek
- Unnamed Tributary to Knotts Creek
- Unnamed Tributaries to Streeter Creek

All of the assessed streams are low gradient systems. Most of these streams are classified as Rosgen C-type and E-type channels, exhibiting higher entrenchment ratios (>>2.2) and slopes of 2 percent or less. Most of the intermittent and perennial systems contain sand bed materials and long reaches with short riffles and deep pools. Edge habitat for benthic colonization is also present. The majority of these streams are too small to support fish; however, the slower flows hold organic material suitable for macroinvertebrate communities where water quality and flow regime are not limiting.

USM Form 1s documenting the condition of each assessed stream and their corresponding RCI are located in **Appendix C**. For a listing of each stream reach and their corresponding RCI, see the USM Form 2 for each alternative in **Appendix C**.

<u>Environmental Consequences</u>

The No-Build Alternative would not involve any construction or changes to the natural environment. None of the roadways would be expanded and no new crossings built. As a result, environmental effects to tidal waters, shallow water habitat, and non-tidal streams from the No-Build Alternative are not anticipated.

Under the four build alternatives, impacts to non-tidal streams, tidal or navigable waterways, and shallow water habitat are unavoidable. **Table 2-2** provides all the tidal or navigable waterbodies that would be potentially impacted by the build alternatives, as well as the area of shallow water habitat included in those totals. The estimated area of impact is the total waterbody area within the LOD. The actual area of permanent impact to WOUS/subaqueous bottom would be limited to dredging and permanent placement of tunnels, the area of piers or pilings associated with bridges, and the area filled with approaches, scour protection measures, and culverts. Although VMRC uses the total area of bridges over subaqueous bottom to calculate encroachment for their permit, the actual direct impact to the bottom would be limited to the footprint of the tunnels and bridge pilings. Construction of all of these structures may also require cofferdams, causeways or temporary roads, work bridges or barges, dredge material dewatering and disposal, and construction staging areas, which can cause temporary impacts.

Impacts to shallow water habitat and vegetation, such as submerged aquatic vegetation, beneath bridges can result from altered light regimes. The height, width, construction materials used, orientation of the structure, and density of piers can all influence the size of the shade footprint and how much of an adverse impact it may have on the habitat beneath it (Johnson et al., 2008).

The alternatives would have the greatest amount of impact on Hampton Roads as it is the largest waterbody within the Study Area Corridors and is crossed by all of the alternatives. As the length of crossing this waterbody increases, so does the amount of impact to it. As **Table 2-2** shows, the potential impact to tidal or navigable waterbodies increases from Alternative A to B to C to D. Alternative A crosses Hampton Roads with the HRBT portion of I-64, as does Alternative B with the addition of the I-564 Connector. Alternative C crosses Hampton Roads with the MMMBT portion of I-64 and the I-664 Connector. Alternative D crosses Hampton Roads with all of these roadway sections.

Potential impacts to shallow water habitat increases as the length of waterbody crossings increase with the exception of Alternative C which has the least amount of potential impact. Its shallow water areas are mainly confined to the southern James River shoreline at I-664 and Craney Island Creek along the VA 164 Connector.

Figure 2-1: HUC Map

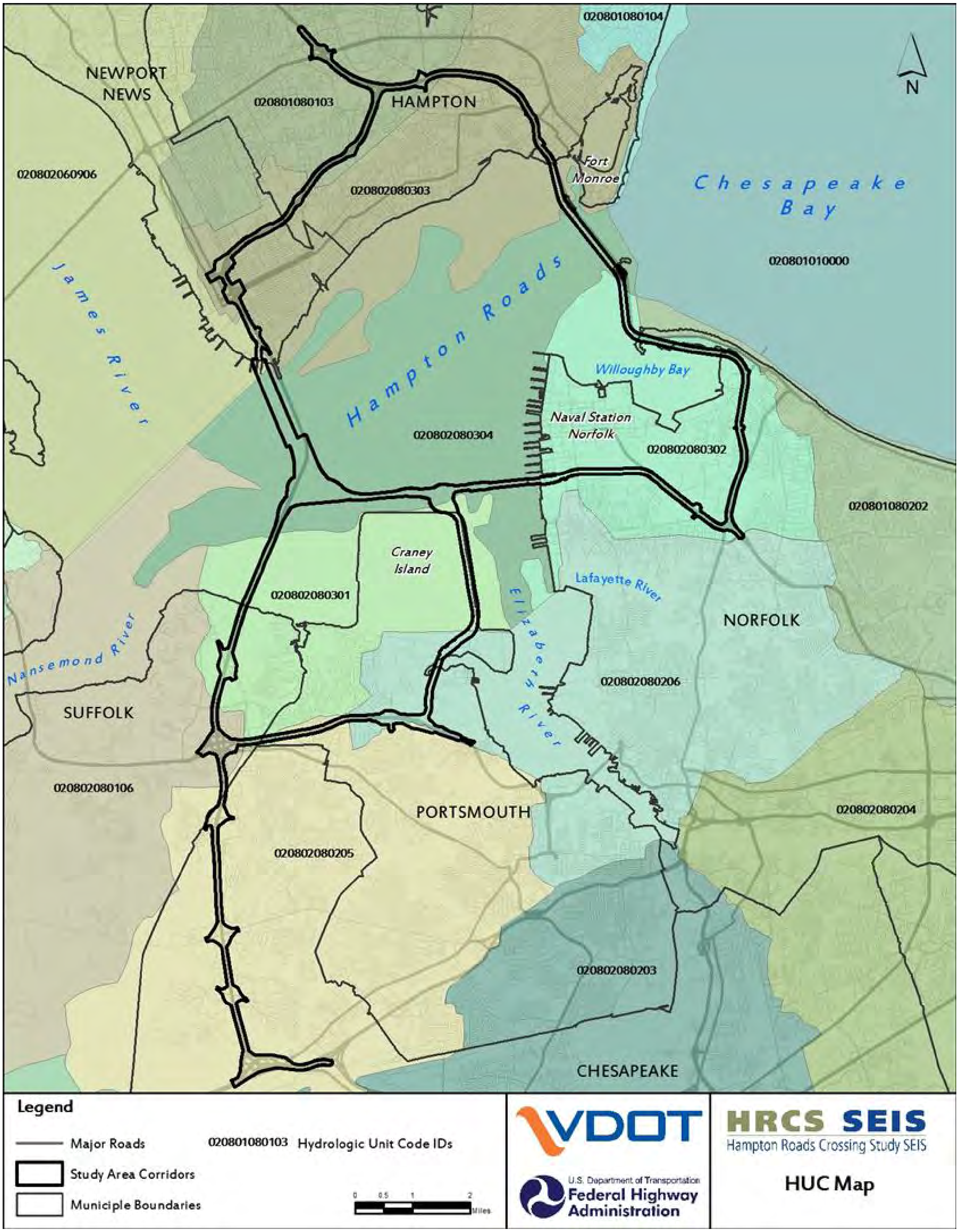


Figure 2-2: Named Waterbodies

Figure 2-3: Shallow Water Habitat

Table 2-2: Potential Impacts to Tidal or Navigable Waters

Waterbody	Existing Crossing Type	Alternative A (acres)	Alternative B (acres)	Alternative C (acres)	Alternative D (acres)
Bailey Creek	Bridge	0	0	0	0
Brights Creek	Culvert	0	0	0	0
Craney Island Creek	Bridge	0	3	3	3
Elizabeth River	Bridge-Tunnel	0	0.2	0.2	0.2
Goose Creek	Bridge	0	0	0.6	0.6
Hampton River	Bridge	0	0	0	0
Hampton Roads	Bridge-Tunnel	126	191	352	442
James River	Bridge-Tunnel	0	0	13	13
Johns Creek	Culvert	0.1	0.1	0	0.1
Mason Creek	Bridge	2	2	0	2
Newmarket Creek	Bridge	0	0	0	0
Newport News Creek	Bridge	0	0	0.2	0.2
Oastes Creek	Bridge	0.7	0.7	0	0.7
Unnamed Tributary to Hampton River	Bridge	0	0	0	0
Unnamed Tributary to Oastes Creek 1	Bridge	0	0	0	0
Unnamed Tributary to Oastes Creek 2	Bridge	0.1	0.1	0	0.1
Willoughby Bay	Bridge	19	19	0	19
Total		**147**	**216**	**369**	**481**
Shallow Water Habitat [1]		43	59	29	73

Source and notes: Photo Interpretation Maps in Appendix B. 1. Shallow water habitat is a subset of the total tidal water acres.

Culverts and culvert extensions would be used to cross non-tidal streams. The estimated total length of non-tidal streams crossed by the alternatives is provided in **Table 2-3**. These lengths are based upon the width of the LOD, but may be reduced through further avoidance and minimization measures during design. Additional specifics regarding these potential impacts are stated under each alternative below.

Table 2-3: Potential Impacts to Non-Tidal Streams (feet)

Non-Tidal Stream Type	Alternative A (feet)	Alternative B (feet)	Alternative C (feet)	Alternative D (feet)
R3	0	0	548	548
R4	0	0	0	0
Total	**0**	**0**	**548**	**548**

Source and notes: Photo Interpretation Maps in Appendix B.

Alternative A would have the least amount of impact to navigable waters and no impact to non-tidal streams. Anticipated impacts associated with the alternative include Willoughby Bay, Johns Creek, Mason Creek, and Oastes Creek. Potential shallow water habitat impacts would occur along the north shoreline of Hampton Roads, around each of the tunnel portal islands, and in Willoughby Bay.

Alternative B would have a greater amount of impact to tidal waterbodies including shallow water habitat compared to Alternative A since it would include all the crossings on Alternative A, plus additional crossings associated with I-564, and the I-564 and VA 164 Connectors in and along the

Elizabeth River and over Craney Island Creek. Permits have been received and work is underway to fill the area immediately offshore as part of the East Expansion Project to the Craney Island Dredged Material Management Area (CIDMMA) (see Maintained Navigational Channels and Civil Works Projects section). If Alternative B were implemented, this area would be upland at the time of construction. Also, a new bridge across Craney Island Creek would be constructed. No non-tidal streams would be impacted by Alternative B. The unnamed tributary to Knotts Creek (Suffolk) located within the Alternative B Study Area Corridor at the I-664/VA 164 interchange is outside the proposed LOD of the Alternative B roadway improvements.

Alternative C would have the second greatest amount of impact to tidal waterbodies. Existing vertical clearances of navigable waterbodies would be maintained. Alternative C would also impact non-tidal streams as indicated in **Table 2-3**, which is considerably less than the amount within the Study Area Corridor. The R4 portion of the unnamed tributary to Streeter Creek (Suffolk), as well as all of the unnamed tributary to Knotts Creek (Suffolk) and unnamed tributary to Drum Point Creek (Chesapeake) are outside the proposed LOD of the Alternative C roadway improvements. The remaining impacts to R3 streams would be the result of culvert extensions and/or roadway fill. These would occur to the unnamed tributary to Streeter Creek (Suffolk), the unnamed tributary to Goose Creek (Chesapeake), and Drum Point Creek (Chesapeake). All potential impacts would occur along I-664 in Suffolk and Chesapeake. Alternative C would have the least amount of impact to shallow water habitat with the areas being mainly confined to the southern James River shoreline at I-664 and Craney Island Creek along the VA 164 Connector.

Alternative D would have the greatest amount of impact to tidal waterbodies including shallow water habitat since it is a combination of the sections that comprise Alternatives B and C, and includes all of the crossings discussed above. The amount of non-tidal stream impact would be the same as those stated for Alternatives B and C.

Avoidance and minimization efforts would be made during final design to reduce the amount of stream and wetland impacts. Efforts would be made during the design to utilize the steepest acceptable fill slopes in order to shorten the length of culverts and minimize the length of stream impacts. Minor alignment shifts could be employed to avoid lateral encroachments on particular streams; however, since the alternatives primarily involve expanding an existing roadway, opportunities are dependent upon the current positioning of the stream relative to the roadway crossing. Culverts would be countersunk and sized appropriately using VDOT criteria to minimize the effects to aquatic species. Employing erosion and sediment control measures and best management practices following the Virginia Erosion and Sediment Control Handbook (VESCH) such as silt fence installation, culvert inlet and outlet protection, diversion ditches, temporary sediment traps and basins, vegetative and structural streambank stabilization, along with temporary and permanent seeding would prevent sedimentation and divert runoff away from receiving streams. Additional measures to minimize impacts include: blocking no more than 50 percent of the streamflow at any given time, changing the roadway crossing angle relative to the stream to be as perpendicular as practicable, ensuring groundwater recharge through the location of outfalls and infiltration trenches, and locating stormwater management facilities outside of WOUS, including streams and wetlands.

Properly staging bridge and tunnel construction, in addition to adhering to any time-of-year restrictions (TOYR), could minimize the disruption to aquatic species and the shallow water habitat. Construction best management practices (BMPs) would be employed to reduce turbidity and sediment disturbance. Examples may include certain dredging techniques discussed in the Dredging and Disposal of Dredged

Material section, filtration of discharge water from barges/scows, and turbidity curtains, where applicable. The length of dredging operations may need to be considered as prolonged dredging would result in disturbance to the shallow water habitat over a longer period of time dependent upon the nature of the bottom substrate, tidal fluctuations, and estuarine dynamics .

A field delineation of streams and other WOUS would be required prior to permitting the project. Based on the scale of the project and multiple crossings of tidal waterways, it is anticipated that a USACE Section 404 Individual Permit, a Virginia Water Protection (VWP) Individual Permit from VDEQ, and a Subaqueous Bottomlands Permit from VMRC would be required to authorize temporary and permanent impacts. The USACE can only issue a permit to discharge dredged or fill material into wetlands and other WOUS for the least environmentally damaging practicable alternative (LEDPA), unless that alternative has other significant adverse environmental consequences (40 CFR 230.10(a)). An alternative is considered practicable "if it is available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes." (40 CFR 230.10(a)(2)) Therefore, an applicant must demonstrate that their proposed alternative has avoided and minimized impacts to wetlands and other WOUS to the greatest extent practicable before the USACE can issue a permit. The USACE determines whether this has occurred through an evaluation under the 404(b)(1) Guidelines (40 CFR 230). The USACE must also complete a public interest review prior to determining the LEDPA and issuing a permit. Bridge permits would also be required from the USCG when crossing navigable waterways. VDEQ also requires that applicants demonstrate that impacts have been avoided and minimized to the extent practicable. VDEQ requires specifically that the applicant demonstrate that the criteria of the 404(b)(1) Guidelines have been met (9 VAC 25-210-115). A Joint Permit Application would need to be submitted to request authorization for impacts.

VDOT is exempt from VMRC royalties for use of subaqueous bottom. Should mitigation be required by any agency, mitigation measures will be negotiated with them during the design and permitting stage. A compensatory mitigation package would be submitted with the JPA. Various forms of habitat creation or enhancement would likely be considered such as shellfish beds, SAV beds, oyster reefs, and removal of contaminated sediments. All stream/river and shallow water habitat impacts would be assessed for compensatory mitigation. The amount of compensatory mitigation for non-tidal wadeable streams would be determined through the USM assessment, the length of impact based upon final design, and coordination with the USACE and VDEQ.

2.1.2 Maintained Navigational Channels and Civil Works Projects

Regulatory Context

The maintenance of waterborne navigation is administered through the USACE Civil Works program. Primary activities performed under the navigation section of the Civil Works program include dredging operations and the disposal and management of dredged material.

Work that may alter, occupy, or use a USACE Civil Works project, such as a USACE maintained navigation channel or USACE administered dredged material disposal area, requires authorization in the form of a Section 408 permit from the USACE under Section 14 of the Rivers and Harbors Act of 1899 (33 U.S.C. 408). Permission under Section 408 must precede the issuance of Section 404 and Section 10 permits. Procedures for processing a Section 408 permit application are outlined in *Engineer Circular 1165-2-216, Policy and Procedural Guidance for Processing Requests to Alter US Army Corps of Engineers Civil Works Projects Pursuant to 33 USC 408*. A permit would only be issued if the USACE determines that the activity would not be injurious to the public interest and would not impair the usefulness of the Civil Works Project (USACE, 2014).

Methods

NOAA navigational charts and bathymetry, NOAA Coastal Maintained Channel GIS files, USACE survey charts, and personal communication with the USACE were used to determine the locations and depths of maintained navigational channels crossed by the Study Area Corridors (NOAA, 2012, 2016c, 2016d) (USACE, 2010a) (Anderson, 2016). Civil Works Projects noted on the USACE Norfolk District webpage in addition to previous correspondence with the USACE on previous studies were reviewed to determine potential implications for the Study Area Corridors.

The quantity of maintained navigable waterways within the Study Area Corridors was determined by performing GIS overlays of the Study Area Corridors onto the resource information referenced above. Potential impacts were calculated by performing GIS overlays of the LOD, which is based on roadway engineering completed to date, onto the resource information referenced above.

Affected Environment

Navigational channels are maintained by the USACE within Hampton Roads to provide transit to the many ports in the region. The Port of Virginia, located along the Elizabeth River, is a naturally deep harbor. Hampton Roads and the James River provide access to the Port of Virginia and several other deep water anchorages within and upstream of the study area (See **Figure 2-4**.) The anchorage areas provide locations for ships to anchor while waiting to access the port areas. Anchorage berths are the specific sites identified for ships to set anchor. Though anchorages are in the vicinity, none are present within the Study Area Corridors, however maintained navigable channels are. The Norfolk Harbor Entrance Reach and the Norfolk Harbor Reach are maintained at -50 feet mean lower low water (MLLW). The Norfolk Harbor Federal Project Deep Draft infrastructure within the vicinity of the Study Area Corridors is maintained to a depth of -50 feet MLLW. This infrastructure is currently under study for a deepening and has Congressional authority for deepening to -55 feet MLLW. The Newport News Channel is maintained at -55 feet MLLW. Since the existing road crossings within the Study Area Corridors are tunnels at the navigational channels rather than bridges, there are no air draft restrictions (vertical clearance) associated with these navigational channels to the ports in the study area. Additionally, the USACE maintains the Hampton River Entrance Channel for recreational and small commercial craft within portions of the City of Hampton. Navigational features are shown on **Figure 2-4** and described in **Table 2-4**. Maintenance conducted through the USACE Civil Works program begins upstream of the HRBT (USACE, 2000). There are 12 acres of maintained navigation channels within the Study Area Corridor of Alternative A, 27 acres within Alternative B, 31 acres within Alternative C, and Alternative D contains 65 acres.

Table 2-4: Maintained Navigation Channels within Study Area Corridors

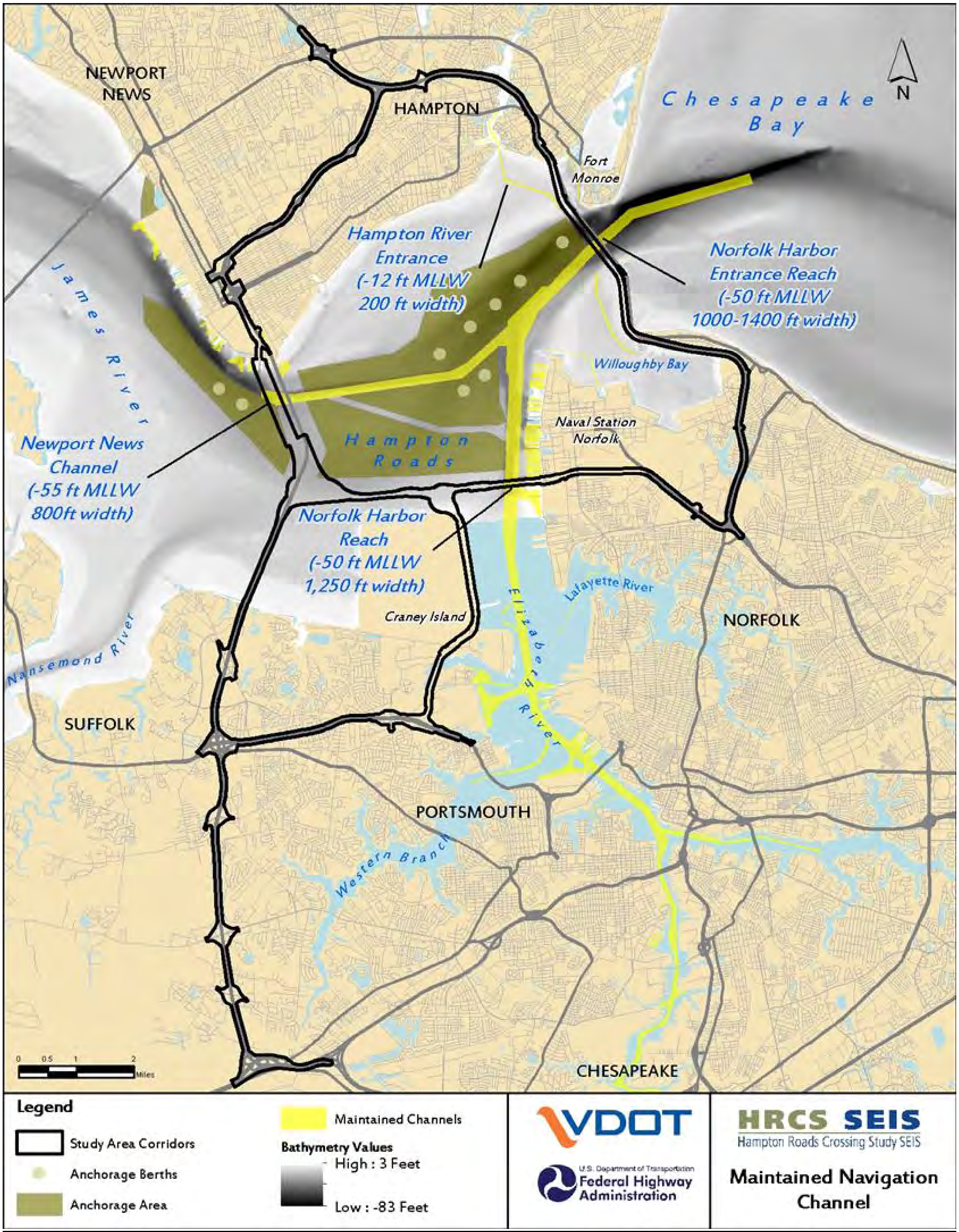
Name of Channel	Channel Width (ft)	Depth MLLW (ft)	Alternatives
Norfolk Harbor Entrance Reach	1000 – 1400	50	A, B, D
Norfolk Harbor Reach	1250	50	B, D
Newport News Channel	800	55	C, D
Hampton River Entrance Channel	200	12	N/A

Source and notes: NOAA Navigational Chart 12245.

The USACE Norfolk District Civil Works program also maintains a 2,500 acre dredged material management area at Craney Island (CIDMMA). There are 90 acres of CIDMMA within the Study Area Corridor of Alternatives B and C, and 114 acres within Alternative D. This acreage does not include the eastward expansion discussed in the following paragraph. This site receives dredged material from numerous federal and private dredging projects within the Hampton Roads area. The facility is authorized to only receive dredged material from projects related to navigation within the defined service area. See the Disposal Alternatives portion of the Dredging and Disposal of Dredged Material section for more information on CIDMMA.

In 2006, the USACE issued a Feasibility Study and Environmental Impact Statement for an eastward expansion of the CIDMMA to resolve projected dredged material capacity issues. Additionally, the Feasibility Study and Environmental Impact Statement assessed the feasibility of providing a new marine terminal site on the expanded area. The CIDMMA expansion is currently underway with diversion dikes under construction in 2016. The marine terminal site is not expected to be needed until around the year 2030.

Figure 2-4: Navigation Channels



Environmental Consequences

The **No-Build Alternative** would not affect any navigational channels maintained by the USACE or the CIDMMA, including the eastward expansion. The existing HRBT and MMMBT crossings of USACE maintained channels would remain unchanged.

All **build alternatives** would require work in navigational channels, and Alternatives B, C, and D would require work along the east side of the CIDMMA. **Table 2-5** shows the potential area of impacts for each alternative. Impacts to the channels would be temporary construction impacts, potentially impeding maritime traffic during construction of the tunnel that would be placed underneath the navigation channel. Impacts to the CIDMMA may be more if the eastward expansion is partially or fully completed prior to implementation of Alternatives B, C, or D. Work that has the potential to alter, occupy, or use a USACE Civil Works project would need a Section 408 permit from the USACE.

Table 2-5: Potential Impacts to Maintained Navigable Channels and the CIDMMA

Name of Channel	Alternative A (acres)	Alternative B (acres)	Alternative C (acres)	Alternative D (acres)
Norfolk Harbor Entrance Reach	12	12	0	12
Norfolk Harbor Reach	0	12	16	12
Newport News Channel	0	0	41	38
Hampton River Entrance	0	0	0	0
CIDMMA[1]	0	89	89	89
Total	**12**	**113**	**146**	**151**

Source and notes: NOAA, 2016c, 2016d. USACE, 2010a. 1. CIDMMA impacts do not include land area created from the eastward expansion. They represent acres currently present at CIDMMA.

Alternative A would require the expansion of the HRBT with a new parallel bridge-tunnel. This expansion would cross the Norfolk Harbor Entrance Reach and would be in close proximity to the Hampton River Entrance. As described in the *HRCS Alternatives Development Technical Report*, the construction of the HRBT expansion would match existing horizontal and vertical clearances to ensure that navigation of the Norfolk Harbor Entrance Reach and Hampton River Entrance is not impeded. A tunnel would be used at the Norfolk Harbor Entrance Reach crossing in Hampton Roads to preserve the no air draft restriction characteristic of the navigational channels west of the crossing. The top of the tunnel would be a minimum of -65 feet MLLW to ensure adequate clearances for shipping, maintenance dredging, and eventual deepening of the Norfolk Harbor Entrance Reach to -55 feet MLLW. A Section 408 permit from the USACE would need to be obtained for the USACE maintained channel crossing. Access to deepwater anchorages within Hampton Roads would be maintained.

Alternative B would include the same work at the HRBT as described for Alternative A, as well as a new bridge-tunnel across the mouth of the Elizabeth River, which comprises the Norfolk Harbor Reach Channel, and work within the CIDMMA. The Norfolk Harbor Reach Channel is maintained at -50 feet MLLW with a width of 1,250 feet. As with Alternative A, the top of the tunnels would be a minimum of -65 feet MLLW to ensure adequate clearances for shipping, maintenance dredging, and eventual deepening of the Norfolk Harbor Entrance Reach and Norfolk Harbor Reach to -55 feet MLLW. This alternative's alignment also traverses the east side of the existing CIDMMA with the VA 164 Connector, and is being designed to be compatible with the CIDMMA expansion. The CIDMMA expansion is located east of the proposed VA 164 Connector. The actual impacts to the CIDMMA may be more than shown in **Table 2-5** if the CIDMMA eastward expansion is partially or fully completed prior to implementation of

Alternative B. A Section 408 permit from the USACE would need to be obtained for the USACE maintained channel crossings and work within the CIDMMA. Additionally, a real estate agreement would need to be reached with the USACE to construct within the USACE property (USACE, 2012b). As with Alternative A, implementation of Alternative B would maintain access to the deepwater anchorages within Hampton Roads.

Alternative C would construct a new bridge-tunnel adjacent to the existing Monitor-Merrimac Memorial Bridge-Tunnel (MMMBT), which crosses the Newport News Channel. The Newport News Channel has a maintained depth of -55 feet MLLW and width of 800 feet. A new bridge-tunnel would be constructed across the mouth of the Elizabeth River as described in Alternative B. As was the case at the HRBT, existing horizontal and vertical clearances at the MMMBT would be matched by the expanded structure. Tunnels would be used at the two channel crossing locations to preserve the no air draft restriction characteristic of the navigational channels. The top of the tunnels would be a minimum of -65 feet MLLW to ensure adequate clearances for shipping, maintenance dredging, and eventual deepening of the Norfolk Harbor Reach to -55 feet MLLW. A new bridge along the north side of the CIDMMA would connect the expanded MMMBT with the new bridge-tunnel across the Elizabeth River. This new bridge would require vertical clearances sufficient to allow access to the CIDMMA for dredged material management. (The USACE has provided VDOT with official comments pertaining to the proposed bridge and there will be continued coordination as the study develops.) This alternative's alignment also traverses the east side of the existing CIDMMA with the VA 164 Connector, and is being designed to be compatible with the CIDMMA expansion. The CIDMMA expansion is located east of the proposed VA 164 Connector. The actual impacts to the CIDMMA may be more than shown in **Table 2-5** if the CIDMMA eastward expansion is partially or fully completed prior to implementation of Alternative C. As with Alternative B, a Section 408 permit and real estate agreement with the USACE would be required. Implementation of Alternative C would maintain access to the deepwater anchorages within Hampton Roads.

Alternative D would require all work potentially affecting federally maintained channels, as described in Alternatives A, B, and C. A Section 408 permit and real estate agreement with the USACE would be required. Implementation of Alternative D would maintain access to the deepwater anchorages within Hampton Roads.

Implementation of any of the build alternatives would require close coordination with the USACE and USCG to ensure that effects to navigation are minimized during construction. This would include notices to mariners during construction, appropriate lighting of barges and construction equipment, and mooring locations away from channels and deepwater anchorages. The depths of the tops of tunnels would ensure that navigation of the channels is not affected by any of the build alternatives.

2.1.3 Wetlands

Regulatory Context

Executive Order 11990, Protection of Wetlands, established a national policy and mandates that each federal agency take action to minimize the destruction, loss or degradation of wetlands and to preserve and enhance their natural value.

Wetlands are currently defined by the USACE (33CFR 328.3[b]) and the EPA (40 CFR 230.3[t]) as:

> *"Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas."*

As described previously in the Tidal Waterways and Non-tidal Streams section, Section 404 of the CWA regulates dredge and fill activities in WOUS, including wetlands, and Section 401 requires state certification prior to issuance of a Section 404 permit, and the Rivers and Harbors Act of 1899 regulates activities in navigable waters, including tidal wetlands. The issuance of a state VWP permit does not depend on the issuance of a federal Section 404 permit. VDEQ consequently regulates certain types of excavation in wetlands and fill in isolated wetlands (which may not be under Federal jurisdiction), adding to those activities already regulated through the Section 401 Certification process.

The VMRC, in conjunction with Virginia's local wetlands boards, where established, has jurisdiction over subaqueous bottoms or bottomlands, tidal wetlands, and beaches and coastal primary sand dunes through Chapters 12-14 of Title 28.2 of the Code of Virginia. Permits to impact subaqueous bottoms are administered by VMRC as described previously in the Tidal Waterways and Non-tidal Streams section. Permits to impact tidal wetlands, beaches, and coastal primary sand dunes under VMRC's jurisdiction are administered by localities that have adopted a wetlands or coastal primary sand dune zoning ordinance. All localities in the Study Area Corridors have adopted a wetlands zoning ordinance. Governmental activity in tidal wetlands, beaches and coastal primary sand dunes do not require a permit from the locality or VMRC if they are owned or leased by the Commonwealth or a political subdivision thereof (VA Code § 28.2-1302 & VA Code § 28.2-1403) , and the applicant (permittee) is a governmental subdivision or local government.

Methods

Wetlands within the Study Area Corridors were mapped using a photo interpretation and groundtruthing process detailed in Appendix B. The following is an abbreviated version of that process.

Wetlands within the Study Area Corridors were mapped according to the Federal Geographic Data Committee's (FGDC) Wetland Mapping Standard (FGDC, 2009). The FGDC Wetlands Mapping Standard is based upon the definition of a wetland as described within the Cowardin et al. system entitled *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin et al., 1979) as follows:

> *"WETLANDS are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. For purposes of this classification, wetlands must have one or more of the following three attributes: (1) at least periodically, the land supports predominantly hydrophytes; (2) the substrate is predominantly undrained hydric soil; and (3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of each year."*

The FGDC Wetlands Mapping Standard is neither designed, nor intended, to support legal, regulatory, or jurisdictional analyses of wetland mapping products, nor does it attempt to differentiate between regulatory and non−regulatory wetlands. The wetland mapping conducted for the HRCS was used to provide an accurate identification of wetlands based on photo interpretation and fieldwork. A verification of jurisdiction has not been requested of USACE and USACE has not made a determination of their limits of jurisdiction for HRCS.

Wetlands were identified through the use of high resolution aerial imagery and a digital terrain model, as well as ancillary data sources such as existing land use cover data, National Wetland Inventory (NWI) mapping, Soil Survey Geographic Database (SSURGO) mapped soils data, and National Hydrography Dataset (NHD). Stereoscopic paired images were viewed at highly efficient SOCET SET softcopy photogrammetry workstations to provide the ability to see height and texture, enhancing the vegetation signatures, and resulting in more accurate photo interpretation. The decision to classify an area as upland or wetland, and the assignment of a Cowardin Classification was made by an experienced wetland photo interpreter on a site specific basis within the Study Area Corridors. Historical imagery and other ancillary data were used to assist with wetland location efforts. A more detailed discussion of the FGDC photo interpretive method as it was performed for this project can be found along with the wetland mapping in **Appendix B**.

Field work was performed to groundtruth preliminary photo interpretation and mapping. The field work process allowed local wetland experts and photo interpretation experts to correlate signatures on the aerial photography with in-field conditions in order to verify cover-type classification and photo interpretation accuracy. This was performed at a sample set of pre-determined locations and reviewed by the study's Cooperating Agencies. Since the identification of wetland areas was performed through a desktop review with select site specific field visits, the limits of wetlands should be considered approximate. A field delineation according to the methodology outlined in the *Corps of Engineers Wetlands Delineation Manual* (USACE, 1987) and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region (Version 2.0)* (USACE, 2010) would need to be performed prior to applying for wetlands permits. A delineation of resources under VMRC's jurisdiction would also be performed, as determined and necessary, at this time.

The quantity of wetlands within the Study Area Corridors was determined by performing GIS overlays of the Study Area Corridors onto the wetlands mapped based on photo interpretation and fieldwork. Potential impacts were calculated by performing GIS overlays of the LOD, which is based on roadway engineering completed to date, onto the wetlands mapped based on photo interpretation and fieldwork.

Wetland Assessments

Wetland assessments were conducted on representative palustrine forested and estuarine wetlands within the Study Area Corridors, as well as one offsite reference site for each type. Assessments are performed to assign numerical values to wetland conditions or functions for use in regulatory programs. They are used for comparative purposes between wetlands potentially impacted as well as a comparison to a high functioning or quality reference wetland. Reference wetlands demonstrate a high level of sustainable functioning and can be used as a benchmark for wetland function or condition in the region where they're applicable.

The method utilized for the tidal wetlands was the Mid-Atlantic Tidal Wetland Rapid Assessment Method Version 3.0 (MidTRAM) (Rogerson et al., 2010). This method was developed as part of a collaborative effort among the Delaware Department of Natural Resources and Environmental Control, Maryland Department of Natural Resources, and the Virginia Institute of Marine Science to assess the condition of tidal wetlands in the Mid-Atlantic region. Metrics, indicators, and index-development were borrowed from the New England Rapid Assessment Method (NERAM) and the California Rapid Assessment Method (CRAM). This method was selected in order to assess the condition of tidal wetlands within the project limits, utilizing values of three attributes: Buffer/Landscape, Hydrology, and

Habitat and their specific attributes. Each assessment area (AA) was established within the Study Area Corridors prior to on-site field visits utilizing draft WOUS photointerpretation maps, as well as an offsite review of the areas using Google Earth and ArcGIS. Suitable access was a limiting factor in the offsite selection of the AA. Locations of the sampling were determined to represent tidal wetlands throughout the Study Area Corridors where access was available. Once on-site, the AA was adjusted in order to fit the project limits and to account for other limiting factors such as access. The center of the AA was determined, and 8 sub-plots were chosen based upon the guidelines of the method. The reference wetland assessment location was chosen to demonstrate a high quality tidal wetland within the same watershed as the Study Area Corridors. All analysis was limited to the Study Area Corridors, with the exception of the reference wetland.

The method utilized to assess forested palustrine wetlands was the Hydrogeomorphic (HGM) Guidebook for Wet Hardwood Flats in the Mid Atlantic Coastal Plain (Regional Guidebook) (Havens et al., 2012). This method was developed to evaluate four characteristics of hardwood mineral flats: habitat, plant community, water level regime, and carbon cycling processes. Each AA was established within the Study Area Corridors prior to on-site field visits utilizing draft WOUS photointerpretation maps, as well as an offsite review of the areas using Google Earth and ArcGIS. Locations of the sampling were determined to represent the different conditions of forested wetlands throughout the Study Area Corridors. These areas consisted of forested wetlands with varying levels of encroachment and fragmentation from current roadways and development. Palustrine wetlands that were designated as emergent or scrub shrub were not evaluated, as this method would not be applicable. In addition, palustrine wetlands designated as excavated were not evaluated and diminished function can be assumed. Once on-site, the AA boundaries and center were determined and three subplots were chosen at random in accordance with the method. An offsite reference wetland location that was utilized in the development of the Regional Guidebook was also chosen to represent a high quality forested wetland similar to those in the Study Area Corridors. Habitat characteristics were measured using the amount of woody debris, number of plant species that provide food, land cover, and tree density. These characteristics reflect the capacity of a wetland to maintain the characteristic attributes of plant and animal communities normally associated with these ecosystems. Plant community characteristics were measured using four variables consisting of Floristic Quality Assessment Index (FQAI), canopy composition, oak regeneration, and invasive plant species cover. These characteristics reflect the capacity of the AA to maintain the characteristic attributes of plant communities associated with these types of wetlands. Water level regime was measured by assessing the impacts of ditching and fills, along with the amount of natural land cover in the area. The percentage of drain was determined by using the ND-Drain program from the NRCS website, which runs the van Schilfgaarde Equation (USDA-NRCS, 2016). These characteristics reflect the capacity of the wetland to maintain variations in water level throughout the wetland ecosystem. Carbon cycling process was measured using the amount of woody debris, FQAI value, amount of herbaceous cover, and the water regime score. These characteristics represent the effects of alterations to wetland ecosystems ability to biogeochemically transform elements and compounds.

<u>Affected Environment</u>

The Study Area Corridors are located within the eastern portion of the Coastal Plain physiographic province of Virginia and include diverse tidal and freshwater wetlands. The diversity of wetlands in this region spans a range of freshwater to saline, lunar-tidal estuaries; tidal and palustrine swamps;

non-riverine, groundwater-saturated flats; seasonally flooded ponds and depressions; seepage slope wetlands; and various tidal and non-tidal aquatic habitats (Fleming and Patterson, 2013).

The locations of mapped wetlands are shown on the Photo Interpretation Maps in **Appendix B**.

Wetland types are classified by their source of hydrology, vegetation form, and modifiers. **Table 2-6** provides a description of the wetland types and total acreage identified within the Study Area Corridors.

Estuarine and palustrine wetlands were identified throughout the Study Area Corridors on the Photo Interpretation Maps (**Appendix B**). The acreage of wetlands within each alternative appears to be generally proportional with increments in size and length. A large portion of the wetlands within each alternative are composed of tidal open waters (E1UB): Alternative A (79 percent); Alternative B (69 percent); Alternative C (76 percent); Alternative D (75 percent). No further discussion of E1UB waters are discussed in this section since they are considered navigable waterways and are discussed in the Tidal Waterways and Non-tidal Streams section.

The remaining wetland areas within the alternatives are predominately palustrine systems. A high percentage of the palustrine wetlands were identified as excavated, indicating recent or historic disturbances and alterations, or the result of water backing up from manmade features that were identified through the photointerpretation (altered wetlands). For the purposes of this evaluation, palustrine unconsolidated bottom (PUB) systems were also considered manmade/influenced. PUB systems present within the Study Area Corridors would have either been excavated or the result of water backing up from a manmade feature.

Table 2-6: Wetland Types within Study Area Corridors

Cowardin Abbreviation	Cowardin Classification	Alternative A (acres)	Alternative B (acres)	Alternative C (acres)	Alternative D (acres)
E1UB	estuarine, unconsolidated bottom	287	531	926	1224
E1UBx	estuarine, unconsolidated bottom, excavated	8	8	6	8
E2EM	estuarine, intertidal, emergent	31	41	28	54
E2EMx	estuarine, intertidal, emergent, excavated	0.8	0.8	0	0.8
E2US	estuarine, intertidal, unconsolidated shore	1	2	0	2
PEM	palustrine, emergent	3	32	36	42
PEMF	palustrine, emergent, semi-permanently or permanently flooded	0	0	0.3	0.3
PEMFx	palustrine, emergent, semi-permanently or permanently flooded, excavated	2	2	2	4
PEMx	palustrine, emergent, excavated	16	33	20	45
PFO	palustrine, forested	7	85	130	164
PFOF	palustrine, forested, semi-permanently or permanently flooded	0	0	2	2

Cowardin Abbreviation	Cowardin Classification	Alternative A (acres)	Alternative B (acres)	Alternative C (acres)	Alternative D (acres)
PFOFx	palustrine, forested, semi-permanently or permanently flooded, excavated	0	0	7	7
PFOx	palustrine, forested, excavated	8	30	58	73
PSS	palustrine, scrub-shrub	0	0.3	0.3	0.3
PSSx	palustrine scrub-shrub, excavated	0.6	1	0.8	2
PUB	palustrine, unconsolidated bottom	0	1	0	3
PUBF	palustrine, unconsolidated bottom, semi-permanently flooded	0	0	0	0
PUBFx	palustrine, unconsolidated bottom, semi-permanently or permanently flooded	6	7	3	9
PUBx	palustrine, unconsolidated bottom, semi-permanently or permanently flooded, excavated	0.6	9	7	9
Total		**371**	**781**	**1,227**	**1,647**

Source and notes: Cowardin et al., 1979. 1. E1UB, estuarine, subtidal, unconsolidated bottom corresponds to subaqueous bottoms as well as navigable waters and is discussed in the Tidal Waterways and Non-tidal Streams section. 2. R3, riverine, perennial, and R4, riverine, intermittent, corresponds to streams and are discussed in the Tidal Waterways and Non-tidal Streams section.

Alternative A is composed of 12 percent palustrine wetlands within the Study Area Corridor. A significantly higher proportion of palustrine wetlands designated as altered (79 percent) are located within Alternative A, compared to other alternatives. The high percentage of altered wetlands within Alternative A is due to heavy development within the Study Area Corridor along I-64 in Hampton, as well as portions of I-64 along Willoughby Bay.

Alternative B is composed of 25 percent palustrine wetlands, of which 45 percent are designated as altered. The occurrence of altered wetlands within Alternative B is lower within portions of the Study Area Corridor in the vicinity of CIDMMA and the Coast Guard Property, as well as areas along VA 164 to the interchange with I-664. Wetlands within CIDMMA are routinely disturbed.

Alternative C is composed of 22 percent palustrine wetland systems and 34 percent of these wetlands are designated as altered. Conditions within Alternative C along I-664 within Hampton and Newport News are similar to Alternative A. The portion of Alternative C along I-664 south of the MMMBT contains larger tracts of unaltered wetland areas throughout this extent of the Study Area Corridor.

Alternative D is composed of 22 percent palustrine wetlands and 44 percent of these wetlands are designated as altered. Alterations within Alternative D are the same within the overlapping sections of the other Alternatives.

Over 99% of estuarine wetlands within the entirety of the Study Area Corridors are designated as unaltered. Unaltered wetlands are those that were not identified through the photointerpretation as being excavated, indicating recent or historic disturbances, or the result of water backing up from manmade features. These wetlands may have been altered in the past but have naturalized. The majority of the existing estuarine wetlands are bridged, with some areas of tidal flow conveyed through culverts. The main exception is the estuarine wetland system along the proposed new section of road south of CIDMMA identified as the VA 164 Connector. Development and armoring of shorelines has reduced the extent of intertidal wetland areas throughout the Study Area Corridors.

Areas under VMRC's jurisdiction (Chapters 12-14 of Title 28.2 of the Code of Virginia) may differ from those under the USACE's and DEQ's jurisdiction or those classified in **Table 2-6**. Non-vegetated wetlands under VMRC's jurisdiction are defined as unvegetated lands lying contiguous to mean low water and between mean low water and mean high water. Vegetated wetlands are defined as lands lying between and contiguous to mean low water and an elevation above mean low water equal to the factor one and one-half times the mean tide range at the site of the proposed project in the county, city, or town in question, and upon which is growing any one of a number of tidal plant species listed in VA Code § 28.2-1300. Beaches under VMRC's jurisdiction are defined as unconsolidated sandy material upon which there is a mutual interaction of the forces of erosion, sediment transport and deposition that extends from the low water line landward to where there is a marked change in either material composition or physiographic form such as a dune, bluff, or marsh, or where no such change can be identified, to the line of woody vegetation (usually the effective limit of storm waves), or the nearest impermeable man-made structure, such as a bulkhead, revetment, or paved road. Coastal primary sand dunes are defined as a mound of unconsolidated sandy soil which is contiguous to mean high water, whose landward and lateral limits are marked by a change in grade from ten percent or greater to less than ten percent, and upon which is growing any one of a number of species listed in VA Code § 28.2-1400.

Tidal wetlands, and beaches and coastal primary sand dunes under VMRC's jurisdiction may be present within the Study Area Corridors, however as previously stated, governmental activity in those tidal wetlands and coastal primary sand dunes are authorized if they are owned or leased by the Commonwealth or a political subdivision thereof (VA Code § 28.2-1302 & VA Code § 28.2-1403).

Wetland Assessments

Palustrine and tidal wetland functions/conditions are classified by attributes defined in the selected assessment methodologies. **Tables 2-7** and **2-8** provide the results of representative wetlands assessed within the Study Area Corridors, as well as offsite reference wetlands. Data forms, photographs, and maps are included in **Appendix D.**

The Hydrogeomorphic (HGM) Regional Guidebook was used to assess function of forested palustrine wetlands. **Table 2-7** provides the results of the assessment.

The assessment of four functions is utilized in this method: Maintain Characteristic Habitat, Maintain Characteristic Plant Community, Maintain Characteristic Water Level Regime, and Maintain Characteristic Ccarbon Cycling Processes. The values for functions range from 0.0 to 1.0 with 1.0 being the highest.

Table 2-7: Palustrine Wetland Assessment Results

Assessment Area	Alternative	Habitat	Plant Community	Water Regime	Carbon Cycling Processes
SB-Ref	*n/a*	*0.99*	*0.70*	*0.91*	*0.98*
H72	B, C, D	0.95	0.23	0.78	0.65
H74	B, C, D	0.97	0.67	0.82	0.93
H92	C, D	0.96	0.89	0.93	0.96
H103	C, D	0.93	0.50	0.91	0.92
H112	C, D	0.97	0.17	0.88	0.81
H112-1	C, D	0.99	0.38	0.91	0.98
H114	C, D	0.90	0.47	0.80	0.86

The results of the functional assessment for palustrine wetland systems demonstrated that many functions appeared to be relatively similar within the Study Area Corridors compared to the reference wetland, in spite of levels of encroachment and fragmentation from current roadways and development. Habitat values were above a value of 0.90 for all AAs and the reference wetland had a value of 0.99, suggesting that the current conditions within the Study Area Corridors have not diminished the habitat value of fragmented forested wetlands. Plant community values were the most varied and were notably lower in fragmented and disturbed areas, ranging from values of 0.17 to 0.89, with a value of 0.70 for the reference wetland. The presence of invasive species and lack of hardwood regeneration are common in lower scoring wetlands. Water regime values varied somewhat within the Study Area Corridors (0.78 to 0.93) compared to 0.91 for the reference wetland. The values indicate some degree of impairment due to the presence of ditches and fill, but fragmentation does not appear to significantly influence the values as hydrologic connections were present. Carbon cycling values were generally similar within the Study Area Corridors (0.81 to 0.98) compared to 0.98 for the reference wetland. These values indicate that biogeochemical processes within the wetlands in the Study Area Corridors still retain significant function in spite of fragmentation. The one exception was AA H72 on CIDMMA which had a carbon cycling value of 0.65, due to an immature canopy, lack of herbaceous cover and poor species richness.

The MidTRAM assessment was used to assess the condition of tidal wetlands. MidTRAM evaluates three parameters: buffer/landscape, hydrology, and habitat. Potential scores range from a low of 0.0 to a high of 100.0. **Table 2-8** provides the results of the assessment.

Table 2-8: Tidal Wetland Assessment Results

Assessment Area	Alternative	Buffer/Landscape	Hydrology	Habitat	Final Score
BC-REF	*n/a*	*20.0*	*83.3*	*53.3*	*52.2*
T5	A, B	33.3	91.7	46.6	57.2
T9	A, B	6.7	50.0	40.0	32.2
T26	A, B	13.3	50.0	20.0	27.8
T73	B, C, D	40.0	66.6	60.0	55.5
T107	C, D	20.0	66.7	26.7	37.8

The results of the tidal wetland assessment demonstrated moderate to low scores for MidTRAM condition. The range of the final scores for the assessed tidal wetlands within the Study Area Corridors was 27.8 to 57.2 while the reference wetland score was 52.2. Buffer/Landscape attribute scores were low for all AAs, ranging from 6.7 to 40 within the Study Area Corridors and 20 for the reference wetland. The prevalence of development within the Study Area Corridors surrounding the wetlands was the cause of the low scores. Hydrology attribute scores ranged from 50 to 91.7 within the Study Area Corridors and 83.3 for the reference wetland. The presence of point sources and tidal restrictions due to existing roadways contributed to mid-ranged scores. Habitat attribute scores ranged from 27.8 to 57.2 within the Study Area Corridors while the reference wetland score was 52.2. Heavily vegetated wetland areas with a high bearing capacity had the higher scores, but in some areas this was due to the presence of monocultures of common reed. Scores could also be lower due to conducting the assessment while vegetation is dormant.

Environmental Consequences

The **No-Build Alternative** would not involve any construction or changes to the natural environment. As a result, environmental effects to wetlands from the No-Build Alternative are not anticipated.

The four **build alternatives** would impact estuarine and palustrine wetland systems. The majority of impacts along I-64 and I-664 in Hampton and Newport News would occur in altered or fragmented palustrine wetland systems. The VA 164 Connector would result in impacts to larger unaltered and relatively un-fragmented estuarine wetland systems and to a mix of altered and unaltered fragmented palustrine wetlands systems. The majority of impacts along I-664 in Suffolk would occur in unaltered fragmented or larger tracts of palustrine wetland systems.

Potential wetland impacts within the LOD for the build alternatives are presented in **Tables 2-9, 2-10, and 2-11**. The estuarine unconsolidated bottom category has been excluded from these impact tables and is discussed within the Tidal Waterways and Non-tidal Streams Section. Impacts on **Table 2-9** are listed by Cowardin classification per alternative. Wetland impacts per alternative on **Table 2-10** are grouped into broader categories: tidal wetlands (estuarine); non-tidal vegetated wetlands (palustrine); and non-tidal open water. Further analysis of wetland impacts per alternative is summarized in **Table 2-11**, which compares the extent of wetland types that are altered (excavated or manmade) to those that are relatively unaltered per alignment.

Table 2-9: Potential Wetland Impacts by Cowardin Classification

Impact Type	Alternative A (acres)	Alternative B (acres)	Alternative C (acres)	Alternative D (acres)
E2EM	5	9	6	11
E2EMx	0.1	0.1	0	0.1
E2US	0.5	0.5	0	0.5
PEM	0	11	11	11
PEMF	0	0	0	0
PEMFx	0	0	0.2	0.2
PEMx	0.2	6	6	9
PFO	0.3	37	55	56
PFOF	0	0	0	0
PFOFx	0	0	7	7
PFOx	2	3	18	19

Impact Type	Alternative A (acres)	Alternative B (acres)	Alternative C (acres)	Alternative D (acres)
PSS	0	0.3	0.3	0.3
PSSx	0	0.2	0.2	0.2
PUB	0	0	0	0
PUBF	0	0	0	0
PUBFx	0	0.2	0.3	0.2
PUBx	0	6	6	6
Total	**8**	**73**	**110**	**121**

Source and notes: Photo Interpretation Maps in Appendix B.

Table 2-10: Potential Wetland Impact Totals

Impact Type	Alternative A (acres)	Alternative B (acres)	Alternative C (acres)	Alternative D (acres)
Tidal Wetlands	5	10	6	12
Non-tidal Vegetated Wetlands	3	57	98	103
Non-tidal Open Water	0	6	6	6
Total	**8**	**73**	**110**	**121**

Source and notes: Photo Interpretation Maps in Appendix B.

Table 2-11: Potential Impacts Comparison of Altered vs. Unaltered Wetlands

Impact Type	Alternative A (acres)	Alternative B (acres)	Alternative C (acres)	Alternative D (acres)
Tidal Wetlands	5	10	6	12
Non-tidal Vegetated Wetlands	0.3	48	66	67
Total Unaltered Wetlands	**5**	**58**	**72**	**79**
Excavated Tidal Wetlands	0.1	0.1	0	0.1
Excavated Non-tidal Vegetated Wetlands	2	9	31	35
Non-tidal Open Water	0	6	6	6
Total Altered Wetlands	**2**	**15**	**37**	**41**

Source and notes: Photo Interpretation Maps in Appendix B.

Alternative A would potentially impact a total of 5 acres of tidal wetlands and 3 acres of non-tidal vegetated wetlands. Approximately 67 percent of the potential palustrine wetland impacts in Alternative A were designated as altered wetlands, consistent with conditions described in Affected Environment. Impacts within the highly developed areas within Alternative A should not alter the condition or function of the palustrine wetland systems. Impacts to palustrine wetlands not designated as altered would also result in a minimal loss of function, as they are already fragmented within developed watersheds.

Approximately 2 percent of the potential estuarine wetland impacts in Alternative A are designated as altered and the majority of estuarine wetlands within the build alternative are currently spanned with bridges and overpasses. Any impacts or the expansion/addition to bridges and overpasses could reduce the condition of these wetland systems. In areas of bridges and overpasses,, tidal wetland areas have lower scores than those without, due to shading and disturbance from piers within the wetlands.

Therefore impacts from constructing piers and additional shading from expansion of bridges or overpasses could cause some reduction in wetland condition.

Alternative B would potentially impact a total of 10 acres of tidal wetlands and 57 acres of non-tidal vegetated wetlands. Approximately 16 percent of the potential palustrine wetland impacts in Alternative B were designated as altered. Effects of the alternative on palustrine wetlands are the same as described for Alternative A, where they overlap. Impacts to wetlands along the existing portion of VA 164 should not result in significant reduction in wetland function, as the majority of these wetlands are altered and/or already fragmented. The construction of the VA 164 Connector would impact several unaltered palustrine forested wetland systems totaling approximately 36 acres. One small wetland area within the Naval Supply Depot at CIDMMA would be impacted. While Alternative B would cause additional fragmentation here, reduction in function is not expected to be severe due to current signs of historic disturbance and a poor vegetative community. Larger areas of contiguous palustrine wetlands are located to the south within and adjacent to the U.S. Coast Guard military base. Alternative B would reduce the larger palustrine wetland system north of Coast Guard Boulevard to smaller fragmented areas to the east and west and would generally disconnect the wetland from the adjacent estuarine wetlands. This would likely result in a significant reduction in the overall function of the palustrine wetlands, especially for the value of plant communities and wildlife habitat. Alternative B would also impact a large palustrine wetland south of Coast Guard Boulevard. Impacts would result in a narrow, fragmented wetland to the west while a large contiguous palustrine forested wetland would still remain to the east. The fragmentation would likely cause a significant reduction in function of the western wetland, particularly for plant communities, while minimal to no reduction in function is expected to the east. These impacts that fragment habitat can also interrupt wildlife movements.

Approximately 1 percent of the potential estuarine wetland impacts within Alternative B are designated as altered. Effects of Alternative B on estuarine wetlands are the same as described for Alternative A, where they overlap. Alternative B would impact a relatively undisturbed estuarine wetland system between CIDMMA and the U.S. Coast Guard property within the proposed VA 164 Connector. The wetland system currently exhibits a greater than average overall condition and was approximately 40 percent higher in value than wetland systems with existing bridges and overpasses. Alternative B may result in a reduction of the condition of this estuarine system, causing it to be similar to those systems currently being bridged. Impacts to the estuarine wetland may result in wetland deterioration by reducing below-ground organic material and the ability of the soil to support the loads applied to the ground (bearing capacity), which could also cause above-ground changes to the plant community. In addition, impacts to adjacent palustrine wetland systems would create barriers to landward migration and reduce buffers, reducing the buffer/landscape values. An increase in point sources, fill and fragmentation and tidal restrictions could further reduce hydrological conditions. No additional vegetated estuarine wetlands systems are located within the proposed VA 164 Connector.

Alternative C would potentially impact a total of 6 acres of tidal wetlands and 98 acres of non-tidal vegetated wetlands. Approximately 32 percent of the potential palustrine wetland impacts in Alternative C were designated as altered wetlands. Effects on palustrine wetlands are the same as described for Alternatives A and B, where they overlap. Impacts to wetlands along I-664 in Hampton and Newport News should result in a relatively minimal reduction in wetland function, as the few wetlands that are present are altered and/or highly fragmented. The portion of Alternative C along I-664 in Suffolk would impact a larger proportion of unaltered wetlands compared to other sections of the alternative. No impacts to the edges of unaltered palustrine wetlands would occur between the

Pughsville Road and Route 58 interchanges in Chesapeake since proposed roadway widening is decreased in that area. Impacts to large intact palustrine forested wetland systems are limited to a narrow fringe along the existing right-of-way. This alteration would result in a minimal reduction in function within these larger wetland systems as the impacts are relatively small and the transition between the existing right-of-way and adjacent wetlands would not be altered.

None of the estuarine wetland impacts are designated as altered and the majority of estuarine wetlands within Alternative C are currently spanned with bridges and overpasses, with the exception of the system within the VA 164 Connector area described under Alternative B. Effects of Alternative C on estuarine wetlands are the same as described for Alternatives A and B, where they overlap. As discussed for Alternative A, tidal wetland areas with bridges and overpasses have lower scores than those without, due to shading and disturbance from piers within the wetlands. Therefore, impacts from constructing piers and additional shading from expansion of bridges or overpasses would cause reduction in wetland condition. Additional point sources and tidal restrictions would also reduce conditions.

Alternative D would potentially impact a total of 12 acres of tidal wetlands and 103 acres of non-tidal vegetated wetlands. Approximately 34 percent of the potential palustrine wetland impacts in Alternative D would occur to altered wetlands. Effects of Alternative D on palustrine wetlands are the same as described for the other build alternatives, where they overlap. While Alternative C would have more impacts than Alternative D along I-664 in Hampton and Newport News, there is no difference in the quality of wetlands that are being impacted or resulting change in function. Less than 1 percent of the potential estuarine wetland impacts within Alternative D are to altered wetlands. Effects of Alternative D on estuarine wetlands are the same as described for the other build alternatives, where they overlap.

Since the build alternatives generally involve expanding existing roads, there is little opportunity to align the road to avoid wetland impacts. The actual area of potential permanent impact to wetlands and other WOUS would be limited to the area of piers, pilings and foundations associated with bridges, and the placement of fill associated with approaches, roadway construction and expansion, scour protection measures, and culverts. All roadway, bridge, and culvert construction may also require cofferdams, causeways or temporary roads, diversion ditches, work bridges or barges, and construction staging areas, which can cause temporary impacts. Impacts could occur to vegetated wetlands due to shading effects from the bridges. Other impacts could result from sedimentation during construction, alterations in hydrology, and the spread of invasive species such as common reed (*Phragmites australis*). The Invasive Species section specifically addresses this potential impact and measures to be taken to avoid and minimize the spread of invasive species.

Minor alignment shifts will be evaluated to avoid and minimizing impacts to wetlands, including isolating remnants of wetlands. Consideration of additional bridging to reduce impacts to waters and wetlands will also be undertaken during design. During design, efforts would be made to use the smallest practicable roadway footprint to avoid and minimize the impact to wetlands by using the steepest practicable fill slopes and/or retaining walls. Bridges would be constructed for tidal wetland crossings and some non-tidal crossings, avoiding and minimizing the impact to these systems. Potential impacts from sedimentation during construction would be minimized through the implementation and maintenance of erosion and sediment control measures following the VESCH such as silt fence and straw bale barrier installation, temporary sediment traps and basins, level spreaders, soil stabilization blankets and matting, temporary and permanent seeding, along with protective fencing or flagging.. Impacts to hydrology would be minimized through the incorporation of culverts, where appropriate, to maintain hydrologic connections between wetlands.

As described in the Tidal Waterways and Non-tidal Streams section, individual permits from the USACE and VDEQ are expected to be required for all build alternatives. The USACE and VDEQ can only permit the LEDPA as stated in that previous section. Compensatory mitigation would be required for all unavoidable impacts to vegetated wetlands.

2.1.4 Water Quality

Regulatory Context

In compliance with Sections 303(d), 305(b), and 314 of the CWA and the Safe Drinking Water Act, VDEQ has developed a prioritized list of waterbodies that currently do not meet state water quality standards. VDEQ monitors streams and waterbodies for a variety of water quality parameters including temperature, dissolved oxygen, pH, fecal coliform, E. coli, enterococci, total phosphorus, chlorophyll a, benthic invertebrates, metals and toxics in the water column, sediments, and fish tissues.

Section 305(b) of the CWA requires each state to submit a biennial report to USEPA describing the water quality of its surface waters. The 305(b) report assesses six primary designated uses, as appropriate for a particular waterbody, based upon the state's Water Quality Standards. The primary uses include:

- Aquatic Life Use – supports the propagation, growth, and protection of a balanced indigenous population of aquatic life which may be expected to inhabit a waterbody.
- Recreation Use – supports swimming, boating, and other recreational activities
- Fish Consumption Use – supports game and marketable fish species that are safe for human health.
- Shellfishing Use – supports the propagation and marketability of shellfish (clams, oysters, and mussels).
- Public Water Supply Use – supports safe drinking water.
- Wildlife Use – supports the propagation, growth, and protection of associated wildlife.

Virginia's Water Quality Standards (9 VAC 25.260) define the water quality needed to support each of these uses by establishing numeric physical and chemical criteria. If a waterbody fails to meet the Water Quality Standards, it would not support one or more of its designated uses as described above. These waters are considered to be impaired and placed on the 303(d) list as required by the CWA.

Once a waterbody has been identified as impaired due to human activities and placed on the 303(d) list, VDEQ is required to develop a Total Maximum Daily Load (TMDL) for the parameters that do not meet state water quality standards. The TMDL is a reduction plan that defines the limit of a pollutant(s) that a waterbody can receive and still meet water quality standards. A TMDL implementation plan, including Waste Load Allocations (WLA), is developed by VDEQ once the TMDL is approved by USEPA. The ultimate goal of the TMDL Implementation Plan is to restore the impaired waterbody and maintain its water quality for its designated uses.

The Virginia Stormwater Management Program (VSMP) includes regulations (9 VAC 25-870) requiring water quality treatment, stream channel protection and flood control standards for all new construction and redevelopment projects. Each project must address compliance through the use of the Virginia Runoff Reduction Method (VRRM), a stormwater compliance framework focused not only on water quality treatment, but also on reducing the overall runoff volume to better replicate pre-development hydrologic conditions. New construction areas must be treated such that post-development phosphorus loads do not exceed an annual limit of 0.41 lbs/acre/year, which is the baseline threshold for water quality compliance with the Chesapeake Bay TMDL, and was developed to better assure that watersheds have healthy receiving water bodies. Redeveloped areas must be treated such that the post-development phosphorus load is between 10% and 20% below the pre-development existing conditions. In effect, the application of these standards results in the post-development load from prior developed lands being reduced from the current condition.

The VSMP and the Stormwater Nonpoint Nutrient Offset legislation ((Code§ 10.1-603.8:1) allow regulated land disturbance activities to utilize offsite options to achieve post-development water quality criteria. Nutrient credits are generated by Nutrient Banks under stringent state and federal criteria and certified by the State Water Control Board (SWCB), and regulated by the VDEQ. In instances where it is not feasible to provide on-site compliance, offsite options such as the nutrient offset program may be used to achieve compliance with water quality requirements. Other options for off-site compliance include A) participation in a local watershed comprehensive Stormwater management plan, B) participation in a locality pro rata share program, C) use of other VDOT properties within the same or upstream 12-digit HUC as the project, or D) other offsite options as approved by the VDEQ. Offsite options may only be used if on-site practices have been implemented to the maximum extent practical (MEP). Criteria governing project compliance and the use of off-site compliance are contained in the Nonpoint Nutrient Offset legislation.

The Virginia Construction General Permit (CGP) outlines specific measures that development projects must address, including the development of a Stormwater Pollution Prevention Plan (SWPPP). The SWPPPs outline how certain potential pollutant sources would be addressed including from nonpoint source pollution, construction activities, potential spills (e.g. petroleum, hydraulic fluids), etc. The SWPPP includes the Stormwater management plan, Erosion and Sediment Control plan, Pollution Prevention plan, specific measures that would be taken to address TMDLs, and other information.

Executive Order 13508 on the Chesapeake Bay, issued May 12, 2009, included goals for restoring clean water by reducing nitrogen, phosphorus, sediment, and other pollutants; recovering habitat by restoring a network of land and water habitats to support priority species and other public benefits; sustaining fish and wildlife; and conserving land and increasing public access. Executive Order 13508 establishes additional responsibilities for Federal agencies to ensure that their actions are not opposed to the goals of addressing water quality issues in the Chesapeake Bay watershed. Subsequent to issuance of EO 13508 the EPA promulgated the Chesapeake Bay TMDL requirements, which necessitates quantitative nutrient reductions by each contributing jurisdiction. The Commonwealth of Virginia developed a Watershed Implementation Plan (WIP) outlining how compliance with the Chesapeake Bay TMDL would be achieved. Included in the WIP were provisions for implementation of the above-referenced VSMP/VRRM criteria, which serve as the Commonwealth's main vehicle for ensuring that nutrient and sediment loads for new development and redevelopment satisfy the requirements of the Chesapeake Bay TMDL.

Sections 107 and 303 of VDOT's specifications require the use of stormwater management practices to address issues such as post-development storm flows and downstream channel capacity. These standards require that stormwater management be designed to reduce stormwater flows to preconstruction conditions for up to a 10-year storm event. As part of these regulations, the capture and treatment of the first half inch of run-off in a storm event is required, and all stormwater management facilities must be maintained in perpetuity.

Methods

A *Draft 2014 305(b)/303(d) Water Quality Assessment Integrated Report* was released by VDEQ on December 15, 2014. As of February 24, 2016, USEPA had not approved VDEQ's 2014 report. Therefore, water quality data and the list of impaired waterbodies is found in the *Final 2012 305(b)/303(d) Water Quality Assessment Integrated Report*, approved by USEPA on December 12, 2013 (VDEQ, 2013). The only change from 2012 to 2014 concerning the Study Area Corridors is the addition of *Enterococcus* as a source of impairment to Willoughby Bay – Beach Area for 2014; therefore, there is no substantial change in the impaired waterbody list. The 2012 report summarizes water quality conditions in Virginia from January 1, 2005 through December 31, 2010. Data from this report are available as GIS shapefiles (VDEQ, 2014). Impaired waterbodies crossing the Study Area Corridors were identified through a review of these data. The VDEQ TMDL database was reviewed to determine whether TMDLs have been prepared for the impaired waterbodies in the Study Area Corridors.

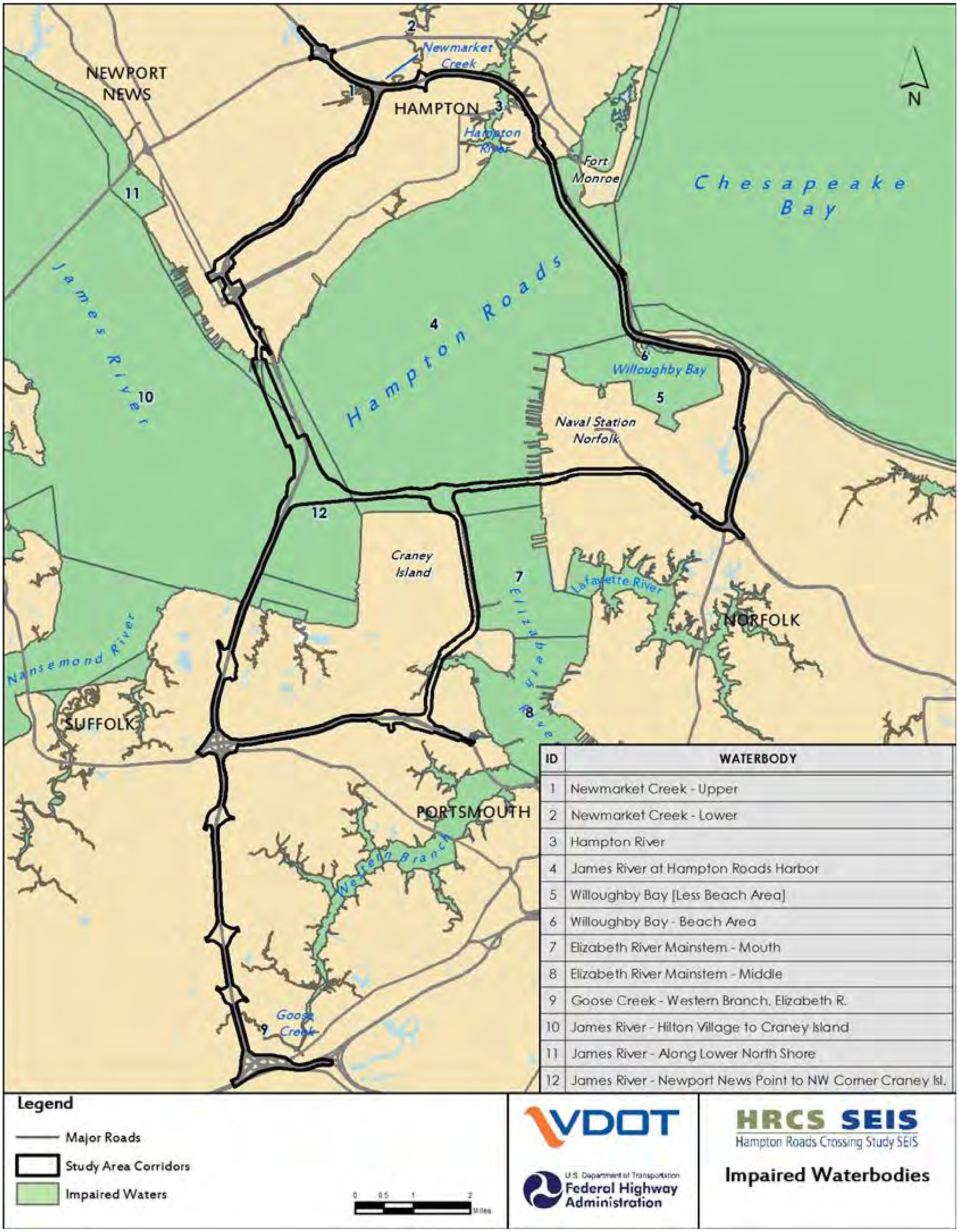
Water and sediment quality monitoring was conducted in support of the *2001 Hampton Roads Crossing Study Final Environmental Impact Statement (FEIS).* The dataset is over 15 years old, but does provide information on some constituents for which VDEQ does not regularly monitor. VDEQ water quality monitoring data between 2001 through 2016 were accessed through the USEPA's STORET website (USEPA, 2016a) to review results for metal and semivolatile organic compounds (SVOC) analyses. VDEQ sediment monitoring results for polychlorinated biphenyls (PCB) between 1995 and 2012 were reviewed with special emphasis on the results of PCB sediment monitoring. Sediment PCB values from the *Hampton Roads Crossing Study FEIS* and VDEQ monitoring were compared to the Effects Range – Low (ER-L) and Effects Range – Median (ER-M) thresholds for estuarine sediment established by the NOAA. The ER-L threshold is the concentration of a chemical in sediment, below which toxic effects are rarely observed among sensitive species. For PCBs, the ER-L is 22.7 parts per billion (ppb). The ER-M is the concentration of a chemical in sediment above which adverse biological effects are frequently or always observed or predicted among sensitive species. For PCBs, the ER-M is 180 ppb.

Affected Environment

Impaired waterways crossing the Study Area Corridors are shown on **Figure 2-5** and listed in **Table 2-12**. Many of these waterbodies do not support use for aquatic life and fish consumption due to dissolved oxygen levels, absence of submerged aquatic vegetation, levels of Chlorophyll-a, benthic invertebrate communities, and PCBs in fish tissue. Other waterbodies do not support recreational and shellfishing uses due to *Enterococcus* and fecal coliform exceedances.

TMDLs have been developed and approved for *Enterococcus* and fecal coliform for the Back River watershed, including Newmarket Creek. This TMDL was developed by VDEQ in 2006 and approved by the USEPA in August 2006. In 2010, VDEQ prepared a TMDL for *Enterococcus* for the Elizabeth River watershed. USEPA approved this TMDL in July 2010. In 2010, the USEPA established TMDLs for nitrogen, phosphorus, and sediment for the entire Chesapeake Bay watershed (Bay TMDL). Nitrogen, phosphorus, and sediment are pollutants that can cause impairments of dissolved oxygen, chlorophyll-a, aquatic macrophytes, and benthic invertebrates. VDEQ is currently developing a TMDL for PCBs in the tidal James River watershed.

Figure 2-5: Impaired Waterbodies



ID	WATERBODY
1	Newmarket Creek - Upper
2	Newmarket Creek - Lower
3	Hampton River
4	James River at Hampton Roads Harbor
5	Willoughby Bay [Less Beach Area]
6	Willoughby Bay - Beach Area
7	Elizabeth River Mainstem - Mouth
8	Elizabeth River Mainstem - Middle
9	Goose Creek - Western Branch, Elizabeth R.
10	James River - Hilton Village to Craney Island
11	James River - Along Lower North Shore
12	James River - Newport News Point to NW Corner Craney Isl.

Table 2-12: Impaired Waters

Waterbody	Alternative	Designated Use	Category	Impairment
Newmarket Creek - Upper	A, B, C, D	Aquatic Life	5D	Dissolved Oxygen Aquatic Plants (Macrophytes)
		Fish Consumption	5D	PCB in Fish Tissue
		Recreation	5D	*Enterococcus*
		Shellfishing	5D	Fecal Coliform
Newmarket Creek Lower	A, B, D	Aquatic Life	5D	Dissolved Oxygen Aquatic Plants (Macrophytes)
		Fish Consumption	5D	PCB in Fish Tissue
		Recreation	5D	*Enterococcus*
		Shellfishing	5D	Fecal Coliform
Hampton River	A,B, D	Aquatic Life	5D	Dissolved Oxygen
		Fish Consumption	5D	PCB in Fish Tissue
		Recreation	5A	*Enterococcus*
James River – Hampton Roads	A, B, C, D	Aquatic Life	5D	Chlorophyll-a, Nutrient/Eutrophication Biological Indicators
		Fish Consumption	5D	PCB in Fish Tissue
Willoughby Bay (Less Beach Area)	A, B, D	Fish Consumption	5D	PCB in Fish Tissue
Willoughby Bay (Beach Area)	A, B, D	Recreation	5D	PCB in Fish Tissue
Elizabeth River Mainstem – Mouth	B, C, D	Aquatic Life	5D	Estuarine Bioassessments (Benthics) Dissolved Oxygen
		Fish Consumption	5D	PCB in Fish Tissue
Elizabeth River Mainstem – Middle	B, C, D	Aquatic Life	5D	Estuarine Bioassessments (Benthics) Dissolved Oxygen
		Fish Consumption	5D	PCB in Fish Tissue
Goose Creek – Western Branch, Elizabeth River	C, D	Aquatic Life	5D	Dissolved Oxygen
		Fish Consumption	5D	PCB in Fish Tissue
James River – Hilton Village to Craney Island	C, D	Aquatic Life	5D	Chlorophyll-a Dissolved Oxygen
		Fish Consumption	5D	PCB in Fish Tissue

Waterbody	Alternative	Designated Use	Category	Impairment
James River – Along Lower North Shore	C, D	Aquatic Life	5D	Chlorophyll-a Dissolved Oxygen
		Fish Consumption	5D	PCB in Fish Tissue
James River – Newport News Point to NW Corner Craney Island	C, D	Aquatic Life	5D	Chlorophyll-a Dissolved Oxygen
		Fish Consumption	5D	PCB in Fish Tissue

Source and notes: DEQ VEGIS 2016. http://www.deq.virginia.gov/mapper_ext/default.aspx?service=public/2012_adb_anyuse .
Category 5A – a Water Quality Standard is not attained. The water is impaired or threatened for one or more designated uses by a pollutant(s) and requires a TMDL.
Category 5D – the Water Quality Standard is not attained where TMDLs for a pollutant(s) have been developed but one or more pollutants are still causing impairment requiring additional TMDL development.

Water quality data collected in support of the 2001 FEIS indicated exceedances of water quality standards for copper, lead, nickel, selenium, and silver at various water quality monitoring stations. Hampton Roads, Willoughby Bay, and the Elizabeth River, including its tidal tributaries, have a specific dissolved copper aquatic life criterion of 16.3 µg/l for protection from acute effects and 10.5 µg/l for protection from chronic effects (9 VAC 25-260-310). Within sediments, four metals including arsenic, silver, mercury, and zinc were found to exceed the ER-L thresholds. All metal concentrations were less than the ER-M thresholds. VDOT also analyzed sediments for SVOCs. SVOC concentrations above the ER-M thresholds were recorded at four sampling stations. None of the waterbodies crossing the Study Area Corridors have been listed as impaired due to heavy metals or SVOCs.

VDEQ water quality data reviewed from USEPA's STORET database contained analyses for several metals and SVOCs at several monitoring stations within the vicinity of the Study Area Corridors. The data showed no exceedances of water quality criteria for any of the metal or SVOC analyses, some of which did exceed criteria when analyzed in support of the 2001 FEIS. **Table 2-13** provides a list of the metal and SVOC analyses performed by VDEQ over this period.

Sediment monitoring of PCBs by VDEQ between 1995 and 2012 and sampling conducted for the 2001 FEIS documented no exceedances of the ER-M threshold within any of the waterbodies crossed by the alternatives. There were no exceedances of the PCB ER-L threshold within waterbodies crossed by the alternatives. Sampling of sediment at locations within the greater Elizabeth River watershed, including the Lafayette River, Western Branch, Eastern Branch, and Southern Branch, revealed PCB concentrations above the ER-L threshold with a maximum of 141.14 ppb (VDEQ, 2016).

Table 2-13: VDEQ Analyses

Metals	SVOCs
Aluminum	Acenaphthene
Cadmium	Acenaphthylene
Calcium	Benz[a]anthracene
Copper	Benzo[a]pyrene
Iron	Benzo(b)fluoranthene
Lead	Benzo[e]pyrene
Manganese	Benzo[g,h,i]perylene
Magnesium	Benzo[k]fluoranthene
Mercury	Chrysene
Nickel	Dibenz[a,h]anthracene
Potassium	Fluoranthene
Sodium	Fluorene
Vanadium	Indeno[1,2,3-cd]pyrene
Zinc	Methylnaphthalene
	Naphthalene
	Phenanthrene
	Pyrene

Source and notes: VDEQ 2001 – 2016 from USEPA STORET (USEPA, 2016a).

Environmental Consequences

The No-Build Alternative would not involve any construction or changes to the natural environment other than those from continued maintenance of the crossing structures. Stormwater control for the existing roadway network was performed in accordance with the stormwater regulations, required at the time of their design and construction. If none of the build alternatives were implemented, the existing stormwater treatment for the roads within the Study Area Corridors would remain the same. No improvement in water quality treatment would occur since no upgraded stormwater management facilities would be constructed.

All four build alternatives have the potential to increase levels of certain contaminants within the affected surface waters. Potential impacts to water quality include short-term impacts associated with construction and long-term impacts associated with the increase of impervious area within the Study Area Corridors.

Possible impacts to water quality associated with construction include erosion and sedimentation, dredging activities, construction of bridges and associated pile driving, and accidental material spills. Runoff from the construction site has the potential to erode disturbed soils, resulting in sedimentation within adjacent waterways. All four build alternatives require dredging for tunnel construction. Dredging would result in the temporary suspension of sediments and a release of nutrients and potential contaminants into the water column. The extent of turbidity associated with dredging is typically localized and the duration short. Additionally, dredging could potentially re-suspend sediments contaminated with PCBs, metals, and SVOCs. Based upon results from sediment sampling documented in the 2001 FEIS, by VDEQ between 1995 and 2012, and as reported in USEPA's STORET database, concentrations of PCBs in the sediment within the vicinity of the Study Area Corridors appear to be below the ER-L threshold, all metals appear to be below ER-M thresholds, and no metal or SVOC water quality criteria are exceeded. Therefore, dredging activities would not be expected to result in increases in PCB, metal, or SVOC levels within the waterbodies affected by any of the alternatives. Further discussion on the potential effects from dredging is provided in the Dredging and Disposal of Dredged Material Section.

If left untreated, long-term minor water quality impacts could occur as a result of increases in impervious surfaces and in traffic volumes. The additional impervious surfaces may increase the volume and speed of surface runoff entering nearby waters, causing erosion and sedimentation, depositing sediment and pollutants into nearby surface waters, and stressing or displacing stream inhabitants. Additionally, without proper stormwater controls, increased volumes of runoff can also amplify the frequency and severity of local flooding due to reduced area and time for infiltration or percolation into the soil / natural environment. Runoff from impervious surfaces can also increase the temperature of receiving streams, interfering with aquatic biological processes (CWP, 1998 and MDDNR, 2016)). Runoff from impervious surfaces includes pollutants washed from the road and bridge surfaces and associated pollutants from increased traffic and road maintenance, such as those associated with accidental fuel spills, crankcase oil drippings, vehicle wear and emissions, and chemicals used for road maintenance. Pollutants associated with such activities and runoff from roadways include heavy metals, salt and other de-icing agents, organic compounds, herbicides, and nutrients. Vehicle-related particulates in highway runoff come mostly from tire and pavement wear (≈30% each), from engine and brake wear (≈20%), and from settleable exhaust (≈8%) (Nixon and Saphores, 2003).

None of the build alternatives are expected to increase *Enterococcus* or fecal coliform, which impair the use of several waterbodies. Construction and post-construction discharges of stormwater, as well as dredging, would have the potential to contribute to minor, localized increases in the pollutants and nutrients causing impairment as measured by dissolved oxygen, benthic invertebrate communities, aquatic plants, and chlorophyll-a.

Stringent stormwater criteria would be applied consistent with the VRRM to mitigate increases in impervious cover and reduce runoff volumes, rate and pollutant loads to the baseline pre-development conditions. As noted above, the redevelopment criteria will further necessitate net reductions of stormwater pollutants from portions of the project disturbing prior developed lands. As required by regulations (9 VAC 25-870), stormwater management controls for all the alternatives would treat newly added impervious areas, in addition to portions of the existing land surfaces to achieve a 20% phosphorus load reduction over existing conditions. This would likely result in an improvement of water quality treatment over existing conditions for any alternative.

Dredging activities would be carefully planned and implemented to control sediment, nutrients and benthic impacts in accordance with permit-specific requirements, to assure that any impacts are localized, temporary, and/or fully mitigated. Examples may include filtration of discharge water from barges/scows, eliminating overflow from barges during dredging or transport, reducing the speed of loaded buckets or cutterheads, sheet-pile enclosures, and turbidity curtains, where applicable. The length of dredging operations may need to be considered as prolonged dredging would result in disturbance to the sediment over a longer period of time dependent upon the nature of the bottom substrate, tidal fluctuations, and estuarine dynamics. Specific dredging BMPs would be identified during the design process, as the phased implementation of any alternative may allow for new methods to be identified prior to construction. Through the implementation of these requirements, none of the alternatives would be expected to contribute to the further impairment of any impaired waterbodies.

Alternative A would have a total of 291 acres of disturbance associated with construction. Although site specific conditions, such as slope, soil type, and amount of disturbance within a drainage area, contribute greatly to the potential for water quality impacts during construction, greater areas of disturbance can lead to greater temporary impacts. The impaired waters that Alternative A crosses or drains to are the Hampton River, James River – Hampton Roads, Willoughby Bay (less beach area), and Willoughby Bay (beach area). The current impairments are noted in **Table 2-12**. PCBs in fish tissue should not increase, nor should *Enterococcus*. Localized changes to dissolved oxygen and eutrophic biologic indicators are unlikely given that construction would primarily take place over large open water areas. Alternative A would require dredging for one new tunnel at the HRBT and requires the least amount of dredging of all four alternatives (see **Table 2-16** for estimated dredge quantities for proposed tunnels on all alternatives). Therefore, this alternative would likely have the shortest duration of localized turbidity associated with dredging. This alternative also has the smallest increase in impervious area; however, this increase is located within land use with a high impervious surface percentage.

Alternative B would have a total of 708 acres of disturbance associated with construction. Alternative B crosses or drains to the same impaired waters as Alternative A with the addition of the Elizabeth River Mainstem – Mouth and Elizabeth River Mainstem Middle. The current impairments noted in **Table 2-12** add estuarine bioassessments (benthics). Further impacts to impaired waters would be negligible as for Alternative A with the potential for added effects to an existing benthic impairment. Like Alternative A, Alternative B would require dredging for a new tunnel at the HRBT but would also require dredging for one new tunnel across the Elizabeth River for the I-564 Connector (see **Table 2-16** for estimated dredge quantities for proposed tunnels on all alternatives). The increase in impervious area relative to Alternative A is largely located in land use with a high impervious surface percentage.

Alternative C would have a total of 1,568 acres of disturbance associated with construction. The impaired waters that Alternative C crosses or drains to are the James River – Hampton Roads, Elizabeth River Mainstem – Mouth, Elizabeth River Mainstem Middle, Goose Creek – Western Branch, Elizabeth River, James River – Hilton Village to Craney Island, James River – Along Lower North Shore, and James River – Newport News Point to NW Corner Craney Island. This is the second highest quantity of impaired waters potentially affected by an alternative. Potential impacts should be negligible as previously stated or localized where construction takes place near smaller drainages or streams. Alternative C would require the greatest amount of dredging because it includes two additional tunnels adjacent to the MMMBT, as well as two tunnels across the Elizabeth River to accommodate two transit-only lanes (see **Table 2-16** for estimated dredge quantities for proposed tunnels on all alternatives). This alternative would have the second largest increase in impervious area compared to the No-Build Alternative. Although the portion of Alternative C in Newport News would be through land use with a high impervious surface percentage, the construction through Suffolk and Chesapeake would be through land use with a lower percent impervious surface.

Alternative D would have a total of 1,748 acres of disturbance associated with construction. The impaired waters that Alternative D crosses or drains to are all those noted in the other alternatives and impacts would be as previously noted, though the cumulative impacts could be greater since it crosses the most impaired waters of all the alternatives. Alternative D would require less dredging than Alternative C because only one tunnel will be placed adjacent to the MMMBT and also across the Elizabeth River (see **Table 2-16** for estimated dredge quantities for proposed tunnels on all alternatives). This alternative has the greatest distance of proposed construction and the greatest number of crossings.

Implementation and maintenance of erosion and sediment control measures in accordance with the VESCH, and as required under the VDEQ Virginia Pollutant Discharge Elimination System, would minimize the potential for impact during construction. Such measures that could be implemented during construction include silt fence and straw bale barrier installation, storm drain and culvert inlet protection, temporary fill diversions and slope drains, temporary sediment traps and basins, subsurface drains, turbidity curtains, and dewatering structures.

Construction activities will be required to obtain coverage under VDEQ's Construction General Permit (VAR10) to authorize discharges of stormwater from construction activities. In order to obtain coverage, a Stormwater Pollution Prevention Plan (SWPPP) would need to be prepared for each segment of construction. In addition to including erosion and sediment control plans and details on inspection frequencies, the SWPPP and VDOT specifications will address material storage to reduce the potential for accidental chemical releases to the aquatic environment. In the case of accidental spills, the contractor is required to immediately notify all appropriate local, state, and federal agencies. The contractor must take immediate action to contain and remove the contaminant. Additionally, the requirements and special conditions of any required permits for work in and around surface waters would be incorporated into contract documents so that the contractor would be required to comply with such conditions.

Pre-construction sediment quality assessments and water quality monitoring during dredging may be conducted to address potential re-suspension of contaminants and nutrients into the water column. Further efforts to avoid and minimize water quality impacts would be made during the final design and include selection of dredging methods, dredged material dewatering options, and incorporation of turbidity curtains where appropriate. Additional avoidance and minimization measures are discussed in the Dredging and Disposal of Dredged Material Section.

Post-construction impacts to water quality would be minimized and avoided through implementation of stormwater management plans. Virginia stormwater management regulations require development, including roads, to address water quantity (9 VAC 25-870-66) and address water quality through requirements for the treatment of runoff from the developed site to maintain predevelopment runoff characteristics (9 VAC 25-870-63 and 9 VAC 25-870-73). Stormwater management measures, including bioretention, stormwater basins, infiltration practices, vegetated swales, filter strips, open space conservation, and others would be implemented to avoid and minimize water quality impacts. These BMPs would be designed using the VSMP requirements and VDEQ standards for VRRM practices, coupled with VDOT BMP Standards and Special Provisions. Measures discussed above, specifically erosion and sediment control measures and post-construction stormwater treatment, would minimize impacts from increases in impervious surfaces, mitigate increases in runoff volume, and satisfy requirements to reduce pollutant loads below existing baseline conditions, as required by the VSMP regulations and Chesapeake Bay TMDL. This would minimize any increases in contaminants which could cause impairment of the area waterbodies.

The SWM plans for all of the alternatives would include certain common elements. As required under the current VSMP stormwater management criteria and new BMP standards, stormwater management measures would not only treat newly developed lands but would also treat and reduce phosphorus loads from existing lands by 20%, including impervious surfaces not previously addressed under previous regulations. Newly developed lands would be treated by Stormwater management measures such that the post-development phosphorus load does not exceed 0.41 lbs/acre/year. Due to the limited options for SWM on the bridge structures and the limited land within the Right of Way along the surface roadways, these areas may be treated through offsite options, such as nutrient trading.

2.1.5 Floodplains

Regulatory Context

Several federal directives regulate construction in floodplains to ensure that consideration is given to avoidance and mitigation of adverse effects to floodplains. These federal directives include the National Flood Insurance Act of 1968, Executive Order 11988, and U.S. Department of Transportation (US DOT) Order 5650.2 entitled "Floodplain Management and Protection". The National Flood Insurance Act of 1968 established the National Flood Insurance Program (NFIP), which is administered by the Federal Emergency Management Agency (FEMA). In Virginia, the VDCR is responsible for coordination of all state floodplain programs. Development within floodplains is also regulated by local flood insurance programs administered by localities under the NFIP.

Executive Order 11988 requires federal agencies to avoid to the extent possible the long and short-term adverse impacts associated with construction and modification of floodplains. The order also requires agencies to avoid direct and indirect support of floodplain development wherever there is a practical alternative. US DOT Order 5650.2 guides the US DOT's implementation of Executive Order 11988 and requires the detailed consideration of impacts to floodplains, as well as avoidance and minimization.

In support of US DOT Order 5650.2, regulations promulgated at 23 CFR 650 state that it is the policy of the FHWA, among other things, to avoid significant encroachments of the floodplain, where practicable. A significant encroachment is defined as:

> A highway encroachment and any direct support of likely base floodplain development that would involve one or more of the following construction- or flood-related impacts:
>
> (1) A significant potential for interruption or termination of a transportation facility which is needed for emergency vehicles or provides a community's only evacuation route.
> (2) A significant risk, or
> (3) A significant adverse impact on natural and beneficial floodplain values.

The VDCR floodplain management program and VDOT construction specifications for roadways also address roadway construction within floodplains, as stated in the Regulatory Context portion of the Water Quality section.

Methods

FEMA is required to identify and map the nation's flood-prone areas through the development of Flood Insurance Rate Maps (FIRMs). Digital floodplain data were obtained from the FEMA Flood Map Service Center and plotted within the Study Area Corridors to determine the extent of floodplain areas (FEMA, 2016a). Floodplain areas were associated with the waterbody that controls hydrology affecting the floodplain elevation associated with the floodplain area.

The amount of 100-year floodplains within the Study Area Corridors was determined by performing GIS overlays of the Study Area Corridors onto the resource information referenced above. Potential impacts were calculated by performing GIS overlays of the LOD, which is based on roadway engineering completed to date, onto the resource information referenced above.

Affected Environment

According to the FIRMs, large portions of the area surrounding the Study Area Corridors consist of 100-year floodplain. The approximate locations of 100-year floodplain limits in the Study Area Corridors are provided in **Figure 2-6**. Within the Study Area Corridors, floodplains are associated with Hampton Roads, the James River, several tidal creeks, and various areas of low-lying ponding. **Table 2-14** shows the area of 100-year floodplain present within the Study Area Corridors. Floodplains within the Study Area Corridors derive their hydrology from coastal flooding events such as tropical storms and nor'easters. Regulatory floodways are defined as areas that must remain free of encroachment to prevent an increase in the 100-year floodplain elevation (44 CFR 59.1). No regulatory floodways are mapped within the Study Area Corridors.

Figure 2-6: FEMA 100-Year Floodplains

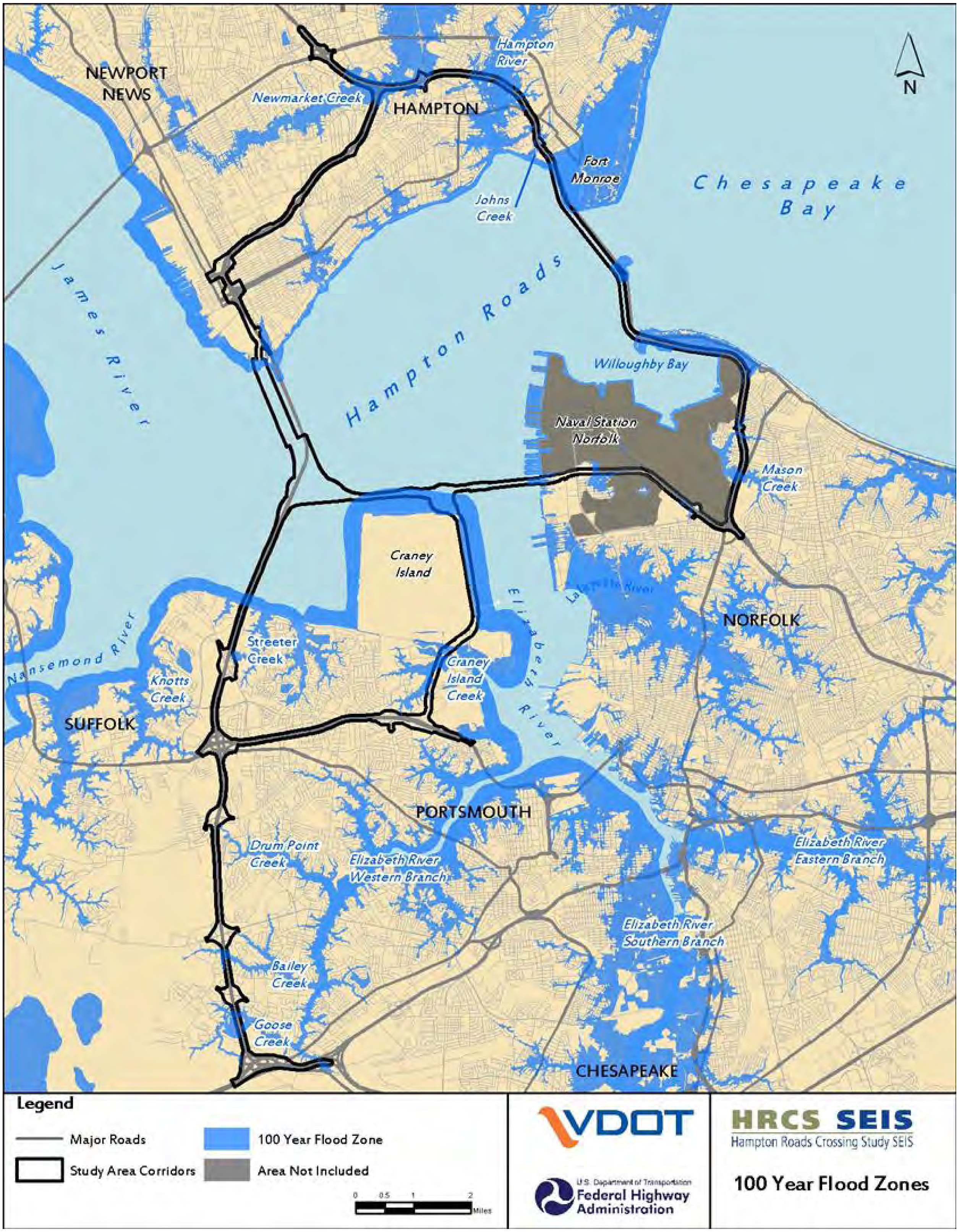


Table 2-14: FEMA 100-Year Floodplains within the Study Area Corridors

Waterbody	Alternative A (acres)	Alternative B (acres)	Alternative C (acres)	Alternative D (acres)
Craney Island Creek	0	48	48	48
Drum Point Creek	0	0	0.1	0.1
Elizabeth River	0	122	119	125
Elizabeth River Western Branch[3]	0	0	29	29
Hampton River[1]	99	99	0	99
James River/Hampton Roads[2]	121	245	205	369
Johns Creek	1	1	0	1
Knotts Creek	0	0.2	0.2	0.2
Mason Creek	22	22	0	22
Newmarket Creek	138	138	95	185
Ponding[4]	0	21	20	21
Streeter Creek	0	0	3	3
Willoughby Bay	81	81	0	85
Total	**463**	**777**	**520**	**989**

Source and notes: FEMA 2010 National Flood Hazard Layer (http://www.msc.fema.gov). 1. Also includes flooding associated with Brights Creek and Jones Creek. 2. Also includes flooding associated with the Small Boat Harbor in Newport News. 3. Also includes flooding associated with Drum Point Creek, Bailey Creek, and Goose Creek. 4. Areas of shallow flooding not associated with a particular waterbody.

Environmental Consequences

The **No-Build Alternative** would not involve any construction or changes to the natural environment. None of the roadways would be expanded and no new floodplain encroachments would occur. As a result, environmental effects to floodplains from the No-Build Alternative are not anticipated.

All of the **build alternatives** would involve encroachment within regulatory floodplains. The build alternatives would not pose a significant flooding risk. They would be designed consistent with procedures for the location and hydraulic design of highway encroachments on floodplains contained in 23 CFR 650 Subpart A. Therefore, the build alternatives are not expected to increase flood elevations, the probability of flooding, or the potential for property loss and hazard to life.

The build alternatives would not have significant adverse impacts on natural and beneficial floodplain values. Efforts such as spanning floodplains where practicable and minimizing wetland impacts would be considered during design to avoid or minimize impacts on natural and beneficial floodplain values.

The build alternatives are consistent with local land use plans and are not projected to either encourage or accelerate growth or changes in land use that are not already anticipated. Therefore, the build alternatives would not encourage, induce, allow, serve, support, or otherwise facilitate incompatible base floodplain development.

Individual impacts to any one floodplain would be relatively small in size and severity. The majority of floodplain encroachments from the build alternatives would be from the perpendicular crossing of floodplains, not from longitudinal encroachments. Perpendicular crossings would result in less floodplain fill, maximizing floodwater conveyance and storage compared to longitudinal encroachments. **Table 2-15** provides the potential 100-year floodplain encroachments within the LOD of each build alternative. The actual encroachment may be different based upon the total extent of fill required for construction and the use of bridges at the major waterways. Temporary causeways and bridges, moored barges, and/or permanent approach fills may be used to support bridge and tunnel construction.

Alternative A may require fill to be placed within the floodplain of the Hampton River to construct the third eastbound lane of I-64. Fill and a culvert extension may be placed within the floodplain of Hampton Roads to construct the expanded crossing of Johns Creek. Fill would also need to be placed within the floodplain of Hampton Roads in order to build the approaches to the expanded HRBT and the terminal islands for the tunnel. The bridge would cross a large portion of the floodplain, including the area at Willoughby Bay. Bridges would be used to cross the floodplain associated with Mason Creek.

Table 2-15: Potential Impacts to FEMA 100-Year Floodplains (acres)

Waterbody	Alternative A (acres)	Alternative B (acres)	Alternative C (acres)	Alternative D (acres)
Craney Island Creek	0	20	20	20
Drum Point Creek	0	0	0.1	0.1
Elizabeth River	0	69	71	69
Elizabeth River Western Branch[3]	0	0	3	3
Hampton River[1]	1	1	0	1
James River/Hampton Roads[2]	91	99	111	196
Johns Creek	0.1	0.1	0	0.1
Knotts Creek	0	0	0	0
Mason Creek	5	5	0	5
Newmarket Creek	0	0	0.4	0.4
Ponding[4]	0	3	7	3
Streeter Creek	0	0	0.01	0.01
Willoughby Bay	15	15	0	15
Total	**112**	**212**	**213**	**313**

Source and notes: FEMA 2010 National Flood Hazard Layer (http://www.msc.fema.gov). 1. Also includes flooding associated with Brights Creek and Jones Creek. 2. Also includes flooding associated with the Small Boat Harbor in Newport News. 3. Also includes flooding associated with Drum Point Creek, Bailey Creek, and Goose Creek. 4. Areas of shallow flooding not associated with a particular waterbody.

Alternative B, in addition to the impacts associated with Alternative A, would include impacts to floodplains associated with the I-564 Connector, VA 164 Connector, and VA 164. The I-564 connector would require fill to be placed within floodplain areas of ponding not associated with any particular waterbody, as well as for the approaches to the bridge-tunnel across the Elizabeth River. Portions of that bridge would also be constructed within the floodplain for Hampton roads. The VA 164 Connector would be constructed within the floodplain for the Elizabeth River; however, this area of floodplain may be modified by the CIDMMA eastward expansion project. The VA 164 Connector would also cross a portion of the Craney Island Creek floodplain with a bridge and may require fill within the floodplain at the approaches.

Alternative C would include impacts to the same floodplains as the I-564 Connector, VA 164 Connector, and VA 164 segments of Alternative B. The approaches to I-664 would require an expanded bridge as well as terminal islands within the James River/Hampton Roads floodplain. Interchange improvements to northbound I-664 from VA 135 may require minor fill within the Streeter Creek floodplain. Along I-664, existing bridges would be widened over the floodplain associated with the Western Branch Elizabeth River at Bailey Creek and Drum Point Creek. Bridges would also be constructed within the

Hampton Roads floodplain for the I-664 Connector. Alternative C would impact less total floodplain than Alternative B due to the relative absence of floodplains through the highly developed I-664 corridor in Hampton and Newport News.

Alternative D is a combination of the sections that comprise Alternatives B and C so it would impact the greatest amount of floodplains.

Roadway design would focus on avoiding and minimizing floodplain encroachment to ensure that the design is consistent with Executive Order 11998, FHWA policy as set forth in 23 CFR 650 Subpart A, and VDOT criteria. Sections 107 and 303 of VDOT's specifications would be met through final design. Detailed hydraulic survey and study would evaluate specific impacts on stormwater discharges and alternatives to any floodplain encroachments. Minimization or avoidance of impacts would be explored to potentially include alignment shifts to the narrowest floodplain crossing, steepening of fill slopes to reduce roadway footprint, lengthening bridges, and adjusting culvert sizes. Implementation of practices that store and infiltrate runoff onsite such as infiltration basins/trenches, and retention/detention ponds would reduce floodplain impacts by facilitating the percolation of runoff through the soil to groundwater, slowly releasing it to receiving waters, resulting in reduced stormwater runoff quantity. Vegetative BMPs such as grassy swales and filter strips would also reduce stormwater runoff quantity by facilitating percolation of runoff and maintaining natural site hydrology. All analyses would adhere to the aforementioned specifications ensuring that no substantial increases to flooding would occur. Based upon the final design, revisions to the FEMA FIRMs may be required to reflect changes in the location of the 100-year floodplain, including areas removed from the floodplain due to increased fill elevation.

2.1.6 Sediment Transportation, Bank Erosion, Shoaling and Hydrodynamic Modeling

Regulatory Context

As stated previously in the Tidal Waterways and Non-tidal Streams section, Section 404 of the CWA regulates dredge and fill activities in WOUS, including wetlands. Requirements set forth in the Section 404(b)(1) Guidelines must be met prior to the issuance of a Section 404 permit. Among the conditions that must be satisfied is that the activity cannot cause or contribute to significant degradation of WOUS. Effects contributing to significant degradation include those on fish, shellfish, life stages of aquatic life, ecosystem diversity, productivity, and stability. These determinations are based upon certain evaluations including potential changes in substrate elevation and bottom contours due to sedimentation from erosion or settlement of suspended sediment, current patterns, water circulation, water fluctuation, wind and wave action, and salinity.

VDEQ must certify that state water quality standards would not be violated by the proposed work (Section 401 of CWA) before the USACE issues a Section 404 permit. As stated previously in the Tidal Waterways and Non-tidal Streams section, VDEQ provides this state certification through its VWPP Program (9 VAC 25-210). Except in compliance with a VWP permit, no person shall dredge, fill, or alter the physical, chemical, or biological properties of surface waters and make them detrimental to the public health or to animal or aquatic life.

VMRC has jurisdiction over subaqueous bottoms or bottomlands through Subtitle III of Title 28.2 of the Code of Virginia as previously stated in the Tidal Waterways and Non-tidal Streams section. Under the authority of Chapter 12 of Title 28.2 of the Code of Virginia, when determining whether to grant or deny any permit for the use of state-owned bottomlands, VMRC shall consider the project's effect on other reasonable and permissible uses of state waters and state-owned bottomlands, marine and fisheries resources of the commonwealth, tidal wetlands, adjacent or nearby properties, water quality, and submerged aquatic vegetation (SAV). Effects of flow and circulation and how they may impact shellfish larvae settlement, sediment transport, dissolved oxygen, suspended solids, and salinity are other important issues that VMRC has stated they will consider. Permits to impact subaqueous bottoms are administered by VMRC as described previously in the Tidal Waterways and Non-tidal Streams section.

Methods

The Virginia Institute of Marine Science (VIMS) is evaluating the potential impact on flow, estuarine circulation, and sediment transport. Their study will improve upon the previous numerical modeling effort in the same area (Boon et al. 1999); the latter used VIMS' 3D Hydrodynamic-Sedimentation Model (HEM3D) to study the impact of the bridge-tunnel infrastructure on the physical characteristics (including tides, currents, circulation, salinity and sedimentation potential) under the existing and 3 alternative scenarios. In this update study, VIMS uses an unstructured-grid modeling system called Semi-implicit Cross-scale Hydroscience Integrated System Model (SCHISM) to enable higher resolution (and thus resolve the bridge pilings) and explicitly simulate the impact of bridge pilings on estuarine dynamics and on sediment transport around the structures.

VIMS applies the modeling system to the current Base Case (existing I-64 and I-664 bridge-tunnels and islands) and Alternatives A, B, C, and D. For the Base Case or present condition, the model is calibrated and validated against available observation data from NOAA (http://tidesandcurrents.noaa.gov/tide_predictions.html) and EPA's Chesapeake Bay Program (http://www.chesapeakebay.net/groups/group/21890). The model calibration includes calibration of the model against surface elevation, current, and monthly salinity. In order to ensure the calibrated model is capable of simulating estuarine dynamics under different hydrological conditions, the calibration period will be 2-3 years covering wet-and-dry periods. For each alternative, VIMS is revising the Base Case model grid to accurately represent the bridge pilings based on the foot-print provided. VIMS is calculating both tidal and residual variables for the Base Case and build alternatives (tidal elevation, 3D currents, flow rate, salinity, temperature, density stratification, and sedimentation potential for erosion and re-suspension) for at least 3 months. Results will be presented at selected virtual stations and at all grid nodes in the form of snapshots.

The differences between alternatives and Base Case is being calculated in the form of RMSD (Root Mean Square Difference), mean difference, and maximum difference. For tidal elevation, harmonic analysis is conducted and the differences in amplitudes and phases computed. Other more sophisticated methods (e.g., with phase lags taken into account) may also be used if warranted. The assessment is focusing on overall changes of dynamics, estuarine circulation and stratification, and change of tidal prism and fluxes.

The *Sediment Transportation, Bank Erosion, Shoaling and Hydrodynamic Modeling Report* will be completed after publication of the *Draft SEIS*. The report will contain the analysis for the four alternatives analyzed as part of the Draft SEIS and will be provided with the *Final SEIS*.

Affected Environment

The study area for which the modeling system is being applied includes the entire Hampton Roads and encompasses all of the Study Area Corridors. The model has been calibrated with the available observation data for the Base Case or present condition which includes the HRBT, MMMBT, and their associated islands and bridges. The yearly averaged bottom and surface salinity for the Base Case has been completed. The bottom salinity shows a much sharper gradient between the navigational channels shown on **Figure 2-4** and the adjacent non-maintained areas (shoals) than the surface salinity. The channels, in particular the Norfolk Harbor Entrance Reach, serve as the main conduit for ocean water to intrude into the James River and Elizabeth River. The surface salinity over the navigational channels is slightly lower than that over the adjacent shoals, enhancing the 2-layer gravitational circulation there. The average bottom-surface salinity difference is 2-5PSU over the channel. Salinity stratification is the strongest in the channel, and the range of salinity in the project area is 20-30 PSU.

Environmental Consequences

The **No-Build Alternative** would not involve any construction or changes to the natural environment. As a result, no changes in flow, estuarine circulation, or sedimentation would occur.

All of **the build alternatives** have the potential to affect flow, estuarine circulation, and sedimentation. Changes to bottom contours, current patterns, water circulation, tides, and salinity could affect various ecosystems and their functions. The potential impacts of such changes include: altered vegetation communities due to changes in salinity or tide ranges; altered behavior patterns for aquatic wildlife due to changes in tide elevations and duration; altered species distribution patterns, foraging, and spawning habitat due to changes in salinity and currents; and altered substrate composition due to sedimentation.

VIMS will continue to assess the proposed river crossings associated with the HRCS improvements. At the time of the publication of this *Natural Resources Technical Report*, the following interim findings have been made:

- Alternative A - Preliminary results suggest a small increase of averaged surface and bottom salinity on the order of ~0.3 practical salinity units (PSU) in the vicinity of the added pilings, due to the decreased flushing there. The salt intrusion along the main channels of James and Elizabeth Rivers is not significantly affected.
- Alternative B - The changes associated with Alternative A in the James River remain, and in addition there is a modest increase in surface salinity near CIDMMA, likely due to increased turbulence mixing there from the tides, waves, and wind. The intrusion along the main channels of the James and Elizabeth Rivers is not significantly affected.
- Alternative C - The impact on bathymetry is larger and more wide-spread especially in the shallows. As a result, the increase in the turbulence mixing from the tides, waves, and wind, and retention time seems to have led to a larger increase in the surface salinity (up to 1 PSU) near the Study Area Corridors. On the other hand, the increase in the bottom salinity is less as the bottom salt intrusion is more channelized.
- Alternative D - This scenario combines all of the alterations in the other 3 alternatives, and therefore the changes in the surface and bottom salinity also resemble the combination of those from the other three alternatives, i.e., there are increases in the salinity near the added I-64, I-664, and Elizabeth River pilings, with the bottom salinity being less affected.

Any effects from the build alternatives to the tides, currents, circulation, salinity, and sedimentation could potentially be minimized with certain design alterations, particularly to the pilings for the bridges. Factors for consideration include the shape, quantity, and the location of the pilings. Pilings with a more streamlined shape or that are placed in shallower water, or out of the high volume flow path, to impede less flow would have smaller impacts to the tides, currents, circulation, salinity, and sedimentation. Likewise, reducing the number of pilings and increasing span length by designing more load carrying capacity for the bridges above the water (such as a suspension bridge) would reduce impacts (VIMS, 2016b). Since the study is ongoing and the results not complete, avoidance, minimization, and mitigation would be further evaluated during the design and permitting phase. Any potential effects to the tides, currents, circulation, salinity, and sedimentation documented in the report would be considered during the design and construction phases to reduce potential effects to them.

2.1.7 Dredging and Disposal of Dredged Material

Regulatory Context

As described previously in the Tidal Waterways and Non-tidal Streams section, Section 404 of the CWA regulates dredge and fill activities in WOUS, including wetlands, and Section 401 requires state certification prior to issuance of a Section 404 permit. Work within navigable waterbodies is federally regulated under Section 10 of the Rivers and Harbors Act of 1899, as amended, and permits to impact subaqueous bottoms are administered by VMRC. VMRC, in conjunction with Virginia's local wetlands boards, where established, also has jurisdiction over subaqueous bottoms or bottomlands, tidal wetlands, and beaches and coastal primary sand dunes as described previously in the Wetlands section, and would need to approve of any dredge disposal in those locations.

Ocean placement of dredged material is regulated under Section 103 of the Marine Protection Research and Sanctuaries Act (MPRSA) (Public Law 92-532). 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 be evaluated through the use of criteria published by the USEPA in order to comply with applicable ocean dumping regulations (40 CFR 220-229) and USACE's regulations for the discharge of dredged materials into WOUS or ocean waters (CFR 320-330 and 335-338) prior to being issued an ocean placement permit. The evaluation of dredged material for ocean disposal is conducted in accordance with the Ocean Testing Manual to determine its environmental acceptability (USEPA, 1991).

Methods

The tunnel design is in a preliminary phase. The construction material under consideration is concrete. Typical tunnel sections were created for each tunnel and each alternative based on the required number of lanes depicted in the roadway alignment file. The same tunnel design assumptions were applied to all Build Alternatives. If a tunnel is part of the Preferred Alternative, it will be designed to meet the latest tunnel standards, which may affect final dredging quantities. Guidelines and information contained in the FHWA manual, *Technical Manual for Design and Construction of Road Tunnels – Civil Elements* were used in this preliminary design and estimate (FHWA, 2009).

Dredging sections were created showing the shape and size of the dredged trench. Existing channel profiles from Google Earth, as-built tunnel plans, and preliminary drawings were used to determine the preliminary dredging quantities. The quantities are based on "cut and cover" estimates and not directional boring to provide a worst case impact scenario. A final decision on which method to use will be made during the detailed tunnel design phase.

Affected Environment

The Norfolk Harbor Entrance Reach in the vicinity of the HRBT (Alternatives A, B, D) (see **Figure 2-4**), as well as the Norfolk Harbor Reach at the mouth of the Elizabeth River (Alternatives B, C & D), are maintained at 50 feet MLLW, although the channels are authorized to be deepened to -55 feet MLLW. A

July 2010 survey of the Norfolk Harbor Entrance Reach and a May 2015 survey of the Norfolk Harbor Reach conducted by the USACE showed depths to be between -50 and -60 feet MLLW within the Study Area Corridors (USACE, 2010a and USACE, 2015b). The Newport News Channel in the vicinity of the MMMBT (Alternatives C & D) is maintained at -55 feet MLLW. A November 2015 survey conducted by the USACE showed depths to be between 53 and 60 feet within the Study Area Corridor (USACE, 2015a).

Coarser sandy bottom sediments are located in the channel and northern flank in Hampton Flats and finer muddy bottom sediments in the southern flank near CIDMMA (Nichols et al., 1991). The surficial sediments contain benthic organisms that form an important part of the food web. Benthic organisms in the vicinity of the Study Area Corridors include commercially important shellfish, such as blue crab, hard clam, and oysters. Additional discussion of the bottom types comprising the subaqueous bed within the Study Area Corridors and surrounding area is presented in Affected Environment portion of the Benthic Species section and shown in **Figure 2-10**. Other natural resources potentially affected by dredging include submerged aquatic vegetation, anadromous fish, and essential fish habitat. These are discussed in detail in their respective sections in this report.

Dredged material disposal alternatives include beneficial use (such as structural fill for tunnel island expansions, wetlands restoration, beach nourishment, shoreline construction, and habitat creation), upland Confined Disposal Facilities (CDFs), and ocean disposal. Existing upland CDFs serving as potential options include CIDMMA on Craney Island, the Weanack Land, LLP facility, in Charles City County, Virginia, and the Whitehurst Borrow Pit on Oceana Boulevard in the City of Virginia Beach. Ocean disposal sites serving as potential options include the Norfolk Ocean Dredged Material Disposal Site (NODMDS) and the Wolf Trap Alternate Placement Site (WTAPS). These options are discussed in more detail in Disposal Alternatives but represent only those known to exist at the present time. The options may vary over the course of the preferred alternative’s implementation. New sites may be identified and more information on the quality/composition of the dredge material will be obtained which could eliminate or add disposal options. Likewise, the capacity of the options would vary also, as the current options presumably get used up or expand.

Environmental Consequences

The **No-Build Alternative** would not involve any construction or changes to the natural environment. As a result, environmental effects from dredging from the No-Build Alternative are not anticipated.

All of **the build alternatives** would involve dredging activities associated with tunnel construction. The potential impacts of dredging to the environment include: the generation of suspended solids/turbidity and the resultant degradation of surface water quality and sediment quality; a decreased photic zone due to increased turbidity, elimination of benthic populations within the dredging zone; deposition of dredge-induced suspended sediment on benthic populations downstream of the dredging zone; fish and sea turtle mortality by dredge equipment; disruption of normal foraging or spawning behaviors; and gill injury from exposure to local increases in turbidity. During the dredging period, the dredging activities would result in re-suspension of sediments and an increase in turbidity with the potential for a decrease in photic zone, re-suspension of contaminants, and/or release of nutrients that increase fertilization of the waters and increase biological oxygen demand and subsequent reduction of dissolved oxygen.

In the case of any pre-existing contaminated sediments, the re-suspension of adsorbed contaminants on the particulates and release (desorbed) of contaminants to the water column will be a function of the total area of disturbed sediment and the characteristics of the sediment (sediment quality) in the areas of disturbance. In addition, the contaminants released and the amounts released are affected by physical characteristics of the sediments such as particle size distribution, total organic carbon, and mineral composition.

Environmental effects of dredge disposal would vary according to the means of disposal. Many of the effects outlined above are applicable to ocean dumping. Potential environmental effects associated with disposal in an upland Confined Disposal Facility (CDF) include loss of upland habitats, stormwater runoff, geochemical transformations caused by oxidized sediments, and exposing wading birds and wildlife to potential contaminants, and odors. The entity with jurisdiction over the CDF would be responsible for ensuring that these effects either don't occur or are mitigated appropriately.

The estimated dredge quantities associated with each alternative is provided in **Table 2-16**. The dredge quantity associated with the I-64 tunnel is the least because it would be a three lane tunnel, while all other tunnels would have four or more lanes of traffic as described previously in the Project Description section. Alternative C would require the most dredging because it includes two additional tunnels adjacent to the MMMBT, as well as two tunnels across the Elizabeth River, compared to one additional tunnel for Alternatives B and D, to accommodate two transit-only lanes.

Alternative A would include construction of a parallel tunnel constructed west of the existing I-64 tunnel, approximately 7,400 feet long. **Alternative B** would include the dredging associated with Alternative A plus one new tunnel under the Elizabeth River for the I-564 Connector. The I-564 connector tunnel is estimated to be approximately 5,100 feet long. Due to the addition of one transit lane in each direction for **Alternative C**, dredging for the I-564 Connector would be for two new tunnels under the Elizabeth River, plus two new tunnels west of the existing I-664 MMMBT, making the estimated dredge quantity for this alternative the highest. The MMMBT tunnels are estimated to be approximately 5,100 feet long. **Alternative D** would include the dredging for the same tunnels as Alternative B plus one new tunnel west of the existing I-664 MMMBT.

As **Table 2-16** shows, the volume of dredge material anticipated for each Alternative varies. The magnitude of the environmental consequences from dredging and disposal would be correlated with the duration, volume, and area dredged, as well as the distance to and location of disposal. This would depend on which build alternative is selected and which tunnel design and disposal alternative is selected. However, there are several mitigating factors associated with a large regional project of this nature that act to reduce overall impacts. First, construction would occur in a relatively small percentage of a large estuarine waterbody. Second, dredging associated with the Preferred Alternative could occur in stages over the course of many years as OISs comprising the Preferred Alternative may be approved in phases resulting in design and construction being spaced over a number of years. This could minimize short term high volume impacts. This would also affect the volume of dredge produced at any given point in time, and thus the amount that needs to be disposed of at any given point in time.

Table 2-16: Estimated Dredge Quantities

Structure	Alternative A (cubic yards)	Alternative B (cubic yards)	Alternative C (cubic yards)	Alternative D (cubic yards)
I-64 Tunnel	1,200,000	1,200,000	0	1,200,000
I-564 Connector	0	2,900,000	4,100,000	2,900,000
I-664	0	0	3,000,000	2,000,000
Total	**1,200,000**	**4,100,000**	**7,100,000**	**6,100,000**

Source and notes: November 21, 2015 RK&K memorandum titled Hampton Roads Crossing Study – Dredging Quantities.

The most notable impact of dredging activities on water quality is the increase in turbidity (Brannon et al., 1989). The intensity and duration of turbidity from dredging and disposal operations is highly dependent on the type of dredge equipment, operator, character of sediment, the duration of water-sediment interaction, and local hydrodynamic conditions (Germano et al., 2005). Turbidity from dredging operations would be expected to exceed background levels in close proximity to the dredge location, however, Nichols et al (1990) found that the levels are of short duration in the Rappahannock Shoals Channel. Background levels were achieved in seven to ten minutes near the bottom after the hopper dredge passed, and about 90 minutes for the upper plume generated by the overflow discharge. Model predictions for dredging the Norfolk Harbor Reach of the Elizabeth River estimated sediment plume duration to be 8-22 hours under the most conservative scenario (Sisson et al., 2007). Model predictions for dredging the CIDMMA eastward expansion project with a cutterhead dredge showed the total suspended solids fall to essentially zero as soon as the dredging stops (CHT, 2008).

Numerical models are used to predict transport and fate of sediments suspended by dredging operations. Wide variations in dredging equipment and sediment characteristics and limited knowledge of the rates of suspension and characteristics of suspended material lead to large uncertainties in model estimates of sediment transport and fate, which are affected by surface and near bottom currents (Priest, 1981 and Smith et al., 2007). For continuous dredging in a tidal estuary, a new plume is formed with each change in current direction, while the old plume is dispersed rapidly under the combined effects of diffusion and settling. The turbidity plume will have its maximum extent near slack tide when the current has been going in the same direction for the maximum possible time period (Kuo et al., 1981). Over a 12 hour period of nearly one tidal cycle, Nichols et al. (1990) observed in the Rappahannock Shoals Channel that turbidity resulting from dredging is confined to a 1.5-2.0 square mile area around the hopper dredge overflow discharge, but as previously stated, quickly returned to background levels within about 90 minutes of cessation of dredging. Boon and Thomas (1975) reported increased turbidity in the surface plume of a hydraulic dredge for only 1,000 feet during construction of the second HRBT, and bottom deposition resulting from the dredging activity within only a 600 foot radius of the dredge. In a study of dredging effects in the shipping channel along the Craney Island Reach of the Elizabeth River, Priest (1981) concluded that tidal and wind generated currents will usually provide sufficient mixing and dilution to return the water to near background levels within 500 - 1,000 feet, and that the plume from the hydraulic cutterhead dredge was confined to the lower half of the water column within the shipping channel. Model predictions for dredging the Norfolk Harbor Reach of the Elizabeth River estimated the sediment plume from a hydraulic cutterhead dredge to extend up to 2,600 feet downstream and up to 9,800 feet upstream. These results were based on the most conservative estimate of the sediment source extending eight feet above the bottom. If the cutterhead is operated at or beneath the water-sediment interface, the extent would be 3-4 times less. Maximum sediment concentrations would be confined to the bottom eight feet (Sisson et al., 2007). Model predictions for dredging the CIDMMA eastward expansion project showed the total suspended solids in all potential scenarios reduced to negligible levels within about 330 feet of any dredging/filling/disposal operations, and sediment deposition reduced to 1-2 mm within about the same distance (CHT, 2008).

Through the permitting process, a dredging plan including dredging methods would be prepared and submitted for agency review and approval. Multiple dredging methods may be appropriate, including the use of the two main methods, hydraulic and mechanical. In order to minimize impacts to water quality as a result of turbidity and sedimentation, dredging best management practices may be considered during the development of a dredging plan. Pre-construction sediment quality assessments and water quality monitoring during dredging may be conducted to address potential re-suspension of contaminants and nutrients into the water column.

In order to reduce water quality impacts as a result of hydraulic dredging, reducing the speed of the cutterhead reduces the potential for side-casting sediments. Reducing the swing speed of a hydraulic dredge ensures that the cutterhead does not move through the cut faster than sediment can be removed. Both of these actions can reduce the volume of re-suspended sediment. Advantages of hydraulic dredging that could further reduce water quality impacts include higher production rates for less time dredging, the ability to pump material directly by pipeline to a CDF, geotubes, or mechanical dewatering and treatment facilities, and is capable of switching dredgeheads for different sediment types and generated residuals.

In order to reduce water quality impacts as a result of mechanical dredging, reducing the ascent rate of the loaded bucket reduces the likelihood of washing sediment from the bucket. While a clamshell bucket is enclosed, reducing the descent rate reduces the re-suspended sediment caused by the bucket striking the bottom. Eliminating multiple bites can reduce the volume of re-suspended sediment and less of the water column is affected by sediment suspension. Advantages of mechanical dredging that could further reduce water quality impacts include the ability to use several different types and sizes of buckets, it is more efficient at removing any hard-packed materials, and it can remove sediments at nearly in-situ density, with minimal requirements for managing excess water.

Regardless of the method of dredging, a number of operational best management practices can be employed to reduce impact to water quality. For example, eliminating overflow from barges during dredging or transport; changing the method or speed of operating the dredge based on changing site conditions such as tides, waves, currents, and wind; and, using properly sized tugs and support equipment. Similarly, there are engineered control measures that can be employed to reduce resuspension of sediments. Site conditions could prohibit use of some of these approaches (e.g., current). Other examples include: cofferdams, removable dams (e.g., geotubes), sheet-pile enclosures, turbidity curtains, and pneumatic (bubble) curtains where applicable (ERDC, 2008).

The time of year and length of dredging operations may need to be considered as prolonged dredging would result in disturbance to the natural resources and adjacent water column over a longer period of time dependent upon the nature of the bottom substrate, tidal fluctuations, and estuarine dynamics. However, this affect may be minimized by the constant mixing of water through wind and tidal action. Potential time-of-year restrictions are discussed in the Anadromous Fish section and the Threatened and Endangered Species section of this report. Monitoring of near-field and far field turbidity during construction would help identify activities that require additional minimization measures or possibly cessation of certain activities.

Disposal Alternatives

Disposal alternatives include beneficial use, upland CDFs, and ocean disposal. Generally, most dredged material represents a valuable resource and should be considered for beneficial uses. Beneficial use is the placement or use of dredged material for some productive purpose from which economic, social or other benefits may be derived. Compared to disposal of dredged material in CDFs, beneficial use reduces the need for disposal. Examples of beneficial use include wetlands restoration, beach nourishment, shoreline construction, and habitat creation (USEPA, 2016).

For any sandy dredge material, Section 10.1-704 of the Code of Virginia provides that the beaches of the Commonwealth shall be given priority consideration as sites for the disposal of that portion of dredged material determined to be suitable for beach nourishment. This is further supported by VMRC's "Criteria for the Placement of Sandy Dredged Material along Beaches in the Commonwealth," Regulation 4 VAC 20-400-10 ET SEQ.

The ideal beach nourishment materials should be similar in geological make-up to the existing sediments of the recipient beach. Further, the nourishment materials should have a low percentage of fine-grained sediments to reduce the potential for excessive turbidity during placement and erosion after placement. The grain size is important for several other reasons. First, if the percentage of fines (clay- and silt-sized grains) in the fill is too high, a correspondingly larger volume of fill material must be emplaced in the beach system to allow for loss of the fines with time caused by winnowing action of the waves. Second, too high of a percentage of fines in a beach sand is recreationally undesirable – there may be clumping of the material, for example. Third, fines can harbor or attract contaminants, which may be hazardous to humans and sea life; placement of a contaminated material on a beach system can be detrimental. More information on the quality/composition of the dredge material that may or may not be able to be used as beach nourishment will be obtained over the course of the phased OIS approvals, designs, and construction. This information would be used to determine which beaches may be suitable to accept the dredge material.

Given the increasing challenges facing localities brought on by sea level rise, VMRC believes that strong consideration should be given to the beneficial use of dredged material in areas where land subsidence and sea level rise threaten existing resources or upland infrastructure (VMRC, 2016b).

Other examples of beneficial use include:

- structural fill for tunnel Island expansions
- replacement fill for upland site development
- topsoil amendments
- wetland restoration
- landfill cap materials
- aquaculture, wildlife habitat, or fisheries improvements

For any beneficial use scenario, geotechnical specifications for the receiving site would need to be developed and representative geotechnical and chemistry samples would need to be collected from the project location to determine if the dredged material is suitable for the specified use and if there are environmental quality regulations that would apply.

The most well-known CDF in the region is CIDMMA on Craney Island. Per the Norfolk District Commander's Policy Memorandum WRD-01, CIDMMA "is for the use of all private interests ...accomplishing dredging to support navigation in Norfolk Harbor and adjacent waters. It is intended for the deposit of navigation material dredged from those areas in accordance with House Document No. 563 of the 79th Congress ....Material dredged for non-navigation related transportation projects (i.e. bridges and tunnels) will not be accepted unless the material is clean and of a quality needed at CIDMMA for dike construction."

In addition, this CDF is in the initial phases of a multi-year 500 acre expansion, known as the Craney Island Eastward Expansion (CIEE) project. Based on the above-referenced memo, CIDMMA would not be able to accept dredged material from the build alternatives “unless the material is clean and of a quality needed at CIDMMA for dike construction,” which cannot be an expectation in project planning. Generally, even if material is suitable and needed at CIDMMA, usable quantities are not sizeable. Thus, CIDMMA cannot be expected to handle more than a minimal quantity from HRCS-related dredging, if any, and is not an important consideration in identifying suitable disposal options.

Other existing upland CDFs available for consideration in the region include the Weanack Land, LLP facility, in Charles City County, Virginia. It is located on the James River approximately 70 miles from the project area. This facility has a current capacity of approximately 2.2 million cubic yards (Graves, 2016). Disposal at this facility requires the material be tested for a full suite of parameters. If all tests are below the exclusion criteria, this facility could be a potential disposal alternative for a portion of the dredged material (Carter, 2016).

The City of Virginia Beach runs the Whitehurst Borrow Pit on Oceana Boulevard. This site is primarily used for small dredge projects in Virginia Beach (City) but other parties can be authorized to use it as well. Use of this site is subject to an agreement with the City that the discharge material is free of hazardous materials. This facility has a current capacity of approximately 500,000 cubic yards and could be a potential disposal alternative for a portion of the dredged material (Gay, 2016).

An additional option is to create a new CDF at an upland location that would be cost effective for the project. Such a site has not been located, and would require right-of-way, and local, state, and federal permits to establish and use. The most important factor in identifying such a site would be the ability to access it and move material there without excessive cost. If it is deemed necessary that a project-specific disposal site be found, and if a suitable location or locations capable of handling the volume of dredged material is identified, then consultation with the USACE and USEPA would be necessary. Once a suitable site is selected, disposal would be undertaken in accordance with applicable permit regulations.

Open ocean disposal is another option. The USACE’s policy is that other alternatives must be ruled out before open ocean disposal is considered. It must be demonstrated that there is a need for open ocean disposal, and the need should not be solely economic (USACE, 2013). Two permitted ocean disposal facilities are located in the region; the Norfolk Ocean Dredged Material Disposal Site (NODMDS) and the Wolf Trap Alternate Placement Site (WTAPS). Each tunnel assumed a consistent percentage of the overall quantity of dredge material is contaminated. This contaminated material would require additional analysis and mitigation before identifying an acceptable disposal site.

Use of the approved off-shore NODMDS site is a potential alternative. This facility is located approximately 30 miles from the HRBT. It is managed jointly by the USEPA and the USACE (USDOT, 2011). As indicated above, use of the NODMDS would require the development of a sampling and analysis plan that evaluates the chemical, physical, and ecotoxicological characteristics of the dredged material to ensure appropriateness for disposal at this location. Subsequent to the preparation of this plan, a permit under Section 103 of the MPRSA would need to be obtained.

The WTAPS facility is a 2,300-acre (4,500 acres with the designated buffer zone) rectangular area located in the Chesapeake Bay, approximately 5 miles east of New Point Comfort and south of Wolf Trap Lighthouse, east of Mathews County, Virginia. As a result of monitoring efforts from both the VIMS and the USACE Waterways Experiment Station from 1987 to 1991, the area was classified into six equally divided cells. The use of the site was authorized by virtue of a 1981 agreement between Virginia and Maryland for material dredged from the Baltimore Harbor Channel within the Virginia portion of the Chesapeake Bay. This agreement did not establish the WTAPS as a placement site for other channel material. Additionally, WTAPS lies within a VMRC designated Blue Crab Sanctuary and is a refuge for overwintering female Blue crabs (*Callinectes sapidus*). As such, it is also considered by NOAA Fisheries to be Essential Fish Habitat (EFH) for several federally managed finfish. Use of the site for dredge material from any channel, other than the Baltimore Harbor Channel, requires authorization from VMRC through a permit (VMRC, 2016c). However us of this site has been limited due to its importance for Blue crabs and EFH designation. The most recent material placement event occurred in 2015 from the York Spit Channel (USACE, 2016b).

The Preferred Alternative could be implemented in phases over the course of many years. OISs comprising the Preferred Alternative may be approved in phases resulting in design and construction being spaced over a number of years. This would affect the volume of dredge material produced at any given point in time, thus the amount that needs to be disposed of at any given point in time. The dredge disposal options discussed here are only those known to exist at the present time. The options may vary over the course of the preferred alternative's implementation. New sites may be identified and more information on the quality/composition of the dredge material will be obtained which could eliminate or add disposal options. Likewise, the capacity of the options would vary also, as the current options presumably get used up or expand.

2.1.8 Aquifers / Water Supply

<u>Regulatory Context</u>

Congress enacted the Safe Drinking Water Act (SDWA) in 1974 and amended and reauthorized it in 1986 and 1996. It is the main federal law that ensures the quality of Americans' drinking water, and authorizes the U.S. Environmental Protection Agency (USEPA) to set national standards for drinking water to protect against health effects from exposure to naturally-occurring and man-made contaminants. These drinking water standards only apply to public water systems, and the USEPA works with states, localities, and water suppliers who carry out these standards (USEPA, 2016).

VDEQ adopted a one mile wellhead protection zone around all groundwater public sources. §15.2-2223 and §15.2-2283 of the Code of Virginia include ground water protection provisions for local governments to consider when developing Comprehensive Plans and/or zoning ordinances. The selection of management methods to protect ground water is determined at the local level (VDEQ, 2005). The Virginia Department of Health (VDH) received USEPA approval for their source water assessment program (SWAP) and completed assessments and susceptibility evaluations on all public water supply systems in the Commonwealth in 2003 (VDH continues to perform assessments as needed) (VDEQ, 2005).

The USEPA's Sole Source Aquifer (SSA) program (authorized by Section 1424(e) of the Safe Drinking Water Act of 1974 (Public Law 93-523, 42 U.S.C. 300 et. seq)) enables them to designate an aquifer as a sole source of drinking water and establish a review area. USEPA defines a SSA as one where 1) the aquifer supplies at least 50 percent of the drinking water for its service area; and 2) there are no reasonably available alternative drinking water sources should the aquifer become contaminated. USEPA has the authority to review proposed projects that both receive federal funding and are located within the review area (area overlying the SSA)(USEPA, 2015b).

The VDEQ, under the Ground Water Management Act of 1992, manages groundwater withdrawals in certain areas called Groundwater Management Areas (GWMA). As defined in 9VAC25-600-10, a GWMA is a geographically defined groundwater area in which the State Water Control Board has deemed the levels, supply or quality of groundwater to be adverse to public welfare, health and safety.

Methods

The VDH reviews projects for their proximity to public drinking water sources. The VDH provided comments in July 2015 related to the proximity of public drinking water sources (ground water wells, surface water intakes, and springs) to the Study Area Corridors. The USEPA's National Sole Source Aquifer GIS Layer (USEPA, 2015a) was used to determine the boundaries of SSAs. Information on groundwater and underlying aquifers was obtained with assistance from VDEQ's Ground Water Withdrawal Permitting Program in their Office of Water Supply. Nearby reservoirs were identified using VDEQ's *What's in my Backyard Online Mapper* (VDEQ, 2016b).

Potential impacts to public drinking water sources and aquifers were determined based on the proximity of the resource to the Study Area Corridors, as stated in agency comments or using GIS overlays of the of the resource location data onto the Study Area Corridors.

Affected Environment

The closest public ground water well is approximately 4,000 feet south of the Alternative C and D Study Area Corridor at the I-664 interchange with Rt. 460; and there are no public surface water intakes, or public springs within the Study Area Corridors. Also, the closest SSA is on the Eastern Shore of Virginia. There are also no reservoirs within the Study Area Corridors. The Study Area Corridors are however within the Eastern Virginia GWMA which comprises all areas east of Interstate 95. **Table 2-17** summarizes these results.

Table 2-17: Results of Public Water Supplies

Item	Results
Public Ground Water Wells [1]	Sunray Artesian Water Supply (PWS ID# 3550775) located in Chesapeake, VA is within 1 mile but greater than 1,000 feet away from the Study Area Corridors.
Public Surface Water Intakes [1]	Not within the watershed of any public surface water intakes.
Public Springs [1]	None within the Study Area Corridors.
Sole Source Aquifers [2]	None designated within the Study Area Corridors.
Reservoirs [3]	None within the Study Area Corridors.
Ground Water Management Areas [4]	Study Area Corridors lie within the Eastern Virginia GWMA. However roadway construction is not anticipated to have any water withdrawals.

Source and notes: 1. VDH July 2015 Scoping Comments. 2. USEPA's National Sole Source Aquifer GIS Layer (USEPA, 2015a). 3. VDEQ's What's in my Backyard Online Mapper (VDEQ, 2016b). 4. VDEQ Ground Water Withdrawal Permitting Program (VDEQ, 2016a).

Environmental Consequences

The **No-Build Alternative** would not involve any construction or changes to the natural environment. As a result, environmental effects from the No-Build Alternative are not anticipated. Since there are no public groundwater wells, surface water intakes, springs, sole source aquifers, or reservoirs near the Study Area Corridors, it is not expected that the **build alternatives** would have any project related effect on public water supplies.

2.1.9 Chesapeake Bay Preservation Act

Regulatory Context

The Chesapeake Bay Preservation Act (CBPA) was enacted by the Virginia General Assembly in 1988 to protect and manage Virginia's "coastal zone". The CBPA balances state and local economic interests and water quality improvement by creating a unique cooperative partnership between state and Tidewater local governments to reduce and prevent nonpoint source pollution while still allowing for reasonable development to continue. The CBPA requires local governments in the coastal zone to include water quality protection measures in their zoning and subdivision ordinances and in their comprehensive plans (VDEQ, 2016f).

Within the Chesapeake Bay watershed of coastal counties, Resource Protection Areas (RPAs) include tidal wetlands, tidal shores, waterbodies with perennial flow, and non-tidal wetlands connected by surface flow and contiguous to tidal wetlands or perennial water bodies, as well as a 100-foot vegetated buffer area located adjacent to and landward of these features. When preserved in their natural condition, RPAs protect water quality, filter and reduce the volume of runoff, prevent erosion, and perform other important biological and ecological functions (9 VAC 25-830-80). These areas are subject to local CBPA requirements to minimize land disturbance, preserve indigenous vegetation, minimize impervious surfaces, control stormwater runoff, and implement erosion and sediment control plans for land disturbances. Activities within RPAs are further restricted to water dependent or redevelopment related activities.

Resource Management Areas (RMAs) include those lands contiguous to the inland boundary of the RPA, which if improperly used or developed, has the potential to degrade water quality or diminish functions of the RPA. RMAs include floodplains, highly erodible soils (including steep slopes), highly permeable soils, non-tidal wetlands not included in RPAs, and any other sensitive lands considered by the local government to be necessary to protect the quality of water resources (9 VAC 25-830-90).

Areas of existing development and infill sites where little of the natural environment remains within Chesapeake Bay Preservation Areas may be designated as Intensely Developed Areas (IDAs) by the local government (9 VAC 25-830-100).

Methods

Web based GIS data was sourced from the Cities of Chesapeake, Hampton, Newport News, Portsmouth, Norfolk, and Suffolk, and used to quantify areas of RPA by performing an overlay of the Study Area Corridors onto the GIS data.

Affected Environment

Within the 500' wide Study Area Corridors, RPA comprises the following area for each alternative:

- Alternative A: 57 acres
- Alternative B: 98 acres
- Alternative C: 492 acres
- Alternative D: 609 acres

All additional lands within the Study Area Corridors are considered either RMA or IDA.

Environmental Consequences

Although RPAs, RMAs, and IDAs occur throughout the Study Area Corridors, public roads and their appurtenant structures are conditionally exempt from regulation under 8VAC25-830-150. Public roads are defined as publicly owned roads designed and constructed in accordance with water quality protection criteria at least as stringent as requirements applicable to the VDOT, and in accordance with the Erosion and Sediment Control Law (§62.1-44.15:51 et seq. of the Code of Virginia) and the Stormwater Management Act (§62.1-44.15 et seq. of the Code of Virginia). This includes those roads where the VDOT exercises direct supervision over the design or construction activities, or both, and cases where secondary roads are constructed or maintained, or both, by a local government in accordance with the standards of that local government. The exemption of public roads is further conditioned on the optimization of the road alignment and design, consistent with other applicable requirements, to prevent or otherwise minimize encroachment in the RPA and adverse effects on water quality. Since all of the alternatives would be public roads that would meet the exemption conditions, they would not be under the CBPA purview. Therefore, provided that the above conditions are met, no additional avoidance or minimization for CBPA areas is necessary. Natural resources (i.e. wetlands, floodplains, threatened and endangered species habitat, etc.) that may be present within the RPAs, RMAs, and IDAs would be avoided and minimized under the individual regulations that govern them.

2.1.10 Virginia Coastal Zone Management Program

Regulatory Context

Federal development projects occurring within, or with the likelihood to affect, any land or water use, or natural resource of a State's coastal zone, including cumulative and secondary impacts, must be consistent with a State's Federally approved Coastal Zone Management Program (CZMP) according to Section 307 of the Federal Coastal Zone Management Act of 1972, as amended, and NOAA regulations (15 CFR part 930). Such actions require a consistency determination that receives concurrence from the state. In Virginia, the VDEQ administers the CZMP and reviews consistency determinations.

The Virginia CZMP was established under Executive Order in 1986 and its mission is to create more vital and sustainable coastal communities and ecosystems. The Virginia CZMP is known as a "networked program", which means that to manage Virginia's coastal resources, the program relies on a network of state agencies and local governments to administer the enforceable laws and regulations that protect our wetlands, dunes, subaqueous lands, fisheries, and air and water quality – within Virginia's coastal zone. The agencies involved in the CZMP include: VDEQ, VDCR, VMRC, Virginia Department of Game and Inland Fisheries (VDGIF), VDH, Virginia Department of Agriculture and Consumer Services (VDACS), Virginia Department of Forestry (VDOF), Virginia Department of Historic Resources (VDHR), Virginia Department of Mines, Minerals, and Energy (VDMME), VDOT, Virginia Economic Development Partnership, and VIMS. These agencies administer the enforceable laws, regulations, and advisory policies that protect our coastal resources and geographic areas of particular concern (VDEQ, 2016d). **Table 2-18** lists the enforceable regulatory programs of the CZMP that must be complied with.

Table 2-18: Virginia Coastal Zone Management Program Enforceable Regulatory Programs

Regulatory Program	Resource	Virginia Code	Regulatory Agency	Notes
Fisheries Management	Conservation and enhancement of finfish and shellfish	28.2-200 to 28.2-713 29.1-100 to 29.1-570	VMRC VDGIF	
Subaqueous Lands Management	Establishes conditions for granting or denying permits to use State-owned bottomlands	28.2-1200 to 28.2-1213	VMRC	
Wetlands Management	Preserve wetlands and prevent their despoliation	62.1-44.15:5 28.2-1301 to 28.2-1320	VDEQ VMRC Wetlands Boards	Non-tidal Tidal Tidal
Dunes Management	Prevent destruction or alteration of primary dunes	28.2-1400 to 28.2-1420	VMRC Wetlands Boards	
Non-point Source Pollution	Reduce soil erosion and decrease inputs of chemical nutrients and sediments	62.1-44.15:51 *et seq.*	VDEQ Local Governments	
Point Source Pollution Control	Regulates discharges into State waters through Virginia Pollutant Discharge Elimination System and Virginia Pollution Abatement permits	62.1-44.15	VDEQ	
Shoreline Sanitation	Septic tank placement	32.1-164 to 32.1-165	VDH	Contact may be required when determining relocations and removal of existing systems
Air Pollution Control	Attainment and maintenance of National Ambient Air Quality Standards	10.1-1300 to 10.1-1320	VDEQ	
Coastal Lands Management	Regulates activities within RMAs and RPAs	62.1-44.15:67 to 62.1-44.15:79 9 VAC 25-830-10 *et seq.*	VDEQ Local Governments	

Source and notes: VDEQ, 2016i.

In addition to the enforceable regulatory programs, the CZMP also includes advisory policies to protect coastal resources. When reviewing projects, the state agencies implementing these policies provide comments concerning the impacts to coastal resources. These resources include:

- Coastal Natural Resource Areas
  - wetlands
  - aquatic spawning, nursery, and feeding grounds
  - coastal primary sand dunes
  - barrier islands
  - significant wildlife habitat areas
  - public recreation areas
  - sand and gravel resources
  - underwater historic sites
- Coastal Natural Hazard Areas
  - highly erodible areas
  - coastal high hazard areas, including floodplains
- Waterfront Development Areas
  - commercial ports
  - commercial fishing piers
  - community waterfronts
- Virginia Public Beaches
- Virginia Outdoors Plan
- Parks, Natural Areas, and Wildlife Management Areas
- Waterfront Recreational Land Acquisition
- Waterfront Recreational Facilities
- Waterfront Historic Properties

Methods

VDOT and VDEQ have established a procedure in which VDOT submits a “Request for Coastal Resources Management Consistency Certification”. This request includes relevant project information and data necessary to evaluate Coastal Zone Management. In this submittal, VDOT seeks VDEQ’s comment as to if more information is needed, if certification is not required, and/or if the proposal has been found to be consistent with the “goals and objectives of the Virginia Coastal Resources Management Program.” This process is completed during the design and permitting phase of a project. As OIS advance from the study, VDOT would work with VDEQ to complete this Coastal Zone Management process.

Affected Environment

According to VDEQ, Virginia’s coastal zone “encompasses the 29 counties, 17 cities, and 42 incorporated towns in ‘Tidewater Virginia’, as defined in the Code of Virginia 28.2-100” (VDEQ, 2016d). All of the Study Area Corridors are entirely located within Virginia’s coastal zone.

2.2 WILDLIFE HABITAT

2.2.1 Terrestrial Wildlife / Habitat

Regulatory Context

Due to the broad use of available habitat by terrestrial wildlife, numerous federal and state agencies may be involved in the regulation of proposed habitat impacts. Federal and state agencies regulate and manage activities associated with terrestrial wildlife and their habitats on conserved lands and through the enforcement of laws related to hunting and fishing as well as rare, threatened, and endangered species. The U.S. Fish and Wildlife Service (USFWS) and VDGIF act as consulting agencies under the U.S. Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et *seq.*), and provide environmental analysis of projects or permit applications coordinated through VDEQ, VMRC, VDOT, the Federal Energy Regulatory Commission, the USACE, and other state or federal agencies. Their role in these procedures is to determine likely impacts upon fish and wildlife resources and habitats, and to recommend appropriate measures to avoid, reduce, or compensate for those impacts (VDGIF, 2016a). The Regulatory Context portion of the Threatened and Endangered Species section contains regulatory specifics pertaining to threatened and endangered species.

The Virginia Department of Conservation and Recreation, Natural Heritage Program (VDCR-DNH) conserves Virginia's natural and recreational resources through programs such as biological inventories, natural community inventory and classification, environmental review, and the creation of Natural Area Preserves. Through the environmental review program, VDCR-DNH provides natural heritage information in order to meet local, state, and federal regulatory needs. In addition to Natural Area Preserves, VDCR-DNH also identifies Conservation Sites, which represent key areas of the landscape worthy of protection and stewardship action because of the natural heritage resources and habitat they support. Terrestrial Conservation Sites are polygons built around one or more rare plant, animal, or natural community designed to include the element and, where possible, its associated habitat, and buffer or other adjacent land thought necessary for the element's conservation (VDCR, 2016a). Conservation Sites are given a biodiversity significance ranking based on the rarity, quality, and number of element occurrences they contain; on a scale of B1-B5, with B1 being most significant (VDCR, 2015b).

Methods

In order to assess the potential for terrestrial wildlife and habitat within the Study Area Corridors, a review of *The Natural Communities of Virginia: Classification of Ecological Community Groups* (Fleming and Patterson, 2013) was conducted along with a literature review of the USEPA's Ecoregions. The 2011 National Land Cover Database (NLCD) (Homer, et.al, 2015) was obtained from the Multi-Resolution Land Characteristics Consortium (MLRC) to classify land cover within the Study Area Corridors. In a letter dated November 12, 2015, VDCR-DNH provided the results of a search of its Biotics Data System for occurrences of natural heritage resources, including Conservation Sites, in the vicinity of the Study Area Corridors. This off-site research was supplemented by threatened and endangered species habitat field assessments and incidental observations while conducting the wetland assessment, and wetlands and WOUS reviews.

An estimate of the land cover types present within the Study Area Corridors was determined by performing GIS overlays of the Study Area Corridors onto the 2011 NLCD land cover types (Homer, et.al, 2015). Potential impacts to land cover types was calculated by performing GIS overlays of the LOD, which is based on roadway engineering completed to date, on top of the 2011 NLCD land cover types. Potential qualitative impacts are also presented based on the field assessments and observations.

Affected Environment

The Study Area Corridors are located within the eastern portion of the Coastal Plain physiographic province of Virginia and include a variety of upland forest communities and diverse tidal and freshwater wetlands and stream systems. The upland forests that originally covered much of the Virginia Coastal Plain have been extensively cleared or altered, making it difficult to determine which species and communities were once naturally prevalent. Much of the contemporary forest consists of successional or silvicultural stands of loblolly pine (*Pinus taeda*) and secondary pine-hardwood forests that have developed after repeated timbering or agricultural abandonment. The most mature remnant stands on mesic uplands are typically characterized by communities of American beech (*Fagus grandifolia*), oaks (*Quercus* spp.), and American holly (*Ilex opaca*). Patches of drier oak-dominated forest and steep bluffs with dense forests of chestnut oak (*Quercus montana*), beech, and mountain-laurel (*Kalmia latifolia*) are fairly common in the dissected inner Coastal Plain, especially north of the James River (Fleming and Patterson, 2013).

The Study Area Corridors are located in Ecoregion 63b of the EPA's Level IV Ecoregions (Woods, et al., 1999). The Chesapeake-Albemarle Lowlands and Tidal Marshes (part of the Middle Atlantic Coastal Plain), is characterized by nearly flat terrain, terraces, tidal marshes, ponds, and swampy streams. Brackish wetlands are common and serve as habitat for fish, shellfish, and wildfowl. Typical elevations range from 0 to 50 feet with relief less than 35 feet. Neighboring ecoregions surrounding 63b are typically higher in elevation and are better drained. Natural vegetation includes oak-hickory-pine forests, northern cordgrass prairie, and southern floodplain forest. Streams are usually low in gradient, low velocity, tidally influenced, poorly incised, and lack a defined channel with wide riparian wetlands. Extensive tidal marshes and salt estuarine bay marshes are found on the poorly drained soils of the silty low terraces. Agriculture is present where natural or artificial drainage is sufficient to support cultivated species. Urban and industrial areas can be found near large harbors (Woods, et al., 1999).

Land cover classes identified by the 2011 NLCD existing within the Study Area Corridors include open water, developed, barren, forest, shrubland, herbaceous, planted/cultivated, and wetlands. **Table 2-19** shows the acreages and percentage of the land cover types present within each of the Study Area Corridors.

As **Table 2-19** indicates, the majority of the existing land cover within the Study Area Corridors consists of developed lands, with the next largest land cover type being open water, and only a small percentage is made up of natural terrestrial communities. Expanses of terrestrial habitat are rare and fragmented as residential, commercial, industrial, government/military, and open water areas are common, resulting in low quality edge habitat. Aerial photographs obtained from Google Earth are included in **Appendix E** and depict the various land cover types and fragmentation within the Study Area Corridors. Aerial photography review supports the results of the 2011 NLCD review.

Table 2-19: Land Cover Types within Study Area Corridors

Land Cover Types	Alternative A		Alternative B		Alternative C		Alternative D	
	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent
Open Water	206	22	434	21	879	29	1,081	26
Developed, Open Space	164	18	366	18	526	17	737	18
Developed, Low Intensity	249	27	564	28	703	23	1,060	26
Developed, Medium Intensity	252	27	439	22	537	18	806	19
Developed, High Intensity	37	4	90	4	190	6	229	6
Barren Land	0	0	4	0.2	6	0.2	6	0.1
Deciduous Forest	1	0.1	7	0.3	21	1	23	1
Evergreen Forest	0.01	0.001	10	0.5	18	0.6	18	0.4
Mixed Forest	0	0	2	0.1	2	0.1	3	0.1
Shrub / Scrub	0	0	22	1	27	1	30	1
Grassland / Herbaceous	0.2	0.02	6	0.3	5	0.2	6	0.1
Pasture / Hay	0	0	3	0.1	6	0.2	6	0.1
Cultivated Crops	0	0	2	0.1	2	0.1	2	0.04
Woody Wetlands	7	1	75	4	106	3	117	3
Emergent Herbaceous Wetlands	4	0.4	16	1	18	1	22	1
Total	**920**	**100**	**2,039**	**100**	**3,046**	**100**	**4,145**	**100**

Source and notes: Homer, et.al, 2015.

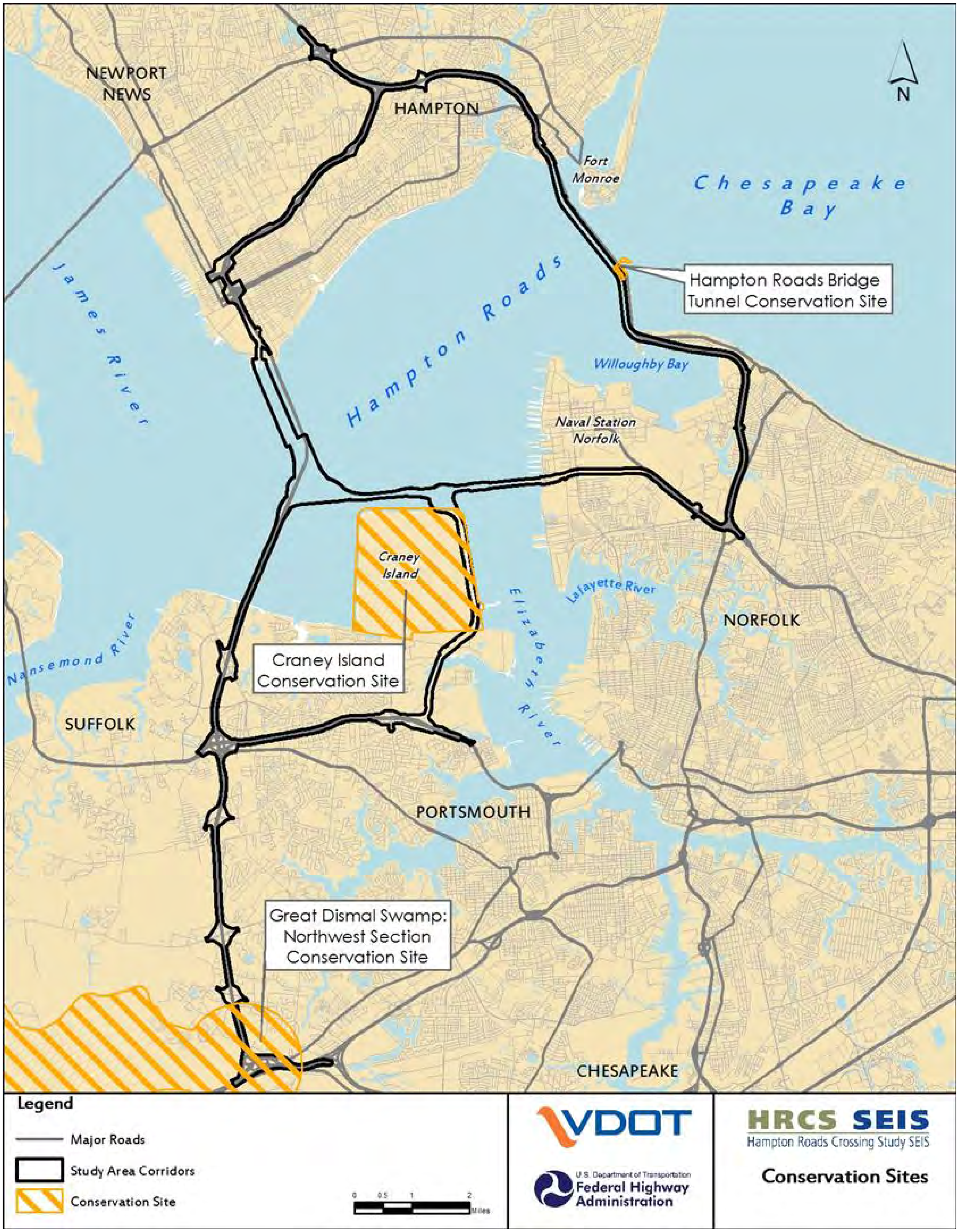
The wildlife species most capable of adapting to habitat fragmentation due to dense urban and suburban development include but are not limited to rabbits, whitetail deer, eastern gray squirrels, red fox, raccoon, striped skunk, and a number of common non-migratory bird species. Some areas within the Study Area Corridors that retain some characteristics of natural vegetation (e.g. wetland and waterbody margins, protected areas) may contain more specialized, less man-compatible wildlife (Fleming and Patterson, 2013). One such area is located south of CIDMMA, north of VA 164 and bisected by Coast Guard Boulevard. A large contiguous wetland system is present greater than 100 acres and is connected to additional forested areas on the Coast Guard property. The additional forest areas are somewhat fragmented, but still accessible over a railroad and secondary roads.

Three Conservation Sites are documented within the Study Area Corridors as shown on **Figure 2-7** (VDOT, 2015 and VDCR, 2016c). These include the Hampton Roads Bridge-Tunnel Conservation Site (along the bridge-tunnel portion of I-64 within Alternatives A, B, and D), the Craney Island Conservation Site (associated with CIDMMA along Alternatives B, C, and D), and the Great Dismal Swamp: Northwest Section Conservation Site (along I-664 in Chesapeake surrounding the Bowers Hill interchange within Alternatives C and D). The Hampton Roads Bridge-Tunnel Conservation Site's natural heritage resources are all waterbirds and further discussion is presented in the Waterbird Nesting section. The Craney Island Conservation Site has a biodiversity significance ranking of B4 on a scale of B1-B5, B1 being most significant. In addition to the Least tern (Sterna antillarum) (a waterbird discussed in the Waterbird Nesting section), the Black-necked stilt (*Himantopus mexicanus*), and the Northern harrier (*Circus cyaneus*) are also natural heritage resources at the Site. Neither of these species is listed as threatened or endangered, but the Northern harrier is classified under Virginia's Wildlife Action Plan as a Tier III species on a scale of Tier I-IV with a "High Conservation Need" (Tier I = Critical Conservation Need, Tier IV = Moderate Conservation Need). It It is considered a transient and winter resident in Virginia (VDGIF,2016b). The Site also has a wetland conservation prioritization ranking of 3 (High) on a scale of 1 (General) – 5 (Outstanding) (VDGIF, 2015). The Site is used by nesting, migrating, and wintering birds and is managed in part for them through habitat creation, changing water depths, vegetation control, and identifying and protecting active nest sites (Beck, 2005). An active dredge material disposal site, the dredging operations provide a variety of habitats attractive to a widely diverse group of birds. Bird surveys have been conducted each Spring and Summer since 1975 with approximately 150 species observed in recent years. Known active nesters include Mallard (*Anas platyrhynchos*), American black duck (*Anas rubripes*), Osprey (*Pandion haliaetus carolinensis*), Bald eagle (*Haliaeetus leucocephalus*), Killdeer (*Charadrius vociferous*), Black-necked stilt, Common nighthawk (*Chordeiles minor*), and Least tern (USACE, 2012c).

The Great Dismal Swamp: Northwest Section Conservation Site has a biodiversity significance ranking of B5 on a scale of B1-B5, B1 being most significant. The natural heritage resources of concern at this site are the Canebrake rattlesnake and the Dismal Swamp southeastern shrew (VDCR, 2015b). See the Threatened and Endangered Species section for further discussion of the suitability of habitat and potential impact to the Canebrake rattlesnake and Dismal Swamp southeastern shrew. The Site has a wetland conservation prioritization ranking of 5 (Outstanding) (VDGIF, 2015).

No wildlife refuges or wildlife management areas are located within any of the Study Area Corridors.

Figure 2-7: Conservation Sites



Environmental Consequences

The **No-Build Alternative** would not involve any construction or changes to the natural environment. None of the roadways would be expanded. As a result, project-related environmental effects to wildlife and terrestrial habitat from the No-Build Alternative are not anticipated.

The four **build alternatives** could potentially impact both terrestrial wildlife and habitat. The existing roadway corridors that comprise the four build alternatives (including I-64, I-564, I-664, and VA 164) pose a substantial barrier to wildlife movement. Increasing the width of the roadway corridor would not likely exacerbate this problem due to the presence of the existing barriers. In addition, narrow corridors between fragmented habitat leads to increased predation due to greater ease of locating prey species. Potential for temporary impacts to wildlife exist with the removal of vegetated cover within the construction footprint, likely causing animal migration away from the disturbance and a temporary reduction in habitat usage by mostly common edge-dwelling species.

Potential impacts to the different land cover types within the LOD for each of the build alternatives is shown in **Table 2-20.** As the table indicates, the LOD for Alternatives A, B, C, and D are composed primarily of various intensities of developed land as well as open water.

As previously discussed, terrestrial habitat is limited within the alternatives due to an urbanized/suburbanized fragmented landscape with varying degrees of clearing and development. **Alternative A** would have the least amount of impact on terrestrial wildlife and habitat. While a significant percentage is over the open water of Hampton Roads, the terrestrial portion of this alternative is primarily through fragmented landscapes of suburban and other types of developed land. The narrow corridors of terrestrial habitat within existing right-of-way and immediately adjacent to it that would be impacted are not part of any larger contiguous tracts of habitat, rather they are components of the fragmented landscape. Impacts to these areas should not alter the condition or function of the surrounding habitat. The I-64 corridor immediately north of I-564 is adjacent to a larger forested tract but impacts would occur to a narrow forested corridor already disconnected from the larger tract. Potential impacts could occur to the Hampton Roads Bridge-Tunnel Conservation Site. Discussion of potential impacts to this site and the waterbirds associated with it is presented in the Waterbird Nesting section.

Alternative B would have the same potential impacts as Alternative A, and adds the I-564 Connector, and the VA 164 Connector and Widening extending along CIDMMA and into Chesapeake. The existing I-564 corridor would not be impacted. Only developed lands would be impacted through the Naval Base and harbor portion of the I-564 Connector. The VA 164 Connector along and south of CIDMMA could potentially disrupt the nesting waterbirds associated with the Craney Island Conservation Site, and other nesting bird species and foraging behaviors, but would not increase fragmentation as the VA 164 Connector traverses the eastern edge of CIDMMA. It would however bisect the existing island and the CIDMMA eastward expansion project if that is completed prior to implementation of this alternative. The alternatives that will pass over/adjacent to CIDMMA will introduce far greater noise and general disturbance than is currently experienced. Colony locations can vary from year to year and be dependent upon where active dredge disposal is occurring. It is difficult to predict the potential effects to the various bird species at this site. The birds would be expected to avoid areas of active construction, which would be immediately adjacent to or over the island but this would most certainly affect foraging behavior at least temporarily. The introduction of a major bridge may impact bird use temporarily or permanently.

The only contiguous tracts of forested habitat that would be impacted exist between Craney Island Creek and VA 164. The majority of this area is PFO wetland and the consequences of bisecting the area were discussed previously in the Wetlands section. The large tidal wetland areas around Craney Island Creek would be bridged, maintaining wildlife corridors. The existing portion of VA 164 bisects suburban neighborhoods with no intact habitat and is highly fragmented. The railroad within the median combined with the eastbound and westbound lanes of VA 164 significantly impede animal movement from one side of the roadway to the other. Impacts along this corridor would primarily be within the median and existing interchanges, with a small amount immediately adjacent to them, and should not alter the condition or function of the surrounding habitat or animal movement.

While **Alternative C** does not include I-64, it includes I-664 through Hampton and Newport News, and has a very significant portion of the roadway that traverses the open water of the James River, Hampton Roads, and the Elizabeth River, having similar potential effects as Alternatives A and B, with the exception of the Hampton Roads Bridge-Tunnel Conservation Site. Very little terrestrial habitat with wildlife value exists along I-664 in Hampton and Newport News. Narrow forested and shrub areas south of the interchange with Power Plant Parkway would be impacted with little effect, since the impact would be to edge habitat of an isolated area bounded by roads, suburban neighborhoods, and industrial development. Alternative C includes the same impacts as Alternative B along the I-564 Connector and VA 164 Connector with the addition of forested and scrub habitat immediately adjacent to the railroad near the interchange of the I-564 Connector and I-564. This would widen the wildlife movement barrier between the scrub and field habitat to the north and the field, forest, and wetland habitat to the south. There is no VA 164 Widening work proposed with Alternative C. Alternative C involves construction in Suffolk and Chesapeake in the southwestern area of the Study Area Corridors adjacent to I-664. This area is the least developed area of the Study Area Corridors and contains the most acres of forested land including small sections of deciduous forest, evergreen forest, and mixed forest, as well as the highest acreage of woody wetlands and emergent herbaceous wetlands and many are components of larger forested tracts. The sections of forest along Alternative C are the most intact habitats that could be impacted. The impacts to these areas would be limited to the forest edges within and adjacent to the existing right-of-way and are areas already affected by existing roadways, interchanges, and/or utility easements. The function and habitat value of these larger forested tracts should not be diminished, nor would they be further fragmented since the existing roadway would be expanded. No impacts to the forested edges of these larger forested tracts would occur between the Pughsville Road and Route 58 interchanges in Chesapeake since proposed roadway widening is decreased in that area. Open fields and forested areas inside existing interchanges would be impacted but movement in and out of these areas is already restricted by the existing roadway network. The Great Dismal Swamp National Wildlife Refuge and Great Dismal Swamp: Northwest Section Conservation Site are proximal to Alternative C. There would be no impacts to the Wildlife Refuge. The I-664 and U.S. 58 interchange at the southern terminus of the alternative is within the Conservation Site, though the forested areas are already fragmented by the roadways in the interchange.

Table 2-20: Potential Impacts to Land Cover Types

Land Cover Types	Alternative A		Alternative B		Alternative C		Alternative D	
	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent
Open Water	120	44	183	30	352	27	437	29
Developed, Open Space	14	5	48	8	146	11	151	10
Developed, Low Intensity	69	26	170	28	341	27	410	28
Developed, Medium Intensity	67	24	137	23	266	21	320	22
Developed, High Intensity	4	1	31	5	102	8	101	7
Barren Land	0	0	3	0.5	3	0.2	3	0.2
Deciduous Forest	0	0	3	0.5	8	0.6	8	0.5
Evergreen Forest	0	0	3	0.5	6	0.5	6	0.4
Mixed Forest	0	0	1	0.2	1	0.1	1	0.1
Shrub / Scrub	0	0	1	0.2	3	0.2	3	0.2
Grassland / Herbaceous	0	0	1	0.2	1	0.1	1	0.1
Pasture / Hay	0	0	2	0.3	2	0.2	2	0.2
Cultivated Crops	0	0	0	0	0.1	0.01	0.1	0.01
Woody Wetlands	0	0	21	3	46	4	35	2
Emergent Herbaceous Wetlands	0.1	0.04	4	0.6	4	0.3	4	0.3
Total	**274**	**100**	**608**	**100**	**1,281**	**100**	**1,482**	**100**

Source and notes: Homer, et.al, 2015.

Alternative D has the greatest potential to affect terrestrial wildlife and habitat. It is a combination of the sections that comprise Alternatives B and C, therefore has the largest area of potential disturbance for construction and other offsite activities. Impacts would be the same as Alternative B along I-64, the I-564 Connector, the VA 164 Connector, and the VA 164 Widening. While Alternative C would have slightly more impacts than Alternative D along I-664 in Hampton and Newport News, there is no difference in the quality of the habitat being impacted or the resulting change in fragmentation. In addition to Alternative C, it is the only other alternative with construction in the less developed areas of

Suffolk and Chesapeake with the impacts and results being the same in this area as described for Alternative C. As such, Alternatives C and D may have the most impact due to the highest amount of forested and wetland communities as shown by the National Land Cover Database results along with field observations.

While each of the build alternatives has the potential for impacts to small amounts of terrestrial habitat and associated wildlife, coordination and concurrence with various agencies would be required through all stages of the project implementation. This coordination, along with any necessary permitting, would help to avoid and minimize potential impacts to these resources.

In order to reduce potential impacts to terrestrial habitats, efforts to minimize the construction footprint would be made. Construction practices would avoid the removal of existing vegetation to the greatest extent possible and may use protective fencing or flagging to demarcate areas not to be cleared. The implementation and maintenance of strict erosion and sediment control measures and stormwater management best management practices following the VESCH would help to reduce potential impacts to adjacent habitats and properties. Examples of such measures include silt fence installation, culvert outlet protection, stormwater conveyance channels, soil stabilization blankets and matting, dust control, and temporary and permanent seeding. For expansion along existing roadways, avoiding the use of plants with high feed value that may attract wildlife could reduce wildlife encounters within the travel lanes of the alternatives. For areas on new alignment, such as the VA 164 Connector, corridor disruption and effects of fragmentation to these more intact habitat blocks can be minimized by incorporating wildlife passages for the anticipated assemblage of species and can be designed to be incorporated as part of efforts to maintain hydrologic connections.

2.2.2 Waterbird Nesting

Regulatory Context

Colonial waterbirds are protected by the USFWS under the federal Migratory Bird Treaty Act (MBTA) (16 U.S.C. 703-712). Those that are federal or state listed as threatened or endangered are also protected by the USFWS through the Endangered Species Act (ESA) of 1973 (16 USC 1531-1544) and by VDGIF (Virginia Code §29.1-563-570) (see the Threatened and Endangered Species section for more regulatory context on threatened and endangered species). The Migratory Bird Treaty Act (MBTA) was enacted in 1918 and implements various treaties and conventions between the U.S. and Canada, Japan, Mexico, and Russia for the protection of migratory birds. Under the MBTA, taking, killing or possessing migratory birds (other than game birds during valid hunting seasons) is unlawful. Protections extend to migratory bird nests determined to contain eggs or young (USFWS, 2015).

In Virginia, waterbird colonies are considered to be sensitive resources because large portions of state populations are concentrated in relatively few locations. Due to the vulnerability of colonial waterbird breeding areas, VDCR Conservation Sites have been established in important breeding areas to protect certain species that are exhibiting decreases in population levels. These Conservation Sites, however, are not afforded any legal protection. Colonial waterbird colonies are considered during permit review and both the VDCR and VDGIF comment on a project's effect on this resource.

Methods

The presence of colonial waterbird colonies was obtained from both VDCR and VDGIF. Through both the scoping process and subsequent inquiries, VDCR responded with information pertaining to colonial waterbird species nesting within the vicinity of the Study Area Corridors. VDGIF's Fish and Wildlife Information Service (VFWIS) database was searched to identify known waterbird colonies within a two-mile radius of the Study Area Corridors.

The presence of colonies within the Study Area Corridors was determined by performing GIS overlays of the Study Area Corridors on top of the polygons noting the approximate location of the colonies obtained from both VDCR and VDGIF. Potential impacts are presented through a discussion of their proximity to the LOD, which is based on roadway engineering completed to date.

Affected Environment

According to the College of William and Mary's Center for Conservation Biology (CCB), colonial waterbirds include herons, egrets, ibises, gulls, terns, skimmers, cormorants, and pelicans. These birds share the unusual characteristic of nesting in dense assemblages, with the result of this behavior being that they typically breed in very few locations. The loss of these breeding areas may have profound consequences on a population level (CCB, 2014). In addition, due to their dependence on aquatic resources, they are considered good indicators of coastal ecosystem health and productivity (Watts and Paxton, 2014). The most substantial threats to colonial waterbirds include human disturbance, predation, habitat loss, and contaminants (Watts and Paxton, 2014). Protection of sensitive colonies depends on the availability of timely information of the birds' locations. Development of strategic management plans to protect these species and breeding areas requires a broader understanding of population trends (CCB, 2014).

All colonial waterbird colonies in the vicinity of the Study Area Corridors are shown on **Figure 2-8**, however, only two colonies are located within the Study Area Corridors. One colony is within Alternatives A, B, and D along the bridge-tunnel portion of I-64, and the other is associated with CIDMMA within Alternatives B, C, and D. According to a letter from VDCR, dated November 12, 2015 (VDCR, 2015b), both of these colonies are located within Conservation Sites.

The colony within Alternatives A, B, and D along the bridge-tunnel portion of I-64 is a component of the Hampton Roads Bridge-Tunnel Conservation Site (**Figure 2-7**). The Hampton Roads Bridge-Tunnel Conservation Site has a biodiversity significance ranking of B5 on a scale of B1-B5, B1 being most significant. The natural heritage resources of concern found at the Site are all colonial waterbirds, and are the Black skimmer (*Rynchops niger*), the Gull-billed tern (*Sterna nilotica*), the Royal tern (*Sterna maxima maximus*), and the Sandwich tern (*Sterna sandvicensis*). While the colony is established, disturbances from cars, boats, and airplanes are constantly present. Constant shipping traffic as well as coastal storms could present disturbances also.

The colony associated with CIDMMA along Alternatives B, C, and D is a component of the Craney Island Conservation Site (**Figure 2-7**). The Craney Island Conservation Site has a biodiversity ranking of B4. One of the natural heritage resources of concern found at the Site is a colonial waterbird, the Least tern (*Sterna antillarum*). Bird surveys on CIDMMA have been conducted each Spring and Summer since 1975, with the Least tern being the most persistent nesting species. Colony locations can vary from year to year, particularly depending upon where active dredge disposal is occurring, however the primary threat to the bird colonies is red foxes, though predator control programs have proven effective. Current management includes posting and closing nesting areas during the breeding season (USACE, 2012c). The dredging operations at CIDMMA provide a variety of habitats attractive to a widely diverse group of birds by managing cells for nesting, migrating, and wintering species through habitat creation, managing water depths, and vegetation and predator control (Beck, 2005).

Provided below are brief summaries of the population status and typical nesting and foraging habits of each colonial waterbird species that occurs within these two colonies, as noted in VDOT's CEDAR GIS Database and by VDCR's November 12, 2015 letter (VDOT, 2015 and VDCR, 2015b).

Great Black-backed Gull (*Larus marinas*) (Hampton Roads Bridge-Tunnel Conservation Site) – Great black-backed gulls are the largest of the gull species. They are a transient species and reside on Virginia's Eastern Shore in the winter. Between 1993 and 2013, the Virginia population has more than doubled in size and expanded in distribution. Colonization of the Hampton Roads Tunnel Island since 2003 represents the first colonization of the lower portion of the Chesapeake Bay (Watts and Paxton, 2014). Great black-backed gulls build their nests on the ground and feed on small fish, insects, and refuse. They breed in June and July and are not a species of concern.

Herring Gull (*Larus argentatus*) (Hampton Roads Bridge-Tunnel Conservation Site) – Herring gulls breed from May to August (VDGIF, VFWIS). They nest near vegetation or on rocks or cliffs on the coast. Herring gulls typically nest on the ground and as such, their nests need to be located in areas without predators. Herring gulls are not a species of concern. New colonies have been recorded in the lower Bay since 2003, including on the Hampton Roads Bridge-Tunnel and near the mouth of the York River (Watts and Byrd, 2006). They feed on a wide variety of sea animals, both dead and alive, as well as seeds, berries, insects, and refuse.

Laughing Gull (*Larus atricilla*) (Hampton Roads Bridge-Tunnel Conservation Site) – Laughing gulls breed from late April to early August and lay their eggs in May and June. They are common in the Tidewater region of Virginia and are not a species of concern. However, a 2013 study by the Center for Conservation Biology (CCB) indicated a population decline from 2003 to 2013 that may be a result of tidal flooding (Watts and Paxton, 2014). Laughing gulls nest in the open on islands of marshes and feed on a variety of small fish, crustaceans, insects, and sometimes refuse. They are known to steal food from other birds.

Gull-billed Tern (*Sterna nilotica*) (Hampton Roads Bridge-Tunnel Conservation Site) – Gull-billed terns breed on Virginia's Eastern Shore and typically inhabit salt marshes or portions of beaches that are away from the tide. The Gull-billed tern is a State Threatened species and is in Tier I of Virginia's Wildlife Action Plan as a species of "Critical Conservation Need." Currently, this species is nearly restricted to shell piles in the barrier island/lagoon system and to a single colony on the Hampton Roads Bridge-Tunnel (Watts and Paxton, 2014). Threats to the Gull-billed tern's habitat may include the use of pesticides, since this species relies heavily on insects as a source of food (VDGIF, 2016b). Other threats to the Gull-billed tern include human development and recreation, and boating. This species begins nesting at the end of April, and lays their eggs from mid-May to July.

Royal Tern (*Sterna maxima maximus*) (Hampton Roads Bridge-Tunnel Conservation Site) – Royal terns are listed in Virginia's Wildlife Action Plan under Tier II, "Very High Conservation Need." However, since 2003, numbers have increased due solely to the establishment of birds on the Hampton Roads Bridge-Tunnel Island. In 2013, this site supported 97.5 percent of the state population (Watts and Paxton, 2014). Royal terns nest in small impressions in the sand near the high tide water level and typically consume small fish by diving. They lay their eggs from mid-May to the end of June (VDGIF, 2016b).

Figure 2-8: Colonial Waterbird Colonies

Sandwich Tern (*Sterna sandvicensis*) (Hampton Roads Bridge-Tunnel Conservation Site) – Virginia and Maryland represent the northernmost breeding range for Sandwich terns (Watts and Paxton, 2014). Sandwich terns nest in slight impressions on low, sandy islands above high tide level with no vegetation present. They feed offshore in the open ocean or among breakers. Sandwich terns are uncommon to fairly common post-breeding summer visitors to the lower Chesapeake Bay (VDGIF, 2016b).

Common Tern (*Sterna hirundo*) (Hampton Roads Bridge-Tunnel Conservation Site) – Common terns are classified under Virginia's Wildlife Action Plan as a Tier III species with a "High Conservation Need," although they are commonly found on Virginia's Eastern Shore during breeding season (mid-April to mid-May) and in the Chesapeake Bay during summer. They lay their eggs from May to mid-July. Incubation takes 24 to 26 days, and young take 26 to 27 days to fledge. The largest colony in the state was recently established on the Hampton Roads Bridge-Tunnel Island; however, the invasion of the laughing gull within this site reduced the population of Common terns by over 75 percent (Watts and Paxton, 2014).

Least Tern (*Sterna antillarum*) (Craney Island Conservation Site) – The Least tern is classified under Virginia's Wildlife Action Plan as a Tier II species with a "Very High Conservation Need." Least terns lay their eggs from May to July and the incubation period lasts from 20-22 days. This species is common in Virginia. In 2008, colonies in Virginia were documented on roof tops in urban areas for the first time (Watts and Paxton, 2014). Least terns feed by skimming the water surface or by hovering and diving to catch prey (VDGIF, 2016b).

Black Skimmer (*Rynchops niger*) (Hampton Roads Bridge-Tunnel Conservation Site) – The Black skimmer is classified under Virginia's Wildlife Action Plan as a Tier II species with a "Very High Conservation Need." They breed from mid-April to mid-May and lay their eggs from mid-May to early July (VDGIF, 2016b). A common visitor to the Eastern Shore and lower Chesapeake Bay during the summer, the Black skimmer feeds mainly on small fish and crustaceans, which they obtain by skimming in shallow water.

Environmental Consequences

The **No-Build Alternative** would not involve construction or changes to the natural environment. None of the roadways would be expanded and no new crossings built. As a result, environmental effects to colonial waterbirds from the No-Build Alternative are not anticipated. Any current effects on waterbird colonies, or lack thereof, would continue. All of the build alternatives have the potential to impact one or both of the waterbird colonies located within the Study Area Corridors. According to the VDGIF, line of sight distance is the primary factor in determining potential impacts of a construction project to colonial waterbirds. One half mile is the standard line of sight distance reviewed by the agencies. As the distance decreases, noise may also become a factor. Construction activity for all the build alternatives would be within one half mile of at least one of the waterbird colonies. The colonies potentially impacted by construction of the build alternatives are shown in **Table 2-21.**

Table 2-21: Potential Waterbird Colony Impacts

Colonies	Alternative
Hampton Roads Bridge-Tunnel Island	A, B, D
Craney Island	B, C, D

Source and notes: VFWIS, and VDCR, 2015b.

Alternative A intersects the Hampton Roads Bridge-Tunnel Island Conservation Site. Proposed construction would occur within current breeding habitat for colonial waterbirds at the Conservation

Site, in conjunction with expansion of the island. Proposed construction activities may reduce the quality of the breeding habitat and possibly render portions of it temporarily unsuitable for future use due to fragmentation and impacts to the habitat. The proposed expansion of the island is anticipated to create additional breeding habitat suitable for the waterbird colonies. Any construction activity on the island that generates noise or sediment could also potentially impact waterbird colonies. However, the colonies have demonstrated the ability to persist at this location amid disturbances from cars, boats, airplanes, constant shipping traffic, as well as coastal storms. The proposed construction activities would not serve as an attractor to predators that could reduce breeding success of the waterbirds.

Alternative B intersects the Hampton Roads Bridge-Tunnel Island Conservation Site, and in addition, the eastern margin of the Craney Island Conservation Site. The effects of Alternative B on the Hampton Roads Bridge-Tunnel Island Conservation Site would have the same results as described for Alternative A. Alternative B would add the VA 164 Connector along the east side of CIDMMA. This would render the roadway footprint unsuitable for future nesting; though colony locations can vary from year to year depending upon where active dredge disposal is occurring. Foraging could temporarily be disrupted due to construction activities that generate noise, light, or sediment; however waterbirds on CIDMMA have demonstrated the ability to utilize other available suitable habitat on the island during construction activities which would be immediately adjacent to or over the island, and they may or may not return to the island following construction. Permanent foraging habitat would be lost beneath the new roadway but should not diminish the overall foraging potential of the Craney Island Conservation Site. As previously mentioned, predator control, as well as habitat creation from dredge disposal, have been the critical factors for the population of waterbird colonies on CIDMMA, but the introduction of a major bridge, and greater noise and disturbance such as from trash and roadway debris may impact bird use temporarily or permanently. While there are no federal noise criteria for protection of birds or natural areas, only a few studies have directly addressed the effect of noise from roads on wildlife. The use of a road's right-of-way by wildlife, including bird species, could indicate that there is no absolute noise levels negatively affecting them. However, there is a general consensus that some, although not all, bird species are sensitive to noise levels at least during breeding season. It is also recognized that the effect of noise on wildlife varies considerably based on the distances between the wildlife and the road and it must be determined if any negative effects are attributable to noise alone or if other factors and/or interactions are present (FHWA, 2004).

Alternative C also intersects the Craney Island Conservation Site and therefore would have the same results described for the Craney Island Conservation Site in Alternative B.

Alternative D intersects both the Hampton Roads Bridge-Tunnel Island Conservation Site and the Craney Island Conservation Site and therefore would have the same results described for Alternative B.

The VDCR's letter dated November 12, 2015 (VDCR, 2015b) recommends avoidance of the nesting sites for the Least tern in the Craney Island Conservation Site between April 15 and August 1, and due to the legal status of the Gull-billed tern, coordination with Virginia's regulatory authority for the management of this species, the VDGIF, is recommended to ensure compliance with the Virginia Endangered Species Act (VA ST §§ 29.1-563 – 570). Close coordination with the VDCR, VDGIF, and USACE will be required to minimize impacts to waterbird colonies to the maximum extent practicable. Minimization techniques resulting from this coordination could include the immediate stabilization and restoration of disturbed areas, construction noise reduction strategies, construction and dredge disposal sequencing or fencing to avoid nesting and foraging areas in use at that time, and dredge material placement that could maximize additional suitable breeding habitat. Surveys to locate existing waterbird colonies would also be required, in addition to evaluations to shift alignments during the design away from the resource to reduce the distance of the construction to the colony.

While beach disturbance during construction may temporarily or permanently make areas unacceptable for nesting waterbirds, all four alternatives could ultimately augment the existing beach habitat, providing an opportunity for increased suitable nesting habitat along the corridors. The construction or expansion of existing or new tunnel islands for all of the alternatives would likely increase the potential suitable nesting habitat for these waterbirds. Construction of new beach areas would include materials such as sand and stone that may provide the suitable nesting habitat. Additionally, the other known waterbird colony nesting sites within a 2 mile radius of the project area would provide temporary suitable nesting habitat during construction activities.

2.2.3 Benthic Species

Regulatory Context

Benthic species are bottom-living organisms which may include shellfish, other macroinvertebrates, and vertebrates. This section discusses three commercially important benthic species known to occur within the Study Area Corridors: the hard clam (*Mercenaria mercenaria*), the blue crab (*Callinectes sapidus*), and the oyster (*Crassostrea virginica*), as well as the benthic community assemblage.

The VMRC manages both recreational and commercial saltwater fishing and marine water bottoms in public trust. The agency is responsible for shellfish regulation and private leasing of State bottom as well as encroachment on these resources under Section 28.2-1203 of the Virginia Code. Impacts to benthic resources are evaluated by VMRC when determining whether to issue a permit to encroach upon State bottom. The USACE also considers impacts to these and other benthic resources during their 404(b)(1) Guidelines evaluation (40 CFR 230.20, 230.31, and 230.40) and public interest review (33 CFR 320.4(a)) when determining whether to issue a permit for the discharge of dredged or fill material into WOUS.

Methods

The Chesapeake Bay Aquaculture Vulnerability Model (AVM), developed by the Center for Coastal Resources Management (CCRM), uses physical, biological, landscape, and regulatory parameters to evaluate aquaculture suitability. In addition to vulnerability ratings for oysters and hard clams, the dataset also includes the extents of public shellfish grounds, submerged aquatic vegetation habitat (crab habitat), and oyster sanctuaries. The data is a product of the Center for Coastal Resources Management's Comprehensive Coastal Inventory Program at the Virginia Institute of Marine Science (VIMS) (CCRM, 2016). Data that was not available through the AVM was requested from regulatory entities, including VMRC and NOAA. The limits of condemnation zones were provided by the VDH Division of Shellfish Sanitation (VDH, 2016). Private lease grounds for shellfishing were provided by VMRC (VMRC, 2016a). These areas apply to both clams and oysters. The location and extents of oyster reefs were acquired from the VIMS Virginia Oyster Stock Assessment and Replenishment Archive (VOSARA) map viewer, and polygons were digitized for use in GIS-based mapping (VIMS, 2015). Blue crab sanctuary locations were provided by VMRC (VMRC, 2016a). Bottom type mapping was provided by NOAA using NOAA's Coastal and Marine Ecological Classification Standard (CMECS) Substrate Component (SC) (NOAA, 2016f). Benthic infauna data was acquired from EPA's National Aquatic Resource Surveys data collected through the National Coastal Conditions Assessment (USEPA, 2012).

The benthic environment present within the Study Area Corridors was determined by performing a GIS overlay of the Study Area Corridors on top of the GIS data obtained from VIMS, VMRC, NOAA, and VDH. Potential impacts to the hard clam, blue crab, and oyster, were calculated by performing GIS overlays of the LOD, which is based on roadway engineering completed to date, on top of the GIS data obtained from VIMS, VMRC, NOAA, and VDH. Potential impacts are also presented through a qualitative discussion of the current population and harvesting status of these resources.

Affected Environment

Benthic species are organisms that live at the bottom of water bodies like the Chesapeake Bay, and form an important part of the food web. Both commercially and ecologically important invertebrate species reside in the vicinity of the Study Area Corridors. Commercially important shellfish, such as the hard clam, blue crab, and oysters are generally epifaunal (reside on the substrate and provide water filtration and are part of the food web). Infaunal species reside within the substrate and are generally primary and secondary consumers and play an important trophic role in the ecosystem. Many benthic species are stationary, feed upon primary producers (phytoplankton) and are good indicators of water quality and sediment conditions.

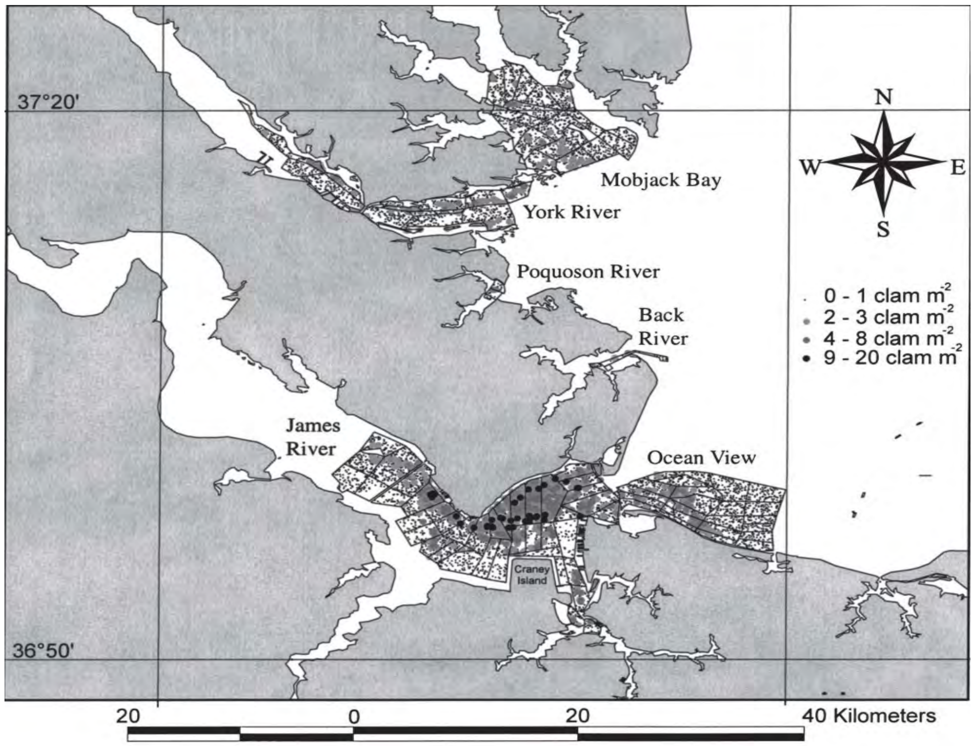
Hard Clam

Hard clams, or quahogs, are filter feeders common to the Chesapeake Bay and Lower James River, inhabiting sand and mud flats throughout the vicinity of the Study Area Corridors. The ecological value of these organisms is high. Hard clams contribute to water quality, nutrient cycling, and serve as an important component of the trophic web as prey for species such as gulls, tautogs, waterfowl, cownose rays, blue crabs, and oyster drills. As oyster and finfish stock has declined in Bay waters, the hard clam has become one of the most important commercial species in the Chesapeake Bay.

Harvesting pressure in the Bay has increased greatly since 1990, reducing the number of high density clam areas and corresponding to a decline in harvest and total catch per license (Wesson, 1995). The most recent population density study was conducted in 2001/2002 and was published in 2005 by Mann et al. Their research sampled Mobjack Bay, the lower York River, a portion of the Chesapeake Bay, and portions of the lower James River and found that the highest densities of hard clams were generally concentrated between the MMMBT and the HRBT, which is the area bounded on both sides by the Study Area Corridors.

As presented in **Figure 2-9**, the highest density of hard clams in the vicinity of the Study Area Corridors is located in the deeper central areas of Hampton Roads, along the shipping channel, between Newport News Point and the HRBT. This area is composed primarily of sand and muddy sand, as shown by the CMECS SC (**Figure 2-10**) (NOAA, 2015d). According to the Chesapeake Bay Program, hard clams can be found from the shoreline to a depth of 60 feet (CBP, 2016b). In addition to the deeper waters of the central channel, highest densities were observed along the shoreline corresponding to the Hampton Flats Hard Clam Harvest Area public clamming grounds along the Hampton shoreline (**Figure 2-11**). As shown in the CMECS SC (**Figure 2-10**), this area and surroundings contains sand substrate, and the public area located on the southern side of the study corridor, offshore of CIDMMA, is primarily mud and sandy mud. This southern area is part of a larger historical public shellfishing grounds known as Baylor Grounds. There are no Baylor Grounds within the Study Area Corridor of Alternative A. There are 103 acres of Baylor Grounds within the Study Area Corridor of Alternative B, 205 acres within Alternative C, and 214 acres within Alternative D. The entirety of all Study Area Corridors is considered potential clam habitat because the entire bottom is composed of sand, mud, or a combination suitable for clams. There are 273 acres of clam habitat present within Alternative A, 576 acres in Alternative B, 961 acres in Alternative C, and 1,477 acres in Alternative D. Private shellfish leases are shown in **Figure 2-11**. While two of them are close to I-664, none intersect any of the Study Area Corridors.

Figure 2-9: Clam Densities (2001-2002)



The Chesapeake Bay AVM identifies areas vulnerable to aquaculture (i.e. suitable for aquaculture) in Virginia waters. Clam vulnerability is presented in **Figure 2-12** according to the AVM classification. All areas that intersect the Study Area Corridors are classified as Level 4: Significant Conflicts. While scientific studies suggest these areas are the most productive in the vicinity, the Level 4 designation identifies the most unsuitable areas for aquaculture. It is not a measure of species productivity, but instead may be based on a number of factors, including pollution, which may condemn or prohibit shellfish harvesting.

The entire area between the MMMBT and the HRBT is classified as a Condemnation Zone for shellfishing, as designated by the Virginia Department of Health (**Figure 2-13**). Shellfish seasons are restricted in condemned areas and a permit from VMRC is required for harvest. Within these areas, shellfish may be collected from April 1 through November 1 in private lease areas and from May 1 through August 15 in public clamming grounds provided collected shellfish are transported to depuration waters for 15 days before market. This process is costly and is a deterrent for most or all commercial harvest in the vicinity; therefore, harvesting activity is virtually non-existent within the condemnation zone (Wesson, 2016). Jim Wesson, VMRC Department Head of Conservation and Replenishment, also noted that the Hampton Flats Hard Clam Harvest Area and Baylor Grounds remains reserved for public use; however, it is unlikely that the condemned status of these waters will be lifted within the foreseeable future or that they will have a high commercial use value. The condemnation zone limits are dictated by a buffer distance from Hampton Roads Sanitation District outfalls, rather than water quality. Therefore, as long as Hampton Roads Sanitation District operates the outfalls, the waters within the study area will remain condemned for shellfishing.

The area known as Hampton Bar is a section of bottom that has been historically productive as a wild clam fishery, although the area is mapped as “sand, no shell” by the CMECS SC. Hampton Bar does not have easily defined limits but is located west of the HRBT with its approximate location shown on **Figure 2-11**. Hampton Bar may be suitable as clam habitat; however, it is not public clamming grounds and commercial harvesting has not been practiced at Hampton Bar in several years (Wesson, 2016a). As with the rest of the Study Area Corridor, it has not been cost effective for commercial operations to catch clams at Hampton Bar due to the rigorous safety controls and expensive relay process required of all condemned areas. VMRC does not anticipate any commercial use in this area in the future. The Commission has also instituted a policy, since 2015, not to accept any new private lease applications in condemned waters; therefore, private harvest may not occur within Hampton Bar (Wesson, 2016).

Figure 2-10: CMECS Substrate Component, Bottom Types

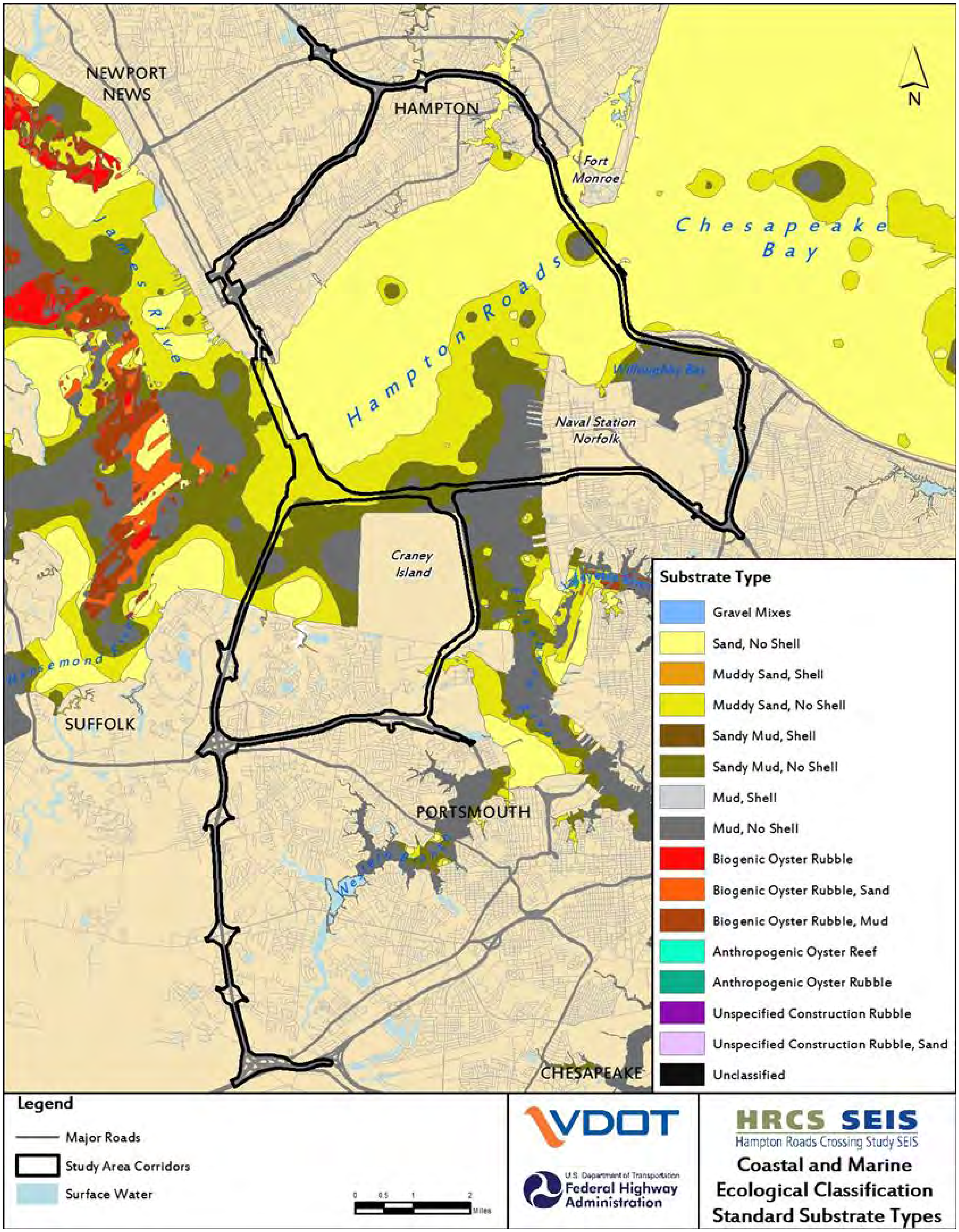


Figure 2-11: Existing Benthic Resource Areas

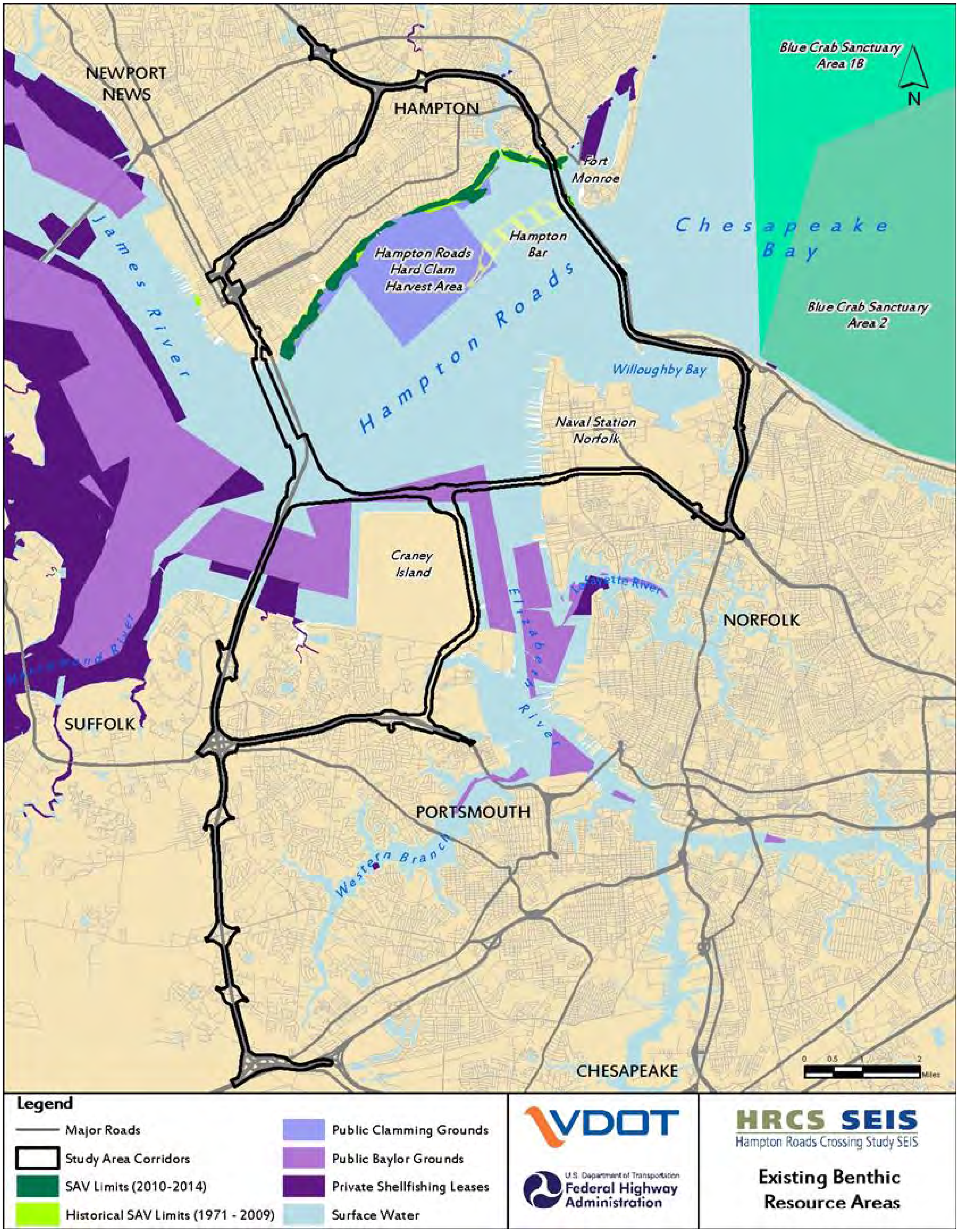


Figure 2-12: Aquaculture Vulnerability Model

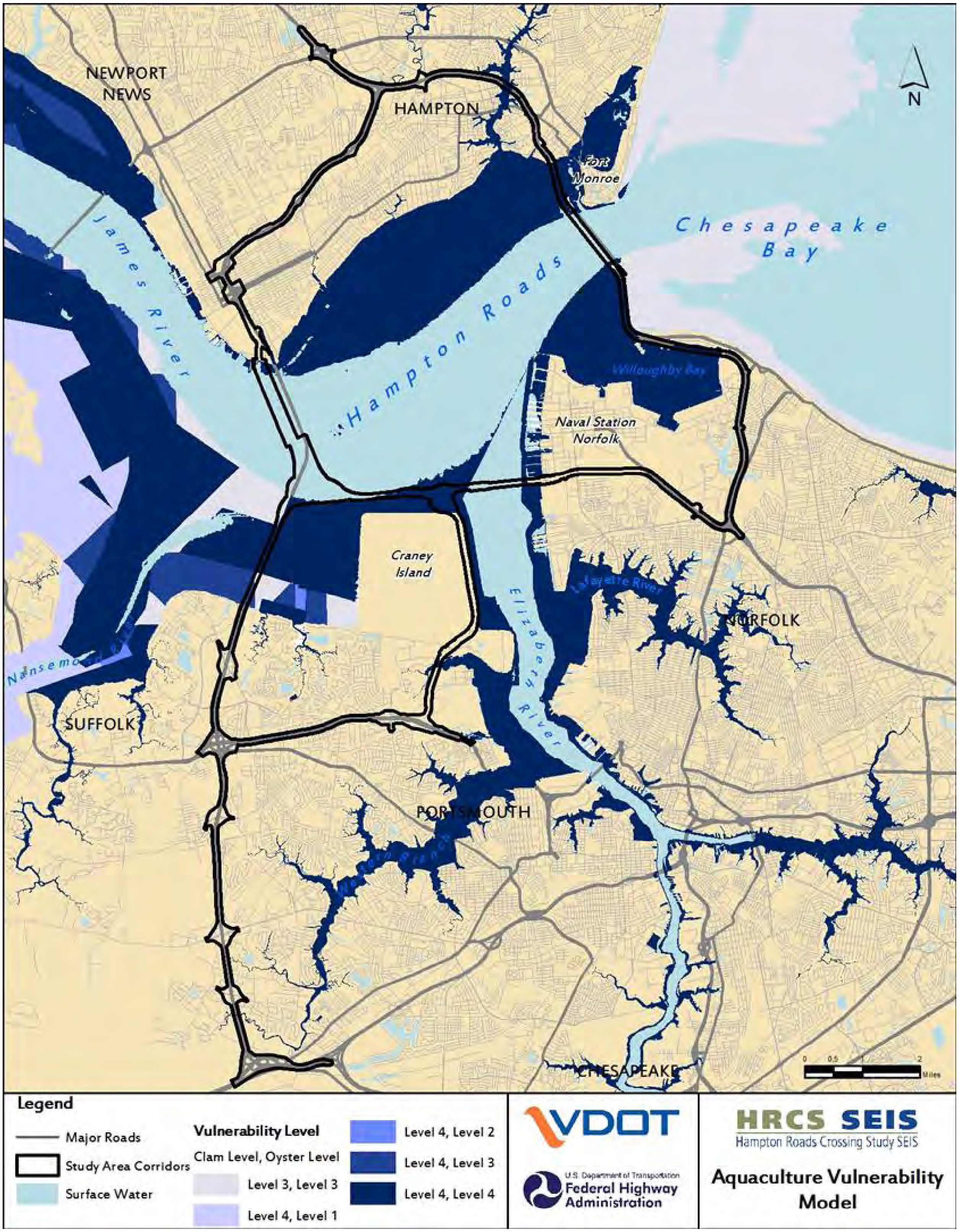
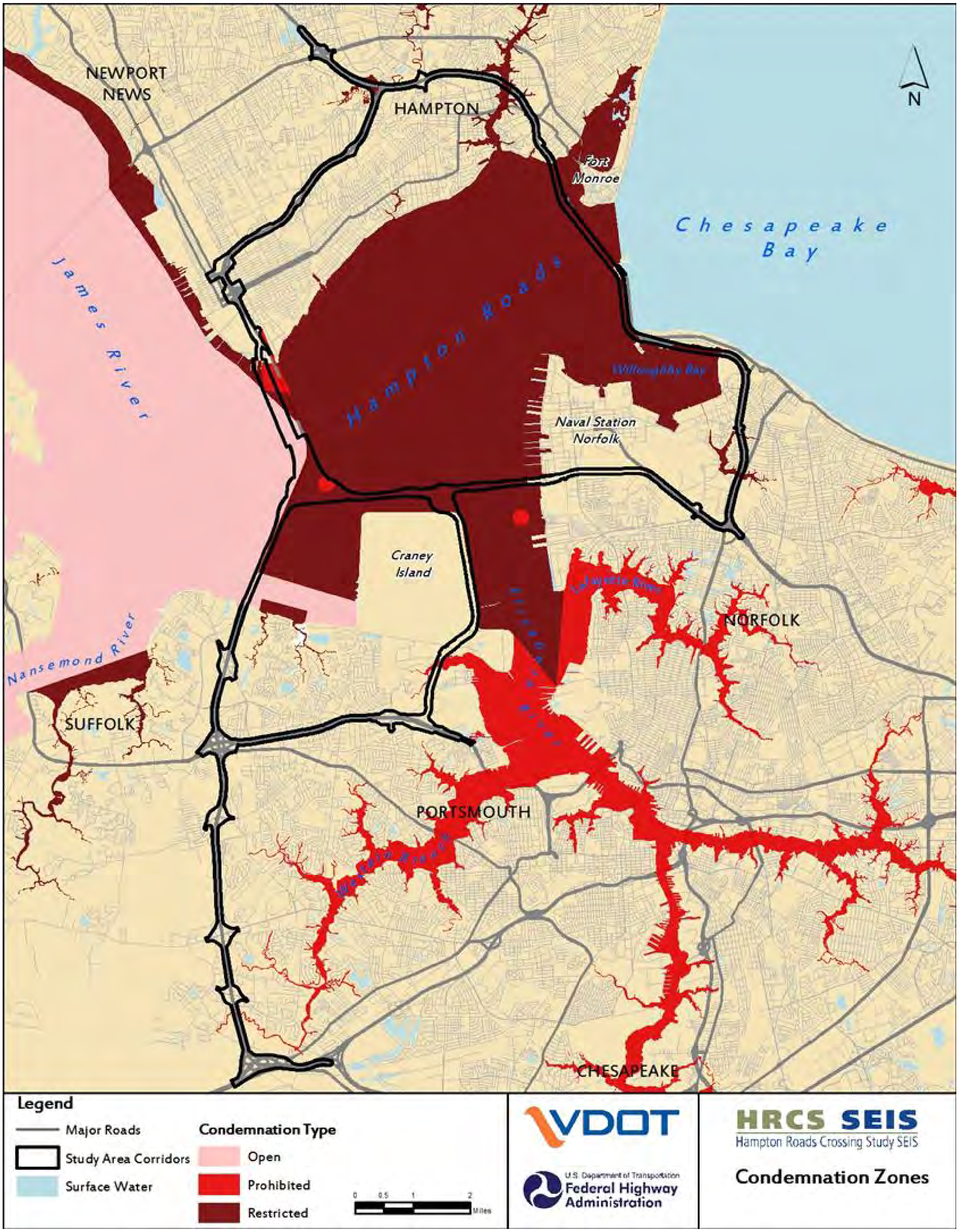


Figure 2-13: Condemnation Zones for Shellfishing



Blue Crab

Blue crabs are important both commercially and ecologically within the Chesapeake Bay and lower James River. Certain life stages of blue crab, particularly juveniles and during molts, are a primary food source for eel, drum, spot, Atlantic croaker, striped bass, sea trout, catfish, some sharks, and cownose rays. As such, the blue crab is an important part of the trophic web. Bay grass is essential habitat for the blue crab, especially while they are vulnerable to predators after molting. They also use underwater grass beds as nursery areas and foraging grounds for feeding. Species of SAV most commonly found in the Chesapeake Bay and its tributaries within the vicinity of the Study Area Corridors include eelgrass (*Zostera marina*) and widgeon grass (*Ruppia maritima*). Other species, less likely to occur due to their association with freshwater and lower salinity levels, include wild celery (*Vallisneria americana*), hydrilla (*Hydrilla verticillata*), redhead grass (*Potamogeton perfoliatus*), sago pondweed (*Stuckenia pectinata*), and Eurasion watermilfoil (*Myriophyllum spicatum*) (Orth et al., 2015). These grass beds serve important rearing and refugia functions and are essential habitat for blue crab survival and propagation. As shown in **Figure 2-11**, SAV is only present along the eastern side of the north island of the HRBT, just west of Fort Monroe, as well as along the north shore of Hampton Roads between I-64 and I-664. Therefore, no SAV beds exist within the Study Area Corridor of Alternative C, however there are approximately 5 acres of existing SAV beds and 5 acres of historic beds located within the Study Area Corridor for Alternatives A, B, and D.

According to the 2015 Chesapeake Bay Blue Crab Advisory Report released by the Chesapeake Bay Stock Assessment Committee (CBSAC, 2015), blue crab productivity has increased greatly in the last year in the vicinity of the Study Area Corridors. Adult females in the Chesapeake Bay increased by 32 percent from 2014 to the start of the 2015 crabbing season, with 101 million female spawning-age crabs. Female spawning-age crabs are considered an indicator of Bay health by the Chesapeake Bay Program (CBP). The 2011 benchmark assessment, cited in the report, recommended a 70 million female minimum threshold and a target abundance of 215 million female spawning-age crabs. Therefore, blue crab populations are not considered depleted, but they remain below the recommended target.

Blue crabs become common within the lower James River beginning in March and become abundant by April (Land et al., 1995). They are at their lowest densities and are nearly absent from these areas in January and February, according to trawl surveys. The closest Blue Crab Sanctuaries, Areas 2 and 3, are located in the Chesapeake Bay, and do not intersect any of the Study Area Corridors (**Figure 2-11**).

Oyster

The eastern oyster has represented an important commercial fishery in the Chesapeake Bay and its tributaries since Colonial times; however, populations have dropped dramatically due to over-harvesting, disease, habitat loss, and pollution. Oysters, as filter feeders, have ecological value both related to water quality and as an important food source for other marine organisms. Oyster habitat is typically brackish or salt water from 8 to 35 feet deep (CBP 2016a).

While the fishery remains at reduced but healthy levels within the Chesapeake Bay, management plans are being implemented to preserve long term oyster stock through a tributary-based restoration strategy. Areas around CIDMMA and the southern portion of the MMMBT are mapped as Baylor Grounds. Public Baylor Grounds are state-owned subaqueous bottom areas that historically contained oyster beds and are classified as public shellfishing grounds, including clam harvest. Densities are extremely low within the vicinity of the Study Area Corridors, and there are no existing oyster sanctuaries, reefs, or high quality habitat within the Study Area Corridors **(Figure 2-11**).

As previously discussed, the entire area between the MMMBT and the HRBT is classified as a Condemnation Zone for shellfishing, which constitutes a closure to direct market harvest of clams and oysters. Indirect harvesting, by permit, is allowed in season within these areas if harvested shellfish are first transported to approved depuration waters for 15 days before market. Although this is permitted, the oyster populations within the project vicinity are not abundant, nor are conditions favorable for their growth. As with clam harvest, additional time and expense of transport and holding is a deterrent for most or all commercial harvest in the vicinity; therefore, harvesting activity is virtually non-existent within the condemnation zone (Wesson, 2016). All areas that intersect the Study Area Corridors are classified as Level 4: Significant Conflicts, by the AVM for oyster vulnerability. The Level 4 designation identifies the most unsuitable areas for aquaculture.

The Hampton Bar has historically been productive as a wild clam fishery, but has limited oyster populations (Wesson, 2016a). It is not included as Baylor Grounds or public oyster grounds. While this area may be suitable as clam habitat, it is unlikely that there would be any interest in oyster restoration in the immediate vicinity of Hampton Bar. There would be little opportunity for any person to improve this area for oyster production since VMRC's policy is to not accept any new private lease applications in condemned waters (Wesson, 2016a).

Additionally, there are no active oyster reefs located within the Study Area Corridors, as documented by the VOSARA (**Figure 2-11**). According to Dr. Roger Mann, of VIMS, oyster populations in the downstream reaches of the James River were eliminated by disease in the 1950s as well as more recently (Mann, 2016). According to NOAA's CMECS SC, there are no historical shell beds, oyster reefs, or shell-inclusive substrate present within the Study Area Corridors or between the MMMBT and the HRBT; however, there are both biogenic and anthropogenic oyster reefs and shell-inclusive substrate types upstream of the MMMBT.

Private Lease Areas

Private lease shellfishing grounds are granted by VMRC pursuant to the provisions of Chapter 6 of Title 28.2 of the Code of Virginia. No private shellfish lease areas exist within the Study Area Corridors. Several private lease areas are located in the vicinity of the Study Area Corridors, including near Fort Monroe and near the southern terminus of the MMMBT (**Figure 2-11**).

Benthic Infauna

Benthic infaunal organisms live in marine and coastal sediments including the Hampton Roads Study Area Corridors and provide important ecological services, particularly as a component of the food web. Benthic infauna have a variety of feeding strategies, which include direct deposit, carnivory, and filtration. Most benthic infaunal species disperse through a motile larval or juvenile stage and as adults have restricted motility. It is the highly motile larval stage that allows for rapid recolonization of disturbed habitats for many benthic infaunal taxa. Additionally, a variety of benthic infaunal taxa are used as indicator species to determine overall sediment and water quality conditions.

EPA's National Aquatic Resource Survey has benthic[i] sampling data from four monitoring stations within the vicinity of the Study Area Corridors (**Figure 2-14**). The total taxa list in **Table 2-22** represents organisms observed at the four monitoring stations sampled between 2005 and 2006, which is the most recent representative dataset in the vicinity of the Study Area Corridors.

Table 2-22: Benthic Infauna Sampling Data

	Benthic Monitoring Stations				
Existing Taxa	VA05-0033-A	VA05-0049-A	VA06-0051-A[1]	VA06-0067-A	Total Individuals
Mediomastus ambiseta	6	33	5	117	161
Paraprionospio pinnata	0	18	23	7	48
Streblospio benedicti	7	20	1	0	28
Glycinde solitaria	7	8	4	7	26
Phoronis	1	2	0	12	15
Caulleriella killariensis	0	0	0	12	12
Leitoscoloplos	0	9	2	1	12
Ampelisca verrilli	2	0	0	9	11
Acteocina canaliculata	1	9	0	0	10
Ampelisca	0	3	0	6	9
Spiophanes bombyx	0	0	0	6	6
Listriella clymenellae	0	0	0	6	6
Nemertea	0	2	0	4	6
Leucon americanus	0	4	0	0	4
Mysidopsis bigelowi	0	3	0	0	3
Phyllodoce arenae	0	0	0	3	3
Stylochus ellipticus	1	0	0	2	3
Tubificoides	0	2	0	0	2
Neanthes succinea	0	0	0	2	2
Rictaxis punctostriatus	2	0	0	0	2
Eteone heteropoda	0	2	0	0	2
Loimia medusa	0	1	0	1	2
Clymenella torquata	1	0	0	1	2
Macoma balthica	0	0	1	0	1
Sigambra tentaculata	0	1	0	0	1
Ameroculodes	1	0	0	0	1
Macoma tenta	0	0	0	1	1
Podarkeopsis levifuscina	0	0	1	0	1
Edotia triloba	1	0	0	0	1
Unciola serrata	1	0	0	0	1
Monocorophium tuberculatum	0	0	0	1	1
Heteromastus filiformis	0	0	0	1	1
Glycera americana	0	0	0	1	1
Notomastus	0	0	0	1	1
Linopherus	0	1	0	0	1
Neomysis americana	1	0	0	0	1

Source and notes: USEPA, 2012. 1. Station VA06-0051-A is located within Little bay at Willoughby Spit. Other stations are located within the Hampton Roads waterbody.

Among the four sampled Hampton Roads stations, abundances were low for most taxa, often with fewer than 10 individuals. The four sampled stations had *Mediomastus ambiseta* as the most abundant taxa.

Mediomastus ambiseta is a capitellid polychaete worm and is considered to be an opportunistic, early successional stage (Stage I) colonizer of disturbed marine habitats. This species can tolerate hypoxic conditions and is frequently found in high abundances in silty, organically enriched habitats. The second and third most abundant taxa were two spionid polychaetes that are also considered opportunistic Stage I species (*Parapionospio piñata* and *Streblospio benedicti*). These spionid polychaetes are rapid recolonizers of disturbed habitats (Rhodes and Germano 1982, Newell 2004). Later successional species are typically represented by larger, longer-lived, deeper burrowing, and predatory organisms that cannot tolerate hypoxic sediment conditions. Secondary successional stage species (Stage II) such as bivalves (*Macoma* spp.) and ampeliscid tube-building amphipods along tertiary, end-stage successional taxa (Stage III) such as Glycera americana were present in these samples but in low abundances, often with two or fewer individuals. Additionally, given the volume of shipping traffic and influence of eutrophication from river based sediment loading, it is unlikely that the Hampton Roads benthic communities will progress to a Stage III community but will continue to remain in fluctuation between Stage I and Stage II with few Stage III organisms present, characteristic of urban coastal waterways.

Figure 2-14: USEPA Benthic Monitoring Stations

Environmental Consequences

The **No-Build Alternative** would not involve any construction or changes to the natural environment. As a result, environmental effects to benthic species from the No-Build Alternative are not anticipated.

All four of the **build alternatives** have the potential to impact benthic resources. Proposed dredge and fill to widen existing infrastructure and to construct additional lanes associated with any of the build alternatives could have permanent impacts, as well as temporary impacts. Loss of habitat and impacts to any existing benthic communities could result from the dredging associated with the tunnels, installation of bridge foundations, and the enlargement of the portal islands. Construction disturbances would temporarily increase suspended solids and could release nutrients, toxicants, and other contaminants potentially within the substrate. Any disturbance to sediment would settle after construction, and benthic habitat would naturalize. Naturalization is a gradual process and can vary from weeks to years, dependent on a number of variables. The Affected Environment section of this report describes existing conditions generally as disturbed and comprised primarily of abundant opportunistic, rapidly recolonizing benthic species with the presence of commercially important species (hard clams, oysters, and blue crabs). The presence of highly abundant opportunistic taxa of benthic infauna suggests that dredging and other disturbances from construction would have temporary impacts to the benthic infaunal community and that these communities will rapidly recover (days to weeks) from surrounding habitats and larval recolonization.

As described by Rhoads and Germano (1982), recolonization by these opportunistic taxa is fast, aggregating within days to weeks after disturbance (Newell, 2004) and typically near the surface of the substrate. For this reason, temporary disturbance within the project area is expected to have minimal impact to the benthic infaunal community and is expected to recover to baseline conditions quickly. Nichols et al. (1990) found that macrobenthic assemblages in the vicinity of the Rappahannock Shoals Channel were not affected by hopper dredging and discharge. Although suspended sediment concentrations in the water column exceeded certain water quality standards, benthic communities survived the perturbation with little effect, as measured by sampling for 14 days after the dredging. Other research in the Chesapeake Bay region shows that impacted benthic populations recolonize and reestablish within months to a year and a half (Nichols et al., 1990).

Temporary impacts could result from cofferdams, causeways or temporary roads, work bridges or barges, dredge material dewatering and disposal, and construction staging areas. Long-term impacts could be associated with any long-term effects to water quality, as discussed in the Water Quality section.

Potential impacts within the LOD of each build alternative is presented in **Table 2-23**. Areas of impact apply to potential habitat and protected areas for each of the three commercially significant species (hard clam, blue crab, and oyster) and would also apply to the benthic infauna. They also include impacts to public use lands, which are impacted by all alternatives except Alternative A, and which would require legislation to convert use prior to permitting construction.

Table 2-23: Potential Impacts to Benthic Resources

Resource	Alternative A (acres)	Alternative B (acres)	Alternative C (acres)	Alternative D (acres)
Hard Clam Habitat (total)[1]	154	236	571	657
Hard Clam Habitat (tunnels)[1]	109	143	294	370
Hard Clam Habitat (portal island expansions and new islands)[1]	29	57	87	105
Public Clamming Grounds[2]	0	0	0	0
Blue Crab Habitat/SAV[3]	2	2	0	2
Blue Crab Sanctuary[4]	0	0	0	0
Oyster Reefs[4]	0	0	0	0
Oyster Sanctuary[4]	0	0	0	0
Public Baylor Grounds[4]	0	5	93	85
Private Shellfishing Leases[5]	0	0	0	0

Source and notes: All shellfish impacts are within a Condemnation Zone, including hard clams and oysters. 1. The entire footprint beneath each alternative is considered potential clam habitat because the entire bottom is composed of sand, mud, or a combination suitable for clams (NOAA, 2015d and NOAA, 2016f). 2. CCRM, 2016). 3. VIMS, 2014. 4. Low density oysters may be present; however, no high quality oyster habitat, sanctuary, or reefs are present (CCRM, 2016 and VIMS, 2015). 5. VMRC, 2016a.

Alternative A would have the least amount of impact of the build alternatives due to its comparably smaller footprint to subaqueous bed and surface waters, as it is the only alternative that has a single crossing (the HRBT portion of I-64). Alternative A would minimally impact SAV blue crab habitat along the north shore of Hampton Roads (discussed in more detail in the Environmental Consequences portion of the Submerged Aquatic Vegetation section), and have the least amount of impact on the bottom types comprising clam habitat. Clam habitat is widespread in the area since all the substrate in Hampton Roads is suitable clam habitat, and there would be no impacts to the Hampton Flats Hard Clam Harvest Area. The entire area surrounding Alternative A is classified as a Condemnation Zone for shellfishing. Furthermore, all areas of potential shellfish harvesting are classified as Level 4: Significant Conflicts, by the AVM for clam and oyster vulnerability. The Level 4 designation identifies the most unsuitable areas for aquaculture.

Alternative B would impact the Public Baylor Grounds north and northeast of CIDMMA with a bridge-tunnel across the Elizabeth River in addition to the impacts of Alternative A. As discussed, these areas have been condemned for shellfishing and no longer support commercial harvest of oysters or clams; however they remain public shellfishing grounds. The VMRC cannot issue a permit to encroach upon Baylor Grounds unless the Virginia General Assembly removes that portion of the Baylor Grounds from the official survey. Therefore, implementation of Alternative B would require legislative action to adjust the limits of the Baylor Grounds. As with Alternative A, the entire area surrounding Alternative B is classified as a Condemnation Zone for shellfishing. Furthermore, all areas of potential shellfish harvesting are classified as Level 4: Significant Conflicts, by the AVM for clam and oyster vulnerability.

Alternative C has the greatest amount of dredging because it includes two additional tunnels adjacent to the MMMBT, as well as two tunnels across the Elizabeth River to accommodate two transit-only lanes. It also has more miles of bridge across subaqueous bottom than Alternatives A and B and a greater amount of overall benthic habitat due to the longer crossing of Hampton Roads with I-664. The status and condition of the resources are equal, with the exception of two small areas beneath I-664 that are open to shellfishing. The area along the south shore of the James River also has a lower vulnerability level and is slightly more conducive to clam and oyster aquaculture. The additional Public Baylor Grounds impacted to the north and west of CIDMMA are, however, within the Condemnation Zone. Clam habitat is widespread since all the substrate in Hampton Roads is suitable clam habitat, and there would be no impacts to the Hampton Flats Hard Clam Harvest Area.

Alternative D has less dredging than Alternative C because only one tunnel will be placed adjacent to the MMMBT and also across the Elizabeth River. It has the largest potential area of disturbance for construction and other offsite activities. One exception is the amount of Public Baylor Grounds. Alternative D would impact less Public Baylor Grounds than Alternative C because of the different lane configurations for I-664, the I-564 Connector, and the I-664 Connector. The status and condition of the resources is the same as previously discussed for the other build alternatives. Since the vast majority of the area between the MMMBT and the HRBT is classified as a Condemnation Zone for shellfishing, there would be minimal effects to clam and oyster harvests. Additionally, there are no oyster reef populations, shellbeds, shell-inclusive substrate, coarse gravel, rock, or rubble substrate within Alternative D, or any other alternative according to the CMECS SC database (**Figure 2-10**). Therefore, impacts to potential habitat are expected to be negligible, and potential impacts to low density populations by any build alternative would be minimal.

Construction BMPs, including conforming to the guidelines contained in the VESCH, would be employed to reduce turbidity and sediment disturbance. Examples may include certain dredging techniques discussed in the Dredging and Disposal of Dredged Material section, filtration of discharge water from barges/scows, and turbidity curtains, where applicable. These practices would also reduce potential nutrient, heavy metal, and other contaminant releases associated with sediment disturbance. The time of year and length of dredging operations may need to be considered as prolonged dredging would result in disturbance to the benthos and adjacent water column over a longer period of time dependent upon the nature of the bottom substrate, tidal fluctuations, and estuarine dynamics. However, this affect may be minimized by the constant mixing of water through wind and tidal action. Monitoring of near-field and far field turbidity during construction would help identify activities that require additional minimization measures or possibly cessation of certain activities. Strict adherence to erosion and sediment control measures and permit requirements would minimize water quality impacts due to sedimentation and turbidity during construction, including stockpiling and dewatering excavated material in a manner that prevents reentry into waterbodies, and strategic placement and continual maintenance of temporary sediment traps and basins. The immediate stabilization and restoration of disturbed areas would also decrease sedimentation and turbidity during construction.

Long-term effects to benthic communities due to changes in water quality would be minimized and avoided through implementation of stormwater management plans designed to minimize impacts from increases in impervious surfaces, mitigate increases in runoff volume, and satisfy requirements to reduce pollutant loads below existing baseline conditions, as required by the VSMP regulations and Chesapeake Bay TMDL. This would minimize any increases in contaminants which could cause impairment of the area waterbodies. Stormwater management measures, including bioretention, stormwater basins, infiltration practices, vegetated swales, filter strips, open space conservation, and others would be implemented to avoid and minimize water quality impacts.

The introduction of additional hard substrate such as pilings and riprap protection could provide beneficial habitat where it did not previously exist for oysters and other marine benthic organisms. The expansion of the portal islands would impact potential clam and benthic infaunal habitat composed of the fine particle substrates noted on **Figure 2-10** but would also provide structural habitat for oysters and other marine organisms. Once the tunnel construction is complete, the substrate above the tunnels would be available for benthic organisms to recolonize rapidly as described previously. Mitigation opportunities for permanent impacts to benthic resources may be available within the vicinity of the Study Area Corridors. The USACE's *Chesapeake Bay Oyster Recovery: Native Oyster Restoration Master Plan, Maryland and Virginia* was published in September 2012 to begin implementation of a sanctuary-based tributary restoration approach to declining oyster populations. Within the Master Plan, the Lower James River is listed as a Tier 1 tributary for future restoration with a restoration target of 900 to 1,800 acres. Tier 1 tributaries are the highest priority sites that demonstrate historical, physical, and biological attributes to promote the highest potential for oyster populations to become self-sustaining (USACE, 2012a). While there are currently no existing oyster reefs within the study area, nearby historical shell beds may be able to be re-established as sanctuaries, and existing upstream oyster reefs may be supplemented or otherwise enhanced. **Figure 2-10** shows historical oyster habitat and substrate composition in the vicinity of the study area corridors. Clam habitat is widespread throughout the project area vicinity and would likely recover over time. SAV areas, as important blue crab habitat, may require replanting or other compensation measures where they have been temporarily disturbed (refer to the Environmental Consequences portion of the Submerged Aquatic Vegetation section for more detail).

2.2.4 Essential Fish Habitat

Regulatory Context

The 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act strengthened the ability of the National Marine Fisheries Service (NMFS) (also known as NOAA Fisheries) and the regional fishery management councils (Councils) to protect and conserve the habitat of marine, estuarine, and anadromous finfish, mollusks, and crustaceans. This habitat is termed "essential fish habitat" (EFH) and is broadly defined to include "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." The Act requires the Councils to describe and identify the essential habitat for the managed species, minimize to the extent practicable adverse effects on EFH caused by fishing, and identify other actions to encourage the conservation and enhancement of EFH. This includes the identification of Habitat Areas of Particular Concern (HAPC), which are discrete subsets of EFH that provide extremely important ecological functions or are especially vulnerable to degradation. The Magnuson-Stevens Fishery Conservation and Management Act also establishes measures to protect EFH. NOAA Fisheries must coordinate with other federal agencies to conserve and enhance EFH, and federal agencies must consult with NOAA Fisheries on all actions or proposed actions authorized, funded, or undertaken by the agency that may adversely affect EFH by reducing the quantity or quality of habitat. In turn NOAA Fisheries must provide recommendations to federal and state agencies on such activities to conserve EFH. These recommendations may include measures to avoid, minimize, mitigate, or otherwise offset adverse effects on EFH resulting from actions or proposed actions authorized, funded, or undertaken by that agency (NOAA, 2015c).

Methods

NOAA's online mapping system (EFH Mapper v3.0) is used to provide the public and other resource managers an interactive platform for viewing a spatial representation of EFH, or those habitats that NMFS and the regional fishery management councils have identified and described as necessary to fish for spawning, breeding, feeding or growth to maturity (NOAA, 2015b). However, it has not yet been populated with all the Mid-Atlantic species and therefore cannot be used to identify EFH in the Hampton Roads region at this time (O'Brien, 2015). NOAA's Guide to EFH Designations in the Northeastern United States online mapping system was used to identify EFH and HAPC within the Study Area Corridors (NOAA, 2015c). This system uses 10-minute longitudinal by 10-minute latitudinal squares and reports the species with EFH within those squares. The Study Area Corridors for the HRCS SEIS lie within the four 10 x 10 minute squares listed in **Table 2-24**. These four squares span an area from approximately 5 miles west of the I-664 Monitor-Merrimac Memorial Bridge-Tunnel to 10 miles east of the I-64 Hampton Roads Bridge-Tunnel.

Table 2-24: 10 x 10 Minute Squares Evaluated for Essential Fish Habitat

Square	North	East	South	West
37007620	37° 10.0' N	76° 20.0' W	37° 00.0' N	76° 30.0' W
37007610	37° 10.0' N	76° 10.0' W	37° 00.0' N	76° 20.0' W
36507620	37° 00.0' N	76° 20.0' W	36° 50.0' N	76° 30.0' W
36507610	37° 00.0' N	76° 10.0' W	36° 50.0' N	76° 20.0' W

Source and notes: NOAA, 2015c.

The amount of EFH and HAPC within the Study Area Corridors was determined by performing GIS overlays of the Study Area Corridors onto the resource information referenced above. Potential impacts were calculated by performing GIS overlays of the LOD, which is based on roadway engineering completed to date, onto the resource information referenced above (NOAA, 2015c).

<u>Affected Environment</u>

Nine fish species, two shark species, and three skate species have EFH for various life stages within each of the 10 x 10 minute squares that encompass the Study Area Corridors. Therefore, all 14 species occur within all of the alternatives (**Table 2-25**). Alternative A contains 202 acres of EFH within the Study Area Corridors, while Alternative B contains 483 acres, Alternative C contains 935 acres, and Alternative D contains 1,382 acres. None of the species are listed as Threatened or Endangered by NOAA Fisheries. The Dusky Shark is listed as a Species of Concern. Species of Concern are those species about which NOAA Fisheries has some concerns regarding status and threats, but for which insufficient information is available to indicate a need to list the species under the Endangered Species Act. Species of Concern status does not carry any procedural or substantive protections under the Endangered Species Act (NOAA, 2016b). After completing a comprehensive status review of the Dusky Shark, NOAA Fisheries published a Notice of 12-Month Finding on December 16, 2014 in the Federal Register concluding that it does not warrant listing as Threatened or Endangered at this time.

Table 2-25: Essential Fish Habitat and Life Stages

Species	Life Stages
Windowpane flounder (*Scophthalmus aquosus*)	Eggs, Juveniles, Adults
Bluefish (*Pomatomus saltatrix*)	Juveniles, Adults
Atlantic butterfish (*Peprilus triacanthus*)	Eggs, Larvae, Juveniles, Adults
Summer flounder (*Paralichthys dentatus*)	Larvae, Juveniles, Adults
Black sea bass (*Centropristis striata*)	Juveniles, Adults
King mackerel (*Scomberomorus cavalla*)	Eggs, Larvae, Juveniles, Adults
Spanish mackerel (*Scomberomorus maculatus*)	Eggs, Larvae, Juveniles, Adults

Species	Life Stages
Cobia (*Rachycentron canadum*)	Eggs, Larvae, Juveniles, Adults
Red drum (*Sciaenops occelatus*)	Eggs, Larvae, Juveniles, Adults
Dusky shark (*Carcharhinus obscurus*)	Larvae, Juveniles
Sandbar shark (*Carcharhinus plumbeus*)[1]	Larvae, Juveniles, Adults
Clearnose skate (*Raja eglanteria*)	Juveniles, Adults
Little skate (*Leucoraja erinacea*)	Juveniles, Adults
Winter skate (*Leucoraja ocellata*)	Juveniles, Adults

Source and notes: NOAA, 2015c. 1) Habitat Area of Particular Concern (HAPC) present on all Alternatives.

NOAA's Guide to EFH Designations in the Northeastern United States online mapping system also identified one HAPC for the Sandbar Shark that spans across all of the alternatives and comprises the same area as the EFH for all 14 species. HAPCs are considered high priority areas for conservation, management, or research because they are rare, sensitive, stressed by development, or important to ecosystem function. The HAPC designation does not confer additional protection or restrictions upon an area, but can help prioritize conservation efforts.

EFH Areas Protected from Fishing are areas in which NMFS and the regional fishery management councils have used the EFH provisions established in Section 303(a)(7) of the Magnuson-Stevens Fishery Conservation and Management Act to prevent, mitigate, or minimize adverse effects from fishing on EFH. These areas do not necessarily represent areas in which NMFS has prohibited fishing. Rather, steps have been taken to minimize the impact that fishing has on EFH. These steps may include anchoring restrictions, required fishing gear modifications, or prohibitions on certain types of gear, among others. There are no EFH Areas Protected from Fishing within the Study Area Corridors (NOAA, 2015a) (NOAA, 2015b). The Study Area Corridors are however within the Southern Fishery Management Area. The purpose of this area designation is to restrict the methods used to fish for Monkfish (NOAA, 2011). There is no Monkfish EFH present within the Study Area Corridors, therefore there would be no impact.

Environmental Consequences

The **No-Build Alternative** would not involve any construction or changes to the natural environment As a result, environmental effects to EFH and HAPC from the No-Build Alternative are not anticipated.

All four of the **build alternatives** would impact EFH and HAPC. The construction of bridge approaches and piers, the placement/construction of tunnels, as well as other tributary and upland disturbances are all potential sources of impacts from dredging, filling, sedimentation, and turbidity. Permanent impacts to substrate or habitat could result from the permanent placement of tunnels, the area of piers or pilings associated with bridges, and the area filled with approaches and scour protection measures. Temporary impacts could result from cofferdams, causeways or temporary roads, work bridges or barges, dredge material dewatering and disposal, construction staging areas, and removal of benthos which could alter foraging behaviors.

During the construction phase, specifically during dredging and filling activities for bridge and tunnel installation, adjacent areas can be affected based on the tides and currents due to the re-suspension of sediment in the water column. Local and temporary siltation and turbidity may reduce the photic zone in areas of SAVs, may release contaminants in the sediment, and would result in the temporary loss of benthic communities which provide food sources for fish. The presence of highly abundant opportunistic taxa of benthic infauna suggests that these communities will rapidly recover (days to weeks) from surrounding habitats and larval recolonization. Further discussion on benthic recolonization is presented in the Environmental Consequences portion of the Benthis Species section.

Impacts to the individual species would vary based on the habitat considered to be essential for each species. Below is a partial list of EFH descriptions for each species showing the habitat that could be affected by construction of any of the build alternatives.

- Windowpane flounder – bottom habitats with a substrate of mud or fine-grained sand (NOAA, 2015b)
- Bluefish – estuaries within the "mixing" and "seawater" zones April through October (NOAA, 2015b)
- Atlantic butterfish – sheltered bays and estuaries, brackish waters (NOAA, 2015b)
- Summer flounder – estuaries within the "mixing" and "seawater" zones, salt marsh creeks, seagrass beds, mudflats, open bay areas (NOAA, 2015b)
- Black sea bass – estuaries within the "mixing" and "seawater" zones spring and summer, in association with rough bottom, shellfish, and eelgrass beds (NOAA, 2015b)
- King mackerel, Spanish mackerel, Cobia – coastal inlets, state designated nursery habitats, high salinity bays, estuaries (NOAA, 2015b)
- Red drum – tidal freshwater, estuarine emergent wetlands, sea grasses, oyster reefs and shell banks, unconsolidated bottom (NOAA, 2015b)
- Dusky shark – shallow coastal waters, inlets, and estuaries to the 82 feet (25m) isobaths (NOAA, 2015b)
- Sandbar shark – shallow areas and the mouth of the Chesapeake Bay (NOAA, 2015b)
- Clearnose skate – soft bottom, rocky, or gravelly substrate (NOAA, 2015c)
- Little skate & Winter skate – sandy, gravelly, or mud substrate (NOAA, 2015c)

The 14 species have various essential habitat requirements. Many of the habitats exist on all four build alternatives, while some may not. Since detailed impacts to each habitat cannot be quantified, **Table 2-26** shows the area of potential impacts to EFH and HAPC within the LOD of each build alternative.

Table 2-26: Potential EFH and HAPC Impacts

Resource	Alternative A (acres)	Alternative B (acres)	Alternative C (acres)	Alternative D (acres)
EFH	138	214	565	636
HAPC	138	214	565	636

Source and notes: NOAA, 2015c.HAPC is for the Sandbar Shark only.

Alternative A would have the least amount of impact of the build alternatives simply because it has the smallest footprint over the open water. Dredging, filling, sedimentation, and turbidity would occur from construction of the bridge-tunnel adjacent to the existing HRBT across Hampton Roads, with a bridge at Willoughby Bay. It is anticipated that this alternative would have the shortest duration of localized turbidity associated with construction compared to the other build alternatives considering the amount of dredging required. As shown in **Table 2-16**, the amount of dredging required for the tunnel is only 30% of the next highest dredge quantity (Alternative B) and 17% of the highest dredge quantity (Alternative C).

Alternative B includes the improvements associated with Alternative A, plus additional crossings associated with I-564, and the I-564 and VA 164 Connectors in and along the Elizabeth River. It would require dredge and fill activities for one new bridge-tunnel across the Elizabeth River, and therefore likely have a longer duration of localized turbidity than Alternative A given the additional dredge and fill activities. Alternative B has the second largest amount of dredging due to the length of the proposed tunnel under the Elizabeth River.

Alternative C includes the I-664 MMMBT and I-664 Connector crossings of the Hampton Roads/James River area in addition to the I-564 Connector. This alternative includes two additional tunnels adjacent to the MMMBT, as well as two tunnels across the Elizabeth River to accommodate two transit-only lanes. It also has more miles of bridge across subaqueous bottom than Alternatives A and B. While the potential acres of impact is less than Alternative D, Alternative C has a greater potential for sedimentation and turbidity because it would produce the greatest amount of dredged material due to two new tunnels adjacent to the MMMBT and across the Elizabeth River.

Alternative D has the largest potential acres of impact to EFH. The amount of dredging is less than Alternative C because only one tunnel will be placed adjacent to the MMMBT and also across the Elizabeth River. As with all other alternatives, the temporary and localized loss of benthic communities should have minimal impacts on prey availability given that the footprint encompasses only 614 acres of EFH and the availability of other benthic foraging habitat throughout Hampton Roads and the southern Chesapeake Bay. In addition, construction would most likely occur in discrete areas throughout the duration of the project, enabling juvenile and adult fish to avoid these areas.

In order to minimize impacts to the species and their EFH listed previously, NOAA Fisheries may require specific time-of-year restrictions on construction which would limit construction activities within a certain area. The time of year and length of dredging operations may need to be considered as prolonged dredging would result in disturbance to the benthos and adjacent water column over a longer period of time, having a greater effect on EFH, dependent upon the nature of the bottom substrate, tidal fluctuations, and estuarine dynamics. Dredging activities would be carefully planned and implemented to control sediment, nutrients, and benthic impacts in accordance with permit-specific requirements, to assure that any impacts are localized, temporary, and/or fully mitigated. Examples may include filtration of discharge water from barges/scows, eliminating overflow from barges during dredging or transport, reducing the speed of loaded buckets or cutterheads, sheet-pile enclosures, and turbidity curtains, where applicable. Stockpiling and dewatering excavated dredge material in a manner that prevents reentry into waterbodies, and strategic placement and continual maintenance of temporary sediment traps and basins would minimize water quality impacts due to sedimentation and turbidity during construction. Specific dredging BMPs would be identified during the design process, as the phased implementation of any alternative may allow for new methods to be identified prior to construction. Monitoring of near-field and far field turbidity during construction would help determine the effectiveness of the minimization measures to help dictate any adjustments or possibly cessation of certain construction activities. The immediate stabilization and restoration of disturbed areas would also decrease sedimentation and turbidity during construction. Other measures such as the use of bubble curtains to reduce sound/pressure waves which could negatively impact a fish species could be used. A formal consultation with the agency may be required during the permitting process to determine specific avoidance, minimization, and mitigation measures.

2.2.5 Anadromous Fish

Regulatory Context

Virginia is a member of the Atlantic States Marine Fisheries Commission (VA Code § 28.2-1000). A duty of the Commission is to prevent the depletion and physical waste of the marine, shell, and anadromous fisheries of the Atlantic seaboard. While this is not a regulatory mandate to protect anadromous fish, the VDGIF, in combination with NOAA Fisheries, oversees anadromous fish in Virginia. NOAA Fisheries has jurisdiction over anadromous fish listed under the Endangered Species Act through their Office of Protected Resources.

Methods

VDGIF documents both confirmed and potential Anadromous Fish Use Areas and maintains a database with this information. The presence of both confirmed and potential Anadromous Fish Use Areas was obtained using VDOT's CEDAR GIS Database which contains VDGIF's anadromous fish information from their VFWIS database (VDOT, 2015).

The amount of Anadromous Fish Use Area within the Study Area Corridors was determined by performing GIS overlays of the Study Area Corridors onto the resource information referenced above. Potential impacts were calculated by performing GIS overlays of the LOD, which is based on roadway engineering completed to date, onto the resource information referenced above.

Affected Environment

Anadromous fish are born in fresh water, migrate to the ocean to grow into adults, and then return to fresh water to spawn. Anadromous Fish Use Areas are areas that are being used, or potentially could be used, by anadromous fish. Confirmed Anadromous Fish Use Areas are those areas where anadromous fish species have been observed.

All build alternatives intersect the James River (including Hampton Roads) and/or the Elizabeth River, which are identified as Confirmed Anadromous Fish Use Areas, with six anadromous fish species using these areas within all of the alternatives to complete their life cycles (see **Table 2-27** and **Figure 2-15**) (VDOT, 2015). Alternative A contains 202 acres of Confirmed Anadromous Fish Use Areas within the Study Area Corridors, while Alternative B contains 483 acres, Alternative C contains 935 acres, and Alternative D contains 1,382 acres. This includes the major rivers depicted as well as any shallow water habitats closer to their shores that contain mudflats, swamps, and brackish wetlands. As described in the Benthic Species section, the substrate in the Hampton Roads area between the MMBMBT and the HRBT is composed primarily of muddy sand. Anadromous fish use this area primarily as a migration corridor to and from upstream spawning areas. While in the area they would typically consume insects, small fish, worms, and small crustaceans. Shellfish are not abundant as there is little to no shell-inclusive substrate in the area.

Table 2-27: Anadromous Fish and Use Areas

Confirmed Species	Status	Stream Name (VDGIF ID)
Alewife (*Alosa pseudoharengus*)	FSOC, VWAP Tier IV	James River 1 / Hampton Roads (C92)
American Shad (*Alosa sapidissima*)	VWAP Tier IV	James River 1 / Hampton Roads (C92)
Blueback Herring (*Alosa aestivalis*)	FSOC	James River 1 / Hampton Roads (C92)
Hickory Shad (*Alosa mediocris*)	--	James River 1 / Hampton Roads (C92)
Striped Bass (*Morone saxatilis*)	--	James River 1 / Hampton Roads(C92)
Yellow Perch (*Perca flavescens*)	--	James River 1 / Hampton Roads (C92) Elizabeth River (C20)

Source and notes: VDOT, 2015. FSOC = Federal Species of Concern. VWAP = Virginia Wildlife Action Plan.

Provided below are brief descriptions of the population status, spawning habits, and feeding habits of each anadromous fish species confirmed within the Study Area Corridors, as noted in VDOT's CEDAR GIS Database (VDOT, 2015). The Atlantic sturgeon (*Acipenser oxyrinchus*), a federally and state-listed endangered species, is also an anadromous fish, but is addressed separately in the Threatened and Endangered Species section.

Alewife (*Alosa pseudoharengus*) - The Alewife is a Federal Species of Concern. The Alewife is listed in Virginia's Wildlife Action Plan as a Tier IV species with a "Moderate Conservation Need." A Tier IV species with a Moderate Conservation Need means the species may be rare in parts of its range, particularly on the periphery. Populations of these species have demonstrated a declining trend or a declining trend is suspected which, if continued, is likely to qualify this species for a higher tier in the foreseeable future. Long-term planning is necessary to stabilize or increase populations, but no procedural or substantive protections are afforded it (VDGIF, 2005). Anadromous Alewives are common during spawning migrations; adults enter freshwater (usually a coastal stream) in the spring to spawn and the young, soon after hatching, return to the ocean. In the ocean, Alewives feed mainly on plankton, including small shrimp and crab-like forms, and small fish. Alewives are commonly transplanted into reservoirs to serve as forage for gamefish. Landlocked populations remain in the open water during the day and move to the littoral zone at night to feed on zooplankton, aquatic insects, and insect and fish larvae (VDGIF, 2016b).

American Shad (*Alosa sapidissima*) - The American shad is listed in Virginia's Wildlife Action Plan under Tier IV, "Moderate Conservation Need." American shad leave the ocean in spring and return to their natal streams to spawn. Adults return to the ocean soon after spawning. The larvae take 4 to 12 days to hatch, and the juveniles spend their first summer in freshwater. Young shad gather in schools and swim to the ocean by autumn (USFWS, 2016a). Non-spawning adults are usually found near the continental shelf. American shad typically feed on microcrustaceans, plankton, insects, worms, and small fishes. This species is native to Virginia (VDGIF, 2016b).

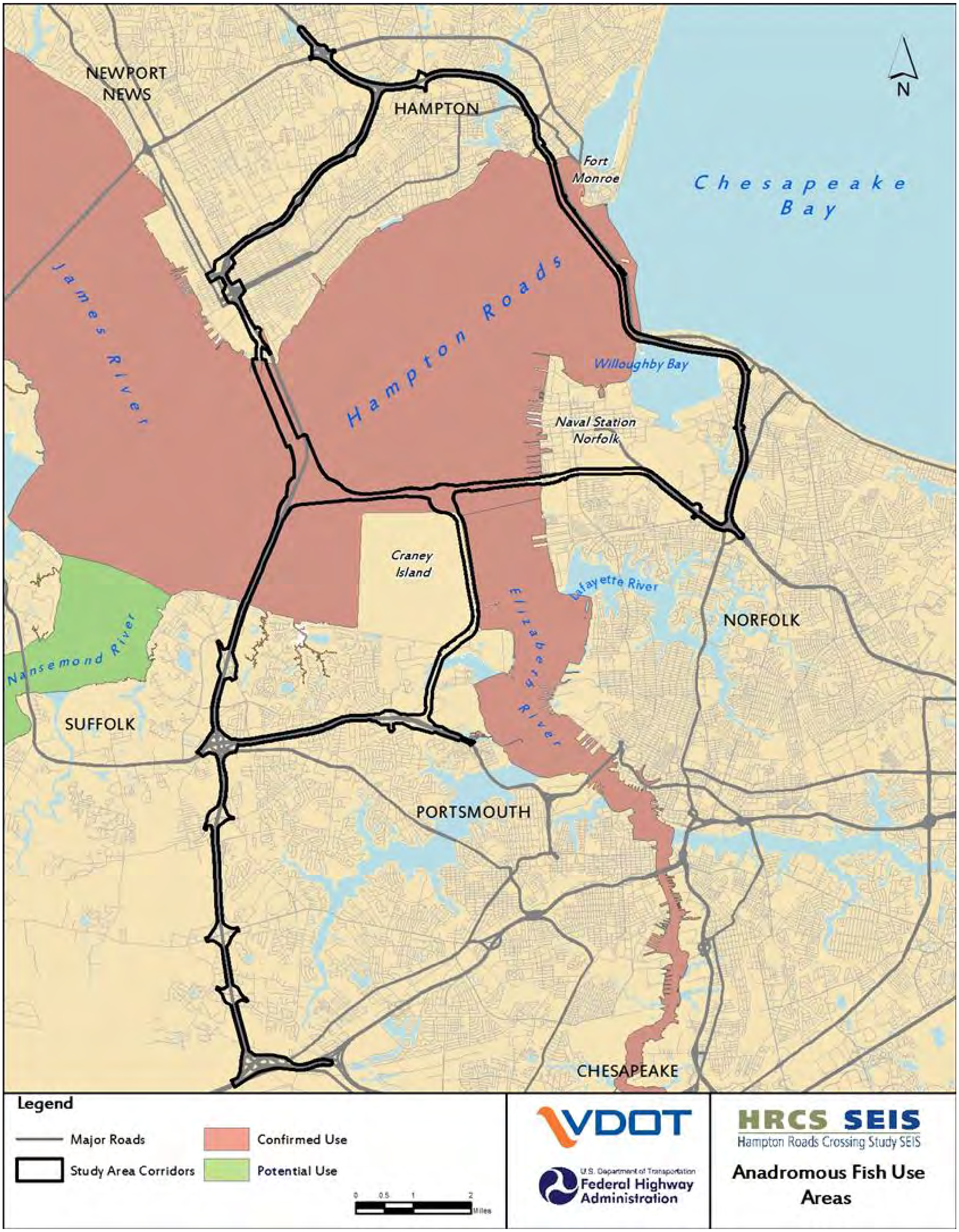
Blueback Herring (*Alosa aestivalis*) - The Blueback herring is a Federal Species of Concern. However, blueback herring are common to abundant in Virginia during spawning migrations and are often sold commercially as forage fish. Alewives and blueback herring are collectively referred to as river herring and are often harvested and managed together. Blueback herring spawn from late March through mid-May. Spawning sites often include areas with submerged aquatic vegetation, rice fields, swampy areas, and small tributaries upstream from the tidal zone. They return to coastal waters in the late spring, approximately one month later than Alewives (NOAA, 2009). Blueback herrings typically feed on plankton, copepods, pelagic shrimp, small fish, fish fry, and insects. This species is native to Virginia (VDGIF, 2016b).

Hickory Shad (*Alosa mediocris*) - Hickory shad are not a species of concern in Virginia. They have become a popular sport fish in recent years. Hickory shad spawn in tidal freshwater in late April through early June and soon return to the ocean. Oceanic movements of the Hickory shad are unknown. Their diet consists primarily of small fish (VDGIF, 2016b).

Striped Bass (*Morone saxatilis*) - The Chesapeake Striped bass is not officially threatened or endangered, but anadromous (non-stocked) populations have experienced a steady decline in recent years. Striped bass feed during the spawning migration and fast immediately prior to and during spawning. Adults consume other fish as well as a variety of invertebrates including squid, clams, lobsters, crabs, and shrimp. Juveniles feed on worms, small crustaceans and fish, and insects. Spawning begins in early April and continues through early June, and takes place in the lower 24-75 miles of tidal and non-tidal sections of large rivers (VDGIF, 2016b).

Yellow Perch (*Perca flavescens*) - Yellow perch are native to Virginia and are not a species of concern. This species is highly valued for recreational and commercial uses (VDGIF, 2016b). Adult Yellow perch migrate in large schools into tidal and non-tidal freshwater to spawn once a year. They usually spawn in shallow areas of lakes or in tributary streams with little current (Krieger et al. 1983 cited in Brown et al. 2009). Yellow perch are typically found in lakes, slow-moving rivers, and brackish water and tend to inhabit areas with ample aquatic vegetation. Larval and young Yellow perch typically consume zooplankton, while juveniles consume insect larvae and adults consume insects, fish eggs, juvenile fish and crayfish (Brown et al., 2009).

Figure 2-15: Anadromous Fish Use Areas



Environmental Consequences

The **No-Build Alternative** would not involve any construction or changes to the natural environment. As a result environmental effects to anadromous fish from the No-Build Alternative are not anticipated.

All four of the **build alternatives** have the potential to impact Confirmed Anadromous Fish Use Areas. Since the area is primarily used as a migration corridor, the primary potential impact would be to food sources, not spawning habitat. Activities that would affect the location or abundance of insects, small fish, worms, and small crustaceans could affect the distribution of anadromous fish. These include dredging, filling, sedimentation, and turbidity. Dredging would result in temporary increases in turbidity, and potential releases of nutrients and contaminants. Both temporary and permanent filling for cofferdams, piers or pilings, and causeways could also disrupt these food sources. The potential impact within the LOD of each build alternative is presented in **Table 2-28**.

Table 2-28: Potential Anadromous Fish Use Area Impacts

Resource	Alternative A (acres)	Alternative B (acres)	Alternative C (acres)	Alternative D (acres)
Anadromous Fish Use Area	138	214	565	636

Source and notes: VDOT, 2015.

Alternative A would have the least amount of impact of the build alternatives simply because it has the smallest footprint over the open water. Dredging, filling, sedimentation, and turbidity would occur from construction of the bridge-tunnel adjacent to the existing HRBT across Hampton Roads, with a bridge at Willoughby Bay. It is anticipated that this alternative would have the shortest duration of localized turbidity associated with construction compared to the other build alternatives considering the amount of dredging required. As shown in **Table 2-16**, the amount of dredging required for the tunnel is only 30% of the next highest dredge quantity (Alternative B) and 17% of the highest dredge quantity (Alternative C).

Alternative B includes the improvements associated with Alternative A, plus additional crossings associated with I-564, and the I-564 and VA 164 Connectors in and along the Elizabeth River. It would require dredge and fill activities for one new bridge-tunnel across the Elizabeth River, and therefore likely have a longer duration of localized turbidity than Alternative A given the additional dredge and fill activities. Alternative B has the second largest amount of dredging due to the length of the proposed tunnel under the Elizabeth River.

Alternative C includes the I-664 MMMBT and I-664 Connector crossings of the Hampton Roads/James River area in addition to the I-564 Connector. This alternative includes two additional tunnels adjacent to the MMMBT, as well as two tunnels across the Elizabeth River to accommodate two transit-only lanes. It also has more miles of bridge across subaqueous bottom than Alternatives A and B. While the potential acres of impact is less than Alternative D, Alternative C has a greater potential for sedimentation and turbidity because it would produce the greatest amount of dredged material due to two new tunnels adjacent to the MMMBT and across the Elizabeth River.

Alternative D has the largest potential acres of impact to Confirmed Anadromous Fish Use Areas. The amount of dredging is less than Alternative C because only one tunnel will be placed adjacent to the MMMBT and also across the Elizabeth River. As with all other alternatives, the temporary and localized loss of food sources should have minimal impacts on their availability given that the footprint encompasses only 614 acres of Confirmed Anadromous Fish Use Areas and the availability of other food sources throughout Hampton Roads and the southern Chesapeake Bay. In addition, construction would most likely occur in discrete areas throughout the duration of the project, enabling juvenile and adult fish to avoid these areas.

Required dredge and fill activities would temporarily result in the localized loss of benthic communities, which provide food sources for anadromous fish. However, due to the limited footprint of the disturbance for each of the alternatives relative to the available habitat in the area, and the availability of other benthic foraging habitat throughout Hampton Roads and the southern Chesapeake Bay, the temporary and localized loss of benthic communities should have a minimal impact on anadromous fish feeding success regardless of which alternative is constructed. Also, construction would occur in a small percentage of the larger estuarine waterbodies at any given time over the course of many years as OISs comprising the Preferred Alternative may be approved in phases resulting in design and construction being spaced over a number of years. As such, the impacts are not anticipated to significantly affect juvenile or adult fish. Eggs and larvae would be more susceptible to turbidity increases, and nutrient and contaminant releases.

The VDGIF and NOAA Fisheries often recommend the use of time of year restrictions (TOYR) on the construction of projects that have the potential to disrupt migration and spawning patterns of anadromous fish. According to the VDGIF's TOYR Table, revised March 26, 2015, no TOYR are recommended on the James River and its tributaries below the Route 17 Bridge or on the Elizabeth River unless the project spans the width of the River to an extent that it significantly impedes fish passage. All of the build alternatives involve spanning either the James River or the Elizabeth River, or both, with bridges and tunnels that would not impede fish passage, except perhaps temporarily during construction activities. Thus, construction of any of the build alternatives would not significantly impede fish migration in these rivers. As such, no TOYR from VDGIF for anadromous fish are anticipated for the James and Elizabeth Rivers. Smaller tributaries draining to these rivers that may be culverted could require a TOYR. NOAA Fisheries or VIMS may recommend a TOYR.

Coordination with VDGIF, VIMS, and NOAA Fisheries would be required to develop project-specific measures for avoidance and minimization, as well as mitigation of impacts to aquatic fauna if necessary. The VDGIF typically recommends the following activities that would apply to the smaller rivers and streams within the alternatives that flow to the confirmed anadromous fish use streams (i.e. those streams and tributaries noted in **Figure 2-2** and **Table 2-2**) : using non-erodible cofferdams to isolate the construction area; blocking no more than 50 percent of the streamflow at any given time; stockpiling excavated material in a manner that prevents reentry into the stream; re-vegetating barren areas with native vegetation; and implementing strict erosion and sediment control measures. Measures such as culvert inlet and outlet protection, rock check dams, dewatering structures, and sediment traps and basins would help to prevent sedimentation of the waterbodies. Other measures suitable for the dredging activities required in the larger waterbodies include filtration of discharge water from barges/scows, eliminating overflow from barges during dredging or transport, reducing the speed of loaded buckets or cutterheads, sheet-pile enclosures, and turbidity curtains, where applicable. Specific dredging BMPs would be identified during the design process, as the phased implementation of any alternative may allow for new methods to be identified prior to construction. Monitoring of near-field and far field turbidity during construction would help determine the effectiveness of the minimization measures to help dictate any adjustments or possibly cessation of certain construction activities.. Dredging activities would be carefully planned and implemented to control sediment, nutrients, and fish impacts in accordance with permit-specific requirements, to assure that any impacts are localized, temporary, and/or fully mitigated. The use of bubble curtains to reduce sound/pressure waves, which could negatively impact a fish species, could also be used. In regards to stream crossings, the agency recommends clear-span bridges. If, however, clear-span bridges are not feasible, the permits obtained from the USACE and VDEQ would require culverts to be countersunk at least six inches below the stream bed or, alternatively, bottomless culverts should be installed to allow passage of aquatic organisms.

2.2.6 Submerged Aquatic Vegetation

Regulatory Context

VMRC has jurisdiction over subaqueous bottoms or bottomlands through Subtitle III of Title 28.2 of the Code of Virginia, and is directed to define existing beds of submerged aquatic vegetation (SAV) in consultation with the Virginia Institute of Marine Science (VIMS) (VA Code § 28.2-1204.1). SAV includes an assemblage of underwater plants found in shallow waters of the Chesapeake Bay and its river tributaries as well as coastal bays of Virginia (VMRC, 2000). SAV is also considered a component of EFH which is broadly defined to include "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (NOAA, 2015c). According to the Virginia Administrative Code (VAC), 4 VAC 20-337-30, any removal or planting of SAV from State bottom or planting of nursery stock SAV for any purpose, other than pre-approved research or scientific investigation, would require prior permit approval by VMRC. Any request to remove SAV from or plant SAV upon State bottom shall be accompanied by a complete Joint Permit Application (JPA) submitted to the VMRC (VMRC, 2000).

Methods

VIMS monitors and maintains a database for the presence and health of SAV in the Chesapeake Bay and its watershed. As part of the Annual SAV Monitoring Program, since 2001 VIMS has been orthorectifying aerial images for the purpose of documenting annually the extent of SAV beds. VIMS also maintains an on-line interactive mapper and GIS data which depict SAV beds in the Chesapeake Bay region dating back to 1971, and was used to obtain historic information on the presence of SAV within the Study Area Corridors (VIMS, 2014).

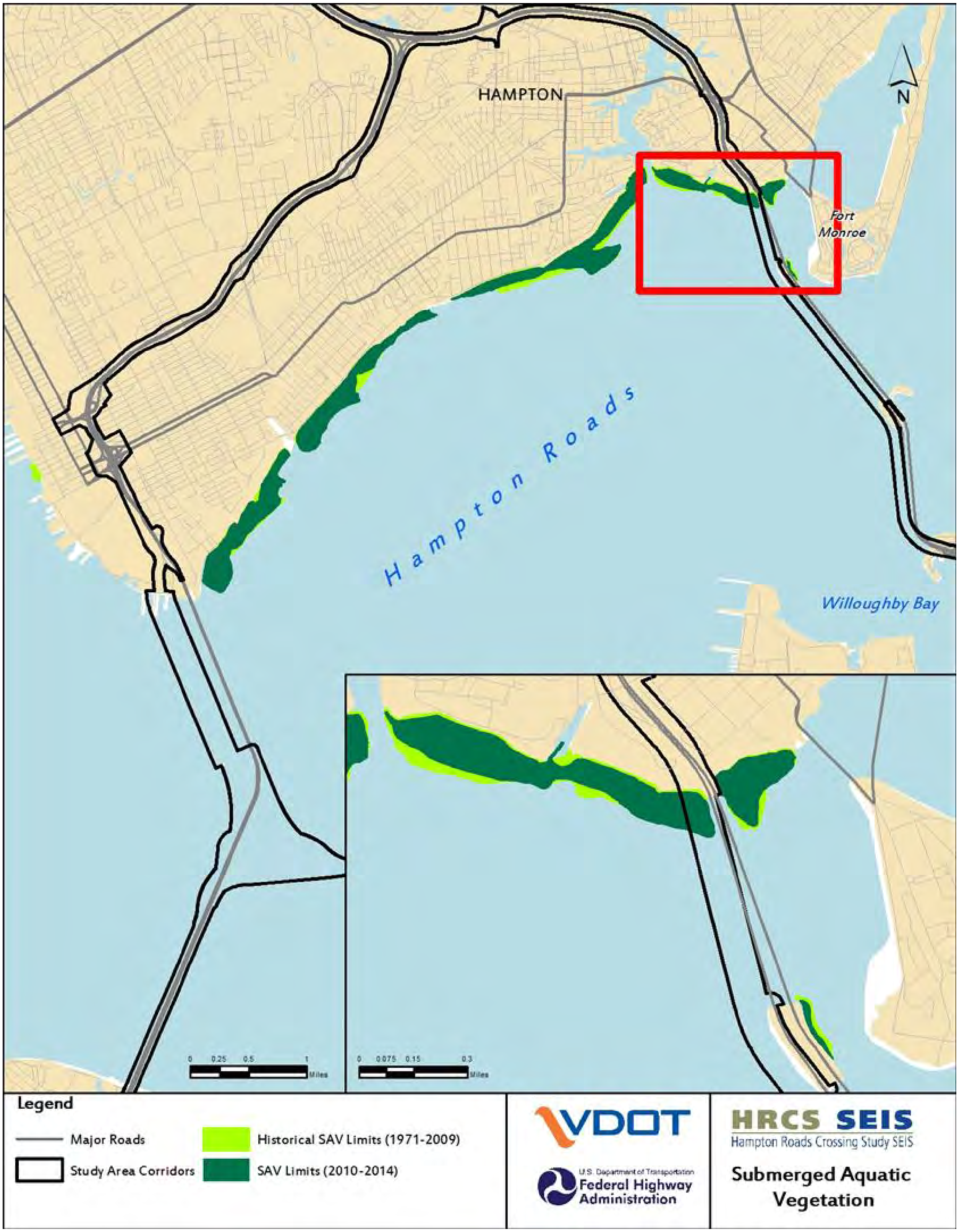
The quantity of SAV present within the Study Area Corridors was determined by performing a GIS overlay of the Study Area Corridors on top of the existing and historical SAV beds obtained from VIMS. Potential impacts to SAV were calculated by performing GIS overlays of the LOD, which is based on roadway engineering completed to date, on top of the existing and historical SAV beds obtained from VIMS.

Affected Environment

Species of SAV most commonly found in the Chesapeake Bay and its tributaries within the vicinity of the Study Area Corridors include eelgrass (*Zostera marina*) and widgeon grass (*Ruppia maritima*). Other species, less likely to occur due to their association with freshwater and lower salinity levels, include wild celery (*Vallisneria americana*), hydrilla (*Hydrilla verticillata*), redhead grass (*Potamogeton perfoliatus*), sago pondweed (*Stuckenia pectinata*), and Eurasion watermilfoil (*Myriophyllum spicatum*) (Orth et al., 2015). An important component of the Chesapeake Bay ecosystem and barometer for water quality, SAV beds filter polluted runoff, provide essential habitat for all life stages of numerous aquatic species, and provide a valuable food source for waterfowl (VIMS, 2016).

Since the presence of SAV can change from year to year based on environmental conditions, such as coastal storms and annual fluctuations in nutrient levels and water clarity, documentation of the presence of SAV in any year within a period of five consecutive years is sufficient to constitute viable SAV habitat. For the purpose of this document, mapped populations of SAV in any year from 2010 to 2014 constitute existing beds and are depicted in **Figure 2-16**. The mapping indicates that existing SAV beds occur along the eastern side of the north island of the HRBT, just west of Fort Monroe, as well as along the north shore of Hampton Roads between I-64 and I-664. SAV beds not documented from 2010 to 2014 but having been present prior to 2010 are considered to be historic beds and are important as they have the potential to support SAV beds in the future, and could serve as mitigation or restoration sites. These historic SAV beds that lie outside of existing beds are also shown on **Figure 2-16**. According to this mapping provided by VIMS, there are approximately 5 acres of existing SAV beds and 5 acres of historic beds located within the Study Area Corridor for Alternatives A, B, and D. The Study Area Corridor of Alternative C does not contain any existing or historic SAV beds.

Figure 2-16: SAV Beds



Environmental Consequences

The **No-Build Alternative** would not involve any construction or changes to the natural environment As a result, environmental effects to SAV from the No-Build Alternative are not anticipated.

Construction of the four **build alternatives** has the potential to impact SAV beds. Permanent loss of SAV would be limited to the footprint of bridge fill approaches, superstructure elements (bent piles, piers), and potentially the area beneath the bridges. Bridges can alter the light regimes below them and affect the distribution and density of SAV. They can shade the surface of the water and attenuate the sunlight available under and adjacent to them. The height, width, construction materials used, orientation of the structure, and density of piers can all influence the size of the shade footprint and how much of an adverse impact it may have on the habitat beneath it (Johnson et al., 2008). Local and temporary siltation and turbidity would occur during dredging and filling activities associated with construction, specifically during dredging and filling activities for bridge and tunnel installation. Construction may also require cofferdams, causeways, work bridges or barges, and construction staging areas along the shoreline, which can cause temporary losses of SAV. After construction, the continued maintenance of the bridge and approaches could have long term, but most likely minor, effects on nearshore habitats and affect aquatic food webs. The loss of SAV results in a reduction of important rearing and refugia functions utilized by migrating and resident species (Johnson et al., 2008). The estimated total acreage of SAV impacts within the LOD of each build alternative is shown in **Table 2-29**.

Table 2-29: Potential SAV Impacts

Resource	Alternative A (acres)	Alternative B (acres)	Alternative C (acres)	Alternative D (acres)
SAV	2	2	0	2

Source and notes: VIMS SAV in Chesapeake Bay and Coastal Bays Interactive Map.

SAV beds within the LOD only occur along the north shore of Hampton Roads in the vicinity of I-64. Therefore **Alternatives A, B, and D** could potentially impact SAV. Since the proposed work in this area for each of these alternatives is the same, the potential impact is the same. Anticipated permanent loss of SAV would be limited to the footprint of the bridge piers and approaches, and potentially the area beneath the bridge. Local and temporary siltation and turbidity would occur during any dredging and filling activities. Adjacent areas could be affected based on the tides and currents due to the re-suspension of sediment in the water column, reducing the photic zone in areas of SAV.

Alternative C would not require any loss of SAV since no beds exist within the LOD.

Implementation of strict erosion and sediment control measures in compliance with the VESCH, to include the use of cofferdams, turbidity curtains, silt fence, storm drain inlet protection, diversion dikes, and temporary and permanent seeding may minimize impacts to water quality and SAV. The length of dredging operations may need to be considered as prolonged dredging would result in disturbance to the adjacent water column over a longer period of time dependent upon the nature of the bottom substrate, tidal fluctuations, and estuarine dynamics. However, this affect may be minimized by the constant mixing of water through wind and tidal action. Methods to reduce dredging effects to the water column could include the type of dredging, reducing the speed of loaded buckets or cutterheads, eliminating overflow from barges during dredging or transport, sheet pile enclosures, dewatering excavated dredge material in a manner that prevents reentry into waterbodies, and filtration of discharge water from barges/scows. Specific dredging BMPs would be identified during the design process, as the phased implementation of any alternative may allow for new methods to be identified prior to construction. Construction within or adjacent to existing SAV beds should be avoided during the growing season for the representative plant species present to the extent practicable. Additional efforts to avoid and/or minimize disturbance to SAV would be made during final design, and could include replanting temporarily disturbed SAV beds, as well as subsequent monitoring to ensure success. Mitigation for unavoidable SAV loss would be developed in coordination with VMRC in accordance with permitting guidelines and may include enhancement or restoration of existing or historic SAV beds.

2.2.7 Invasive Species

Regulatory Context

The VDCR-DNH defines invasive species as a non-native (alien, exotic, or non-indigenous) plant, animal, or disease that causes or is likely to cause ecological and/or economic harm to the natural system (VDCR, 2010).

In accordance with Executive Order 13112, *Invasive Species*, as amended (42 U.S.C. 4321 et seq.), no federal agency can authorize, fund, or carry out any action that it believes are likely to cause or promote the introduction or spread of invasive species. Other regulations in governing invasive species include the Non-indigenous Aquatic Nuisance Prevention and Control Act of 1990, as amended (16 U.S.C. 4321 et seq.), Lacey Act, as amended (18 U.S.C. 42), Federal Plant Pest Act (7 U.S.C. 150aa et. seq.), Federal Noxious Weed Act of 1974, as amended (7 U.S.C. 2801 et seq.), and the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.). Likewise, the State of Virginia acted in 2003 to amend the Code of Virginia by adding in Chapter 5 of Title 29.1 an article numbered 7, known as the Nonindigenous Aquatic Nuisance Species Act which among other things addresses the development of strategies to prevent the introduction of, to control, and to eradicate invasive species.

Methods

The VDCR-DNH, in association with the Virginia Native Plant Society, have identified and listed invasive plant species that are known to currently threaten Virginia's natural populations. To date they have listed approximately 90 invasive plant species on the Virginia Invasive Plant Species List (Heffernan et al., 2014) that threaten or potentially threaten natural areas, parks, and other lands. This list also classifies each species by level of invasiveness, including High, Medium, and Occasional. Highly invasive species generally disrupt ecosystem processes and cause major alterations in plant community and overall structure. They can easily establish themselves in undisturbed habitats and colonize disturbed areas rapidly under the appropriate conditions. While plants with medium and low invasiveness can become management problems, they tend to have less adverse effects on natural systems and are more easily managed.

Invasive plant species potentially present within the Study Area Corridors were identified by cross referencing the Virginia Invasive Plant Species List with the United States Department of Agriculture's Plant Database, which documents known occurrences of plants by county. While a detailed survey of invasive species was not performed, observations and notes were made during field investigations for wetlands and threatened and endangered species. Nuisance animal species in Virginia are designated in the Virginia Administrative Code 4VAC15-20-160. Potential effects the HRCS alternatives could have on invasive plant species and nuisance animal species is presented through a discussion of construction and seeding practices that could encourage their spread or establishment.

Affected Environment

Plants

Cross referencing the Virginia Invasive Plant Species List with the United States Department of Agriculture's Plant Database shows there could be 24 highly invasive plant species within one or more of the Study Area Corridors. The highest probability of invasive species establishment in areas disturbed during construction would be from those species already known to be in the Study Area Corridors. Most notably the list of highly invasive species identified during field investigations to be present in all Study Area Corridors. The following highly invasive species were observed to be present within all of the Study Area Corridors:

- *Ailanthus altissima* Tree-of-heaven
- *Lespedeza cuneata* Chinese Lespedeza
- *Ligustrum sinense* Chinese Privet
- *Lonicera japonica* Japanese Honeysuckle
- *Phragmites australis ssp. Australis* Common Reed
- *Rosa multiflora* Multiflora Rose
- *Sorghum halenpense* Johnson Grass

This is not intended to be an all-inclusive list, rather it shows these species to be of particular concern since seed or vegetative reproductive structures currently exist within or adjacent to all of the Study Area Corridors.

Animals

A number of aquatic and terrestrial animal species threaten the native plant and animal communities in Virginia. The following species list includes common species that could affect the study area if encountered within the construction limits. None of these species were directly observed during field investigations.

The Virginia Administrative Code (4VAC15-20-160) designates the following as nuisance species in Virginia: House mouse (*Mus musculus*); Norway rat (*Rattus norvegicus*); Black rat (*Rattus rattus*); Coyote (*Canis latrans*); Nutria (*Myocastor coypus*); Woodchuck (*Marmota monax*); European starling (*Sturnus valgaris*); English Sparrow (*Passer domesticus*); Pigeon (*Columba livia*); and other non-native species as defined in the Migratory Bird Treaty Reform Act of 2004 and regulated under 50 CFR 10.13. Likewise, the VDCR-DNH has identified a number of invasive species which threaten Virginia's wildlife and plant systems such as the Emerald ash borer (*Agrilus planipennis*), Northern snakehead fish (*Channa argus*), Rapa welk (*Rapana venosa*), and the Imported fire ant (*Solenopsis invicta*). These species are listed as established in Virginia.

In addition, the VDCR-DNH has also identified the Zebra mussel (*Dreissena polymorpha*), Sirex woodwasp (*Sirex noctilio F.*), Rusty crayfish (*Orconectes rusticus*), and the Chinese mitten crab (*Eriocheir sinensis*) as species that may threaten Virginia's wildlife and plant systems; however they are not well established in the Commonwealth.

Environmental Consequences

The **No-Build Alternative** would not involve any construction or changes to the natural environment. As a result, environmental effects to invasive species from the No-Build Alternative are not anticipated.

Invasive species would continue to grow, spread, and be treated using current roadside management strategies. The **four build alternatives** could increase the spread of invasive species, particularly those species noted in above. While most of the area within the LOD is comprised of open water, impervious surface, and is previously disturbed by a myriad of development activities, the disturbance of remaining natural areas as well as the removal and transfer of fill from borrow sites within the limits of disturbance or offsite locations could spread invasive species. The spread could be exacerbated if vegetation clearing takes place while the plants are dispersing seed. Likewise, the ground disturbance could encourage the spread of species that spread through rhizomes. Clearing native vegetation could also aid the spread or introduction of invasive/nuisance animal species. The introduction of both plant and animal invasive/nuisance species could occur from vehicles transporting these species or their seed. Offsite borrow and disposal areas, staging areas, and access roads could contribute similarly to the spread or introduction of these species.

While all of the **build alternatives** have the potential to spread or introduce invasive species, **Alternative A** would have the least amount of potential. Alternative A is a highly developed corridor with few tracts of native vegetation that could be threatened. In addition, a significant portion of the roadway traverses open water (Hampton Roads and Willoughby Bay) where no invasive species would be present or vegetation cleared.

Alternative B extends along I-564 and across the Elizabeth River, having similar potential effects as Alternative A. The VA 164 Connector and Widening extending along CIDMMA and into Chesapeake increases the potential effect due to the work in and around the dredge spoils at CIDMMA. Disturbed soils such as those present at CIDMMA can be conducive to invasive plant species establishment.

While **Alternative C** does not include I-64, it includes I-664 through Hampton and Newport News, and has a very significant portion of the roadway that traverses the James River, Hampton Roads, and the Elizabeth River, having similar potential effects as Alternatives A and B. Like Alternative B, Alternative C would involve construction and potential concerns in and around CIDMMA. In addition, Alternative C involves more construction in Suffolk and Chesapeake which are less disturbed and less developed than other portions of the study area. This creates more opportunity for invasive species to establish where native species are currently growing.

Alternative D has the greatest potential to affect the spread of invasive species. It is a combination of the sections that comprise Alternatives B and C, therefore it has the largest area of potential ground disturbance for construction and other offsite activities. In addition to Alternative C, it is the only other alternative with construction in the less developed areas of Suffolk and Chesapeake with larger tracts of vegetated corridors.

In accordance with Executive Order 13112, *Invasive Species,* the spread of invasive species would be minimized by following provisions in VDOT's Road and Bridge Specifications. These provisions require prompt seeding of disturbed areas with mixes that are tested in accordance with the Virginia Seed Law and VDOT's standards and specifications. Specific seed mixes that are free of noxious or invasive species may be required for environmentally sensitive areas and would be determined during the design and permitting process. In addition, in order to prevent the introduction of new invasive species and to prevent the spread of existing populations, best management practices would be followed, including conforming to the guidelines contained in the VESCH. These best management practices may include washing machinery before it enters the area, minimizing ground disturbance, using fencing or flagging to demarcate areas not to be disturbed, and reseeding disturbed areas with native seed mixes as appropriate. While the proposed right-of-way would be vulnerable to the colonization of invasive plant species from adjacent properties, implementation of the stated provisions would reduce the potential for the establishment and proliferation of invasive species during and after construction of any of the alternatives.

Because much of the work required by any of the alternatives would be along existing disturbed corridors, the addition of invasive animal species is expected to be minimal. Designers should acknowledge the possibility that some of these animals could inhabit the project area post construction and include measures to minimize their impact. For instance, Nutria can tunnel into embankments and berms possibly destabilizing an area and allowing erosion to occur and Ash species should be eliminated from any planting plans to reduce the risk of the Emerald ash borer.

2.3 THREATENED AND ENDANGERED SPECIES

Regulatory Context

Endangered species are defined as those species in danger of extinction throughout all or a significant portion of their range. Threatened species are defined as those species that are likely to become endangered within the foreseeable future throughout all or a significant portion of their range. The USFWS and NOAA Fisheries regulate and protect federally listed threatened and endangered species under the Endangered Species Act (ESA) of 1973 (16 USC 1531-1544) with the primary goal of conserving and recovering listed species. The USFWS is afforded jurisdiction over threatened and endangered terrestrial species, the manatee, and nesting sea turtles, while NOAA Fisheries is afforded jurisdiction over all other threatened or endangered marine wildlife, including seaward sea turtles and anadromous fish.

Compliance with the ESA is required for projects that have the potential to impact federally listed threatened or endangered species or their habitat. The ESA, with few exceptions, prohibits activities affecting threatened and endangered species unless authorized by a permit. Anyone who is conducting otherwise-lawful activities that will result in the "incidental take" of a listed wildlife species needs a permit. If a project is federally funded or authorized or carried out by a federal agency, as this project is, the permitting process is conducted through Section 7 consultation. Section 7 of the ESA requires federal agencies to consult with USFWS and/or NOAA Fisheries to ensure that any federal action authorized, funded, or carried out is not likely to jeopardize the continued existence of any threatened or endangered species or result in the destruction or modification of critical habitat, unless granted an exemption for such action (USFWS, 2013).

A December 2012 Memorandum of Understanding between VDOT and FHWA titled "Compliance with Section 7 of the Endangered Species Act in Relation to the National Environmental Policy Act Process" documents the timing of compliance with Section 7 of the ESA. In some situations where a project may adversely affect a threatened or endangered species, the design and construction details needed to consult with USFWS and complete a biological assessment may not be available until further along in the project development process. In lieu of concluding the Section 7 consultation process during the development of this DSEIS, this section documents the Section 7 efforts that have been accomplished to date, and the following commitments are being made:

- Section 7 consultation will be completed before any irreversible or irretrievable commitments of resources are made expressly for construction activities;

- FHWA's anticipated location decision represented by its NEPA approval would not change based on the results of the Section 7 consultation process; and
- Additional steps to complete the Section 7 process prior to construction will be taken. These steps would likely include:
  - o Update the database searches to list current species;
  - o Perform Informal consultation with the UFWS to determine if the species or critical habitat is potentially present;
  - o Conduct habitat assessments for any new species and update habitat assessments for the species they've been previously conducted;
  - o Determine what effect the project may have on the species or its habitat;
  - o Conduct presence/absence surveys if necessary;
  - o Prepare the Biological Assessments for any species to support Section 7 formal consultation, if necessary.

In addition to the federal oversight, threatened and endangered species are also regulated at the state level. The VDGIF has adopted the federal list as well as a state list of endangered and threatened species, with the primary focus of managing Virginia's wildlife (Virginia Code §29.1-563-570). In addition, the Virginia Department of Agriculture and Consumer Services (VDACS) regulate threatened and endangered plant and insect species (Virginia Code §3.2-1000-1011). Through a Memorandum of Agreement established between the VDCR and VDACS, the VDCR represents VDACS in comments regarding potential impacts to state-listed threatened and endangered plants and insect species. The legal state status is determined by the VDGIF (all animals except insects) and the VDACS (plants and insects).

Methods

State and federally listed species that are reported to occur or potentially occur within the vicinity of the Study Area Corridors were identified through the USFWS's Information for Planning and Conservation database (IPaC), VDGIF's Virginia Fish and Wildlife Information Service database (VaFWIS), and VDCR's Department of Natural Heritage (DCR-DNH) database, as well as state and federally listed species addressed in the November 2012 Natural Resources Technical Report for the I-64 Hampton Roads Bridge-Tunnel (HRBT NRTR) and the March 2001 FEIS for the Hampton Roads Crossing Study.

The correspondence located in **Appendix F** documents the process by which species listed on **Table 2-30** were selected for the habitat assessment and agreed to with the agencies and contains the following information:

- Database search results.
- Letter from VDOT to the agencies requesting approval of the species list and proposed review actions for each species.
- Documentation that the alternatives are not likely to impact the Piping plover. Therefore the Study Area Corridors were re-evaluated to reaffirm or update the conclusions previously reached.
- Documentation that the alternatives are not likely to adversely affect sea turtles. Therefore no habitat assessments were performed, but their natural history and discussion of construction concerns is presented in this section.
- Documentation that the Atlantic sturgeon does not reside in the Study Area Corridors, but rather uses it as a migration corridor. Therefore no habitat assessments were performed, but its natural history and discussion of construction concerns is presented in this section.

- Resumes of personnel in charge of the habitat assessments.
- USFWS approval of the personnel in charge of the habitat assessments and the survey plan.

In order to evaluate the potential impact of the alternatives to these species, potential habitat for the listed species was assessed and documented with previously noted exceptions. An initial offsite analysis was conducted, to determine aquatic and terrestrial habitat types that correspond with habitat criteria for the agreed upon list of species. This analysis was conducted utilizing multiple resources, including existing land cover map products, WOUS mapping produced as part of the photo interpretation mapping, and aerial and infrared photography. This information, in addition to the agency coordination information in **Appendix F**, was utilized to generate a map depicting the location of the land cover types that may provide suitable habitat for the individual species. It was also used to help understand the potential effect of the alternatives on habitat fragmentation due to potential impacts within the 500-feet wide Study Area Corridors.

Field maps were generated with areas of potential habitat for individual species identified, based upon the offsite analysis and coordination. The mapping contained 2013 VGIN orthophotography, alignment boundary, land cover types, and associated species, roads, and parcel boundaries. An onsite evaluation was conducted within the areas identified in the offsite analysis to further evaluate these habitat areas and determine if they contain suitable characteristics for each species. Field notes were recorded from each location and representative photographs were taken for both suitable and unsuitable habitat. Habitat boundaries were refined on the field mapping to accurately depict the extent of potential suitable habitat for individual species.

The quantity of potential habitat within the Study Area Corridors was determined by performing a GIS overlay of the areas identified through on and offsite assessment as having suitable habitat. Potential impacts were calculated by performing GIS overlays of the LOD, which is based on roadway engineering completed to date, onto the same suitable habitat.

Affected Environment

As a result of the agency coordination summarized in Methods above, **Table 2-30** represents the agreed upon list of species that are currently listed as threatened or endangered, their status, source of listing, and alternatives in which the species may be present according to the source of listing. The Dismal Swamp southeastern shrew was originally on this list as a State Threatened species, but was delisted on April 1, 2016.

Table 2-30: Threatened and Endangered Species Mapped within the Vicinity of Study Area Corridors

Species	Status	Source of Listing	Alternatives
Piping Plover (*Charadrius melodus*)	FT/ST	IPaC, VFWIS, DCR-DNH, HRBT-NRTR, FEIS	A, B, C, D
Wilson's Plover (*Charadrius melodus*)	SE	VFWIS, DCR-DNH	A, B, C, D
Gull-billed Tern (*Sterna nilotica*)	ST	VFWIS, DCR-DNH, HRBT-NRTR	A, B, D
Red Knot (*Calidris canutus rufa*)	FT	VFWIS	A, B, D
Peregrine Falcon (*Falco peregrinus*)	ST	VFWIS, DCR-DNH, HRBT-NRTR, FEIS	A, B, C, D

Species	Status	Source of Listing	Alternatives
Northern Long-eared Bat (*Myotis septentrionalis*)	FT	IPaC	A, B, C, D
Mabee's Salamander (*Ambystoma mabeei*)	ST	VFWIS, DCR-DNH, HRBT-NRTR	A, B, C, D
Canebrake Rattlesnake (*Crotalus horridus*)	SE	VFWIS, DCR-DNH, HRBT-NRTR, FEIS	A, B, C, D
Atlantic Sturgeon (*Acipenser oxyrinchus*)[1]	FE/SE	VFWIS, DCR-DNH, HRBT-NRTR, FEIS	A, B, C, D
Kemp's Ridley Sea Turtle (*Lepidochelys kempii*)[1]	FE/SE	VFWIS, HRBT-NRTR, FEIS	A, B, D
Leatherback Sea Turtle (*Dermochelys coriacea*)[1]	FE/SE	VFWIS, HRBT-NRTR	A, B, C, D
Loggerhead Sea Turtle (*Caretta caretta*)[1]	FT/ST	VFWIS, HRBT-NRTR, FEIS	A, B, C, D
Green Sea Turtle (*Chelonia mydas*)[1]	FT/ST	HRBT-NRTR, FEIS	A, B, D
Little Brown Bat (*Myotis lucifigus lucifigus*)	SE[2]	VFWIS	A, B, C, D
Tri-colored Bat (*Perimyotis subflavus*)	SE[2]	VFWIS	A, B, C, D

Source and notes: 1. No habitat assessment performed. 2. State listed as of April 1, 2016. FE = Federally Endangered. FT = Federally Threatened. SE = State Endangered. ST = State Threatened. IPaC = USFWS Information for Planning and Conservation, October 2015. VFWIS = Virginia Fish and Wildlife Information Service, October 2015. DCR-DNH = Virginia Department of Conservation and Recreation – Division of Natural Heritage, October 2015. HRBT-NRTR = I-64 Hampton Roads Bridge-Tunnel – Natural Resources Technical Report, November 2012. FEIS = Hampton Roads Crossing Study – Final Environmental Impact Statement, March 2001.

The following sections provide a brief summary of the natural history and distribution of the species listed on **Table 2-30**. This information was utilized as a general framework for the habitat evaluation to determine the presence of habitat, affected environment, and environmental consequences of the proposed activities within the Study Area Corridors. Additionally a discussion is included for those species that were determined to have potentially suitable habitat within the Study Area Corridors. No critical habitat has been designated by USFWS or NOAA Fisheries within the Study Area Corridors.

2.3.1 Federally Endangered (FE) Species Information

Affected Environment

Atlantic Sturgeon (*Acipenser oxyrinchus*) - The Atlantic sturgeon is a Federal and State Endangered species. It is listed in Virginia's Wildlife Action Plan as a Tier II species with a "Very High Conservation Need," meaning it has a high risk of extinction or extirpation. Populations of this species are at very low levels, face real threat(s), or occur within a very limited distribution. Immediate management is needed for stabilization and recovery (VDGIF, 2016b). The Atlantic sturgeon is an anadromous fish and has the potential to be present throughout the Study Area Corridors of all alternatives during spawn migrations. Spawning occurs near the fall line in the James River, with the closest area at Turkey Island (Bushnoe et al., 2005), approximately 70 miles upstream of the Study Area Corridors. Two spawning races have been identified in the James River. Spawning adults for both races appear to migrate upriver beginning in late-March or April. The spring race spawns between late March and early May with adults leaving the river by June. The fall spawning race spawns around September after an extended staging period approximately 25 miles upstream of the mouth of the James. Fall spawning adults migrate out of the river in October (Balazik and Musick, 2015). Juveniles may spend several years in rivers or estuaries before migrating to the ocean. Adult Atlantic sturgeons are benthic feeders and consume mainly worms, aquatic insects, shellfish, crustaceans, snails, sand lances, and large amounts of mud and debris (VDGIF, 2016b).

Atlantic sturgeons primarily use the project area as a migration corridor. During the migrations, they primarily transit along the river within natural or artificial channels (Balazik et al, 2012). Atlantic sturgeon would generally be found within these deep water habitats in the alternatives during the migration period. Potential foraging habitat is present throughout Hampton Roads as the entire substrate is composed of sand, mud, or a combination suitable for benthic species. SAV beds could be used for foraging and occur only along the eastern side of the north island of the HRBT, just west of Fort Monroe, and along the north shore of Hampton Roads between I-64 and I-664. Thus, Alternatives A, B, and D contain SAV foraging habitat while Alternative C does not. No individuals in early life stages are expected to be present in the vicinity of the Study Area Corridors since they cannot withstand exposure to salinity.

Leatherback Sea Turtle (*Dermochelys coriacea*) – The Leatherback sea turtle, listed as Federal and State Endangered, is the world's largest sea turtle and the third most abundant turtle in Virginia's waters (VIMS, 2016a). The leatherback sea turtle is the largest marine sea turtle and is also the only known endothermic sea turtle. They are the most pelagic of the sea turtles only coming into shore to nest and occasionally to feed. Sometimes they will roam near shore and into estuaries, but usually feed in coastal and offshore waters. Leatherback sea turtles forage primarily on jellyfish, but occasionally on squid, crustaceans, some fish, and seaweed. In Virginia, leatherbacks feed primarily on the moon jellyfish and sea nettle (VDGIF, 2016b). Breeding occurs just off shore near the nesting sites which require a sloping sandy beach backed with vegetation. Nesting occurs in Florida, Georgia and the Caribbean (NMFS and USFWS 1992). No nesting occurs on Virginia beaches. They occur in Virginia's offshore waters during the warmer months but linger longer than other species. Nothing is known of the ecology or behavior of leatherbacks in Virginia or of its ecological role in estuarine systems (VDGIF, 2016b). Leatherbacks have had known occurrences in the Cities of Hampton, Norfolk, and Virginia Beach, and in the Lower and Middle Chesapeake Bay. There have been two “likely” occurrences of leatherbacks in the City of Newport News (VDGIF, 2016b).

Kemp’s Ridley Sea Turtle (*Lepidochelys kempii*) – Kemp’s Ridley sea turtle is the second most common sea turtle in the Chesapeake Bay. It is the smallest and rarest of all sea turtles and is listed as “endangered” throughout its range; however, their population has been increasing exponentially in recent years (NFMS et al, 2011 and VIMS, 2016a). Nesting occurs on ocean beaches, overwhelmingly in Tamaulipas, Mexico, (NMFS et al, 2011). A Kemp’s Ridley sea turtle nest has been documented in Virginia by VDGIF (Barco and Lockhart, 2015); however, no ocean beaches occur within the vicinity of the Study Area Corridors. Juvenile Kemp’s Ridley sea turtles comprise a majority of the occurrences within the Chesapeake Bay (NMFS, 2014a). Kemp’s Ridley sea turtles mainly forage for blue crabs, but also for mollusks and other crustaceans in a variety of benthic communities, including seagrass beds, oyster reefs, sandy bottoms, mud bottoms, or a combination of communities and substrates. Juveniles enter the bay as the water warms and leave by early November (NMFS et al, 2011). Radio telemetry and acoustic array monitoring studies solicited by the Navy have documented Kemp's Ridley sea turtle occurrence throughout the Hampton Roads marine environment (Barco and Lockhart, 2015).

2.3.2 Federally Threatened (FT) Species Information

Affected Environment

Piping Plover (*Charadrius melodus*) – The piping plover is a Federal and State Threatened species. It is listed in Virginia's Wildlife Action Plan as a Tier I species with a "Critical Conservation Need," meaning it faces an extremely high risk of extinction or extirpation. According to the VDGIF FWIS database (VDGIF, 2016b), populations of these species are at critically low levels, facing immediate threat(s), or occur within an extremely limited range. Intense and immediate management action is needed. Piping plovers are a native to the Virginia barrier islands and about 100 pairs can be found there presently. Piping plovers arrive on breeding grounds in Virginia around mid-March and lay eggs from mid-April to early July. However, Piping plovers have been absent from historical nesting sites on CIDMMA (Portsmouth) and Grandview Beach (Hampton) due to a number of predators and continued human interference. On Virginia's barrier islands, nests are typically laid in washover areas cut into or between dunes and often in close proximity to backside marshes, mudflats, or vegetation barriers where there is greater protection from predators and increased foraging opportunities for young chicks. They forage in intertidal beaches or flats on the lagoon side of barrier beaches. Their prey includes marine worms, fly larvae, beetles, crustaceans, mollusks and other invertebrates. Piping plovers are mostly preyed on by raccoons, foxes, laughing gulls and herring gulls. The presence of humans and pets on nesting grounds can also reduce hatching and fledging success and result in abandonment of breeding and non-breeding sites (VDGIF, 2016b).

Red Knot (*Calidris canutus rufa*) – Red knots are among the largest of the small sandpipers and are listed as Federally Threatened (USFWS, 2005). This species is listed as Tier IV in the Virginia Wildlife Action Plan with "Moderate Conservation Need" meaning the species may be rare in parts of its range, particularly on the periphery. Populations of these species have demonstrated a significant declining trend. Long-term planning is necessary to stabilize or increase populations (VDGIF, 2016b). There are five recognized races of Red knot. *C. canutus rufa* winters at the tip of South America in Tierra del Fuego and travels more than 9,300 miles every spring to breed on the mainland and islands above the Arctic Circle (USFWS, 2005). Red knots converge on staging areas along the entire Atlantic coast and are faithful to these specific sites, stopping at the same location each year. Breeding occurs from June to July and while incubation is performed by both sexes, the males assume most of the responsibility. Non-breeding birds may remain along the Atlantic coast all summer long. Feeding occurs primarily on sandy or stony beaches but may also occur in mudflats. Primary food sources include crustaceans, insects, mollusks, larvae, caterpillars, bees, algae, buds, horseshoe crab eggs, and crayfish. Red knots have known occurrences in the Cities of Chesapeake, Hampton, Newport News, Norfolk, Portsmouth, and Suffolk (VDGIF, 2016b).

Northern Long-Eared Bat (*Myotis septentrionalis*) - On April 2, 2015, the USFWS determined the northern long-eared bat (NLEB) should be listed as Threatened under the Section 4d provision (80 FR 17974 – 18033) of the ESA. The final ruling to list the NLEB took effect on May 4, 2015. A final 4d rule was issued and became effective as of February 15, 2016. The status review conducted by the USFWS identified white-nose syndrome (WNS) as the primary threat to the NLEB, although other threats do exist including impacts to hibernacula, summer habitat, and during migration (USFWS 2016). WNS is caused by the fungus *Pseudogymnoascus destructans* and is responsible for unprecedented mortality in some hibernating insectivorous bats in the northeastern U.S., including dramatic and rapid population declines in NLEB populations of up to 99 percent from pre-WNS levels (USFWS, 2016c).

The NLEB is a medium-sized bat in the genus Myotis that can be found throughout the eastern and midwestern U.S. and southern Canada. The NLEB uses a wide variety of forested habitats for roosting, foraging and traveling, and may also utilize some adjacent and interspersed non-forested habitat such as emergent wetlands and edges of fields. This species has also been found roosting in structures like barns and sheds (particularly when suitable tree roosts are unavailable). The bats emerge at dusk to forage in upland and lowland woodlots and tree-lined corridors, feeding on insects, which they catch while in flight using echolocation. This species also feeds by gleaning insects from vegetation and water surfaces (VDGIF, 2016b).

Roosting habitat includes forested areas with live trees and/or snags with a dbh of at least 3 inches with exfoliating bark, cracks, crevices and/or other cavities. Trees are considered suitable if they meet those requirements, and are located within 1,000 feet of the nearest suitable roost tree, woodlot, or wooded fencerow. Maternity habitat is defined as suitable summer habitat that is used by juveniles and reproductive females. The summer maternity season in Virginia is April 1 through September 30. Winter habitat includes underground caves and cave-like structures such as abandoned or active mines and railroad tunnels. The NLEB migrate between their winter hibernacula and summer habitat, typically between mid-March and mid-May, and mid-August and mid-October. They are considered a short-distance migrant (typically 40 - 50 miles), although their known migratory distances can vary greatly between 5 and 168 miles (USFWS, 2014).

Green Sea Turtle (*Chelonia mydas*) – Breeding colony populations of the green sea turtle in Florida and on the Pacific Coast of Mexico are listed as Federal Endangered; all others are listed as Federal Threatened (NOAA, 2016g). They are also listed in Virginia as State threatened. They nest in tropical and subtropical regions with a Virginia nest documented by VDGIF (Barco and Lockhart, 2015). They are seen in the Chesapeake Bay during the late summer and early fall (VIMS, 2016a). Most documented green sea turtle occurrences within the Chesapeake Bay during this time are juveniles (Barco and Lockhart, 2015). Within the Chesapeake Bay, this species forages in marine grasses, preferring sea grass flats that occur in shallow areas of the Chesapeake Bay (VDGIF, 2016b). Juveniles are omnivorous but adults mainly eat sea grass and algae. The adults are well-known for long migrations and impressive navigation skills. Studies conducted by the Navy document green sea turtles as occasional visitors to the Hampton Roads area (Barco and Lockhart, 2015).

Loggerhead Sea Turtle (*Caretta caretta*) – The loggerhead sea turtle is a Federal and State Threatened species and is listed in Virginia's Wildlife Action Plan as a Tier I species with a "Critical Conservation Need" (VDGIF, 2016b). It is the most common sea turtle in Chesapeake Bay and most abundant in U.S. waters (VIMS, 2016a). They are found in the Chesapeake Bay from May to November with peak abundance in mid-June. Breeding season is from April to August (VDGIF, 2016b). Nesting in Virginia has been reported on the barrier beach islands off the Eastern Shore and in or near Back Bay Wildlife Refuge. Nesting sites are sandy beaches which are high enough that that they are not inundated by high tides or soaked by ground water rising from below and support few predators. No nesting beaches occur within the vicinity of the Study Area Corridors. Loggerheads are the only sea turtle that nests annually in Virginia, but averages less than ten nests per year in the past ten years. Loggerheads are mainly carnivorous feeding primarily on mollusks, horseshoe crabs, barnacles, echinoderms and sponges. Studies solicited by the Navy document Loggerhead sea turtles, particularly juveniles, as frequent visitors to the Hampton Roads area (Barco and Lockhart, 2015).

2.3.3 State Endangered (SE) Species Information

Affected Environment

Wilson's Plover (*Charadrius wilsonia*) – Wilson's plover is a State Endangered species and is listed in Virginia's Wildlife Action Plan as a Tier I species with a "Critical Conservation Need". According to the VDGIF FWIS database (2016b), Wilson's plovers are migratory (except in Florida) and native to Virginia. Virginia's barrier islands support the majority of the state population of Wilson's plovers. Statewide estimates have exceeded 45 pairs in only two of twelve years. Nesting occurs from May through June and is conducted either singly or semi-colonially. Nest sites typically consist of a scrape or hollow in sand or shell; either in the open, next to some objects or shaded by beach grass. Foraging occurs in oceanfront intertidal zones, salt marsh edges, and on mud flats. Their diet consists of small crabs, shrimp, crayfish, beetles, ants, bugs, flies, and spiders. The Wilson's plover population is suffering due to the loss of nesting habitat as development restricts the species to the barrier islands. This disturbance coupled with excessive predation may also limit population growth (VDGIF, 2016b).

Canebrake Rattlesnake (*Crotalus horridus*) – Canebrake rattlesnakes are State Endangered and also listed as Tier IV of the Virginia Wildlife Action Plan with "Moderate Conservation Need" meaning the species may be rare in parts of its range, particularly on the periphery. Populations of these species have demonstrated a significant declining trend or one is suspected which, if continued, is likely to qualify this species for a higher tier in the foreseeable future. Long-term planning is necessary to stabilize or increase populations (VDGIF, 2016b). Canebrake rattlesnakes are large venomous snakes reaching a length of 36-60 inches (Conant, 1991) with males growing larger than females (Mitchell and Schwab, 1991). Color variations are common in this species and may include pink, gray, yellow, or light brown hues with a series of brown to black chevrons, or crossbands, across the dorsum. A brown or chestnut colored middorsal stripe is present on most individuals. Canebrake rattlesnakes occupy hardwood and mixed hardwood-pine forests, cane fields, and the ridges and glades of swampy areas (Mitchell and Schwab, 1991). Canebrake rattlesnakes are generally active in Virginia from early April – October. During the fall and winter months, the snakes hibernate in forested habitat and are known to utilize the base of hollow trees, or stumps, and the underground tunnels resulting from stump and root decomposition (Fernald, 1999; Mitchell and Schwab, 1991) as den sites. Gray squirrels (Sciurus carolinensis), other rodents, and rabbits are considered primary prey items (Fernald 1999). Known occurrences of canebrake rattlesnake are in the Cities of Chesapeake, Hampton, Newport News, and Suffolk (VDGIF, 2016b).

2.3.4 State Threatened (ST) Species Information

Affected Environment

Gull-Billed Tern (*Sterna nilotica*) – Species information for the Gull-billed tern was previously provided in the Waterbird Nesting section.

Peregrine Falcon (*Falco peregrinus*) – The Peregrine falcon is listed as a State Threatened species and is also in Tier I of Virginia's Wildlife Action Plan as a species of "Critical Conservation Need". Peregrine falcons are medium sized raptors that feed chiefly on avian prey, including shorebirds, pigeons, blackbirds, jays and other medium-sized birds. Peregrines have historically nested on the ledges of natural cliff faces in western Virginia. Although this mountain population is beginning to stage a comeback, the majority of peregrines currently nest in the Coastal Plain on artificial structures such as specially-constructed towers, nest boxes, bridges and tall buildings. After the widespread use of DDT, in conjunction with human disturbance, it is believed that the peregrine falcon was totally extirpated from Virginia and the eastern U.S. by the mid-1960's. Following the re-introduction to Virginia in the late 1970's, the coastal falcon population has continued to grow. Known occurrences have been documented in the Cities of Chesapeake, Hampton, Newport News, Norfolk, Portsmouth, and Suffolk (VDGIF, 2016b).

Mabee's Salamander (*Ambystoma mabeei*) - Mabee's salamander is State Threatened and listed in Tier II of the Virginia Wildlife Action Plan for "Very High Conservation Need" (VDGIF, 2016b). Mabee's salamander is a small, stout member of the mole salamander family reaching a total length of 3-4 inches (Conant, 1991). Like other members of the mole salamander family, Mabee's salamanders spend the larval period of their life cycle in aquatic environments, but most of the adult life is spent in terrestrial burrows. The breeding habitat is described as fish-free vernal ponds or Coastal Plain ephemeral sinkholes up to 5 feet deep. Breeding occurs from late fall to early spring. Females lay 2 to 6 eggs and attach them to small twigs, leaves, or debris. Larval young live in ponds until April or May, when they become juveniles (VDGIF, 2016b). Surrounding forests are generally composed of bottomland hardwoods mixed with pines, pine savannas, bogs, and swamps (Prague and Mitchell, 1991; VDGIF, 2016b). This species forages for zooplankton, arthropods, crustaceans, and worms in the water and on land. Known occurrences of Mabee's salamander are in the Cities of Hampton, Newport News, and Suffolk (VDGIF, 2016b).

Little Brown Bat (*Myotis lucifigus lucifigus*) – On April 1, 2016, the little brown bat was listed as Endangered in Virginia. This is a small to medium size Myotis species. This species mates primarily in the fall, and also winter after arousal from hibernation. There is delayed fertilization until spring ovulation, after departure from the hibernacula. The gestation period is 50-60 days and nursery colonies of several to 1000 or more females form late April-May in warm dark locations. The females are sexually mature by the first autumn, and bear young by the first summer. The young are weaned after six weeks. This species migrates primarily north to south up to several hundred miles to hibernation caves and mines from October to November and March to April. They form hibernation colonies of a few to many thousand. The summer colony may disperse to several hibernacula, and the hibernating colony may come from many summer colonies. The females leave the hibernacula earlier and form separate nursery colonies of several thousands. High temperatures there contribute to the rapid growth of the young. They are weaned in late July and the maternity colonies disperse. They emerge to forage at late dusk, and often repeat hunting flight patterns. They have strong site fidelity for roosts, especially females to the nursery colony site. The populations have drastically declined in many parts of the range. *M. sodalis* frequently uses the same hibernation caves. Predators include the mink, raccoons, voles, mice, hawks, leopard frogs, snakes (rat snake) and some house cats. Moths are a major part of the diet and they may prey heavily on aquatic insects. They may sweep low over water for drink before they begin foraging (VDGIF, 2016b).

Tri-colored Bat (*Perimyotis subflavus*) – On April 1, 2016, the tri-colored bat, formerly known as the eastern pipistrelle, was listed as endangered in Virginia. This is one of the smallest eastern bats. There are two, rarely one, young born in sex-segregated maternity colonies from mid-June to early July. Mating occurs in autumn, or frequently in winter and in spring as well. They are active until late October, and hibernate in caves/mines often too tiny for other species. They begin leaving caves in March to fly daily in the sun. They may roost in caves, rock crevices, trees/foliage, and seldom buildings. This species forages in the early evening in treetops, often over water (usually solitary, but may be 4-5 by one tree in late summer). They are never in deep woods or open fields unless large trees are nearby.

The female is more specific than the male for roosting in the same site. They tolerate more light than other species. The hoary bat and the leopard frog are confirmed predators (VDGIF, 2016b).

Based upon an understanding of the life histories discussed above, and a result of the offsite and field analysis performed, potential habitat was verified within the Study Area Corridors for all of the terrestrial species found in **Table 2-31**. Their potential habitats are shown on the maps in **Appendix G**, with the exception of the Mabee's salamander due to reasons stated in the Mabee's salamander discussion below.

Table 2-31: Terrestrial Threatened and Endangered Species Habitat within Study Area Corridors

Species	Alternative A (acres)	Alternative B (acres)	Alternative C (acres)	Alternative D (acres)
Shorebirds (Piping Plover, Wilson's Plover, Gull-billed Tern, Red Knot)	2	94	92	94
Canebrake Rattlesnake	0	41	140	140
Mabee's Salamander	0	0	0.7	0.7
Bats (NLEB, Little Brown Bat, Tri-colored Bat)	8	115	174	191

The following sections describe the results of the habitat assessment by species or group and the conditions of the potential habitat present within each of the alternatives. Representative photographs of threatened and endangered species habitat are included in **Appendix G.**

Shorebirds

Based upon the habitat assessment conducted within the Study Area Corridors, habitat is present for the Gull-billed tern, Piping plover, Red knot, and Wilson's plover within all four build alternatives. The quantity in each alternative is shown in **Table 2-31** and is based upon a broad and conservative estimate of foraging and breeding habitat. For the purposes of this assessment, all estuarine intertidal emergent wetlands (E2EM) and estuarine, intertidal, unconsolidated shore (E2US) were identified as having foraging potential for the four shorebirds. A large portion of this wetland type was heavily vegetated with dense coverage of phragmites, saltmeadow cordgrass (*Spartina patens*) or smooth cordgrass (*Spartina alternifolia*). Mudflats appeared to be limited to smaller discrete areas and shaded areas beneath bridges and overpasses, although some areas were only observed during high tide conditions when mudflats would not be visible. Per correspondence with USFWS (Nystrom, 2016), E2EM wetland areas that do not currently provide foraging potential, such as monocultures of phragmites, were mapped as habitat due to potential future management/restoration activities converting these areas to suitable habitat. A few areas of sandy shoreline at Willoughby Spit within Alternatives A, B, and D were also identified as suboptimal foraging areas. Potential breeding habitat for the shorebirds was limited to known areas for current or historic nesting, at the HRBT (Gull-billed tern) within Alternatives A, B and D, and CIDMMA (Piping plover) within Alternatives B, C, and D. The eastern portion of CIDMMA within the Study Area Corridors appears to have more frequent human disturbance than the western portion of the island, which would make this area suboptimal habitat for the plover. The Red knot does not breed in Virginia. A large portion of the shorelines within the Study Area Corridors are hardened and/or developed and provide no habitat potential for any of the four shorebird species. All potential habitat for the four shorebird species is depicted on the Shorebird Habitat Map in **Appendix G**.

Peregrine Falcon

Although no breeding pairs have been observed within the Study Area Corridors (Watts, 2015; Watts, 2016), bridges within the Study Area Corridors, particularly the HRBT and MMMBT, could potentially provide suitable nesting areas. The closest confirmed breeding pair identified is in a nest box on the James River Bridge west of the MMMBT and a nest box on the Chesapeake Bay Bridge-Tunnel east of the HRBT.

Canebrake Rattlesnake

Areas of suitable Canebrake rattlesnake habitat were identified within two general locations in the Study Area Corridors. One area of habitat is located south of CIDMMA and north of Route 164, within Alternatives B, C and D. The majority of the habitat is located along I-664 south of the MMMBT and extends south to the interchange with Military Highway, within Alternatives C and D. A portion of this habitat area is located within the Great Dismal Swamp: Northwest Section Conservation Site. The quantity of Canebrake rattlesnake habitat within each Study Area Corridor is shown in **Table 2-31**.

Suitable habitat can generally be characterized as forested mineral flats and other hardwoods/palustrine wetland areas, 100 acres or greater. Hummocks, hollow trees, and stumps present within the habitat provide suitable hibernacula. Mast producing species such as oaks are present in sufficient numbers to provide an adequate food supply for the grey squirrel, which is the snake's main food source. The existing roadway corridors have caused fragmentation of the habitat and act as a barrier to migration between the habitat areas. Unsuitable habitat is characterized by estuarine wetlands, developed land, and forested communities less than 100 acres. All potential habitat for the Canebrake rattlesnake is depicted on the Canebrake rattlesnake Habitat Map in **Appendix G**.

Mabee's Salamander

Potential breeding habitat for Mabee's salamander within the Study Area Corridors is limited to two vernal pools located north of the interchange of I-664 and Route 164 and west of I-664 (Alternatives C and D). The habitat area within the Study Area Corridors is 0.7 acre. The buffer surrounding the pools is characterized as lowland forest dominated by mature pine and mixed hardwoods. The understory is somewhat open with pine and mixed hardwood saplings and giant cane. Water within the pools was approximately 1.5' deep at the time of the field assessment in February 2016. During normal years, seasonal hydrology within the pools likely persists for a sufficient period of time to allow for larval salamanders to metamorphose into the juvenile stage, typically April or May. The forested buffers surrounding the ponds may be utilized as non-breeding habitat by juveniles following metamorphosis and adult salamanders. Due to the potential for occurrence of the Mabee's salamander within suitable habitat, the locations of these habitat areas have not been depicted on maps in **Appendix G**.

Bats

Suitable foraging and summer roosting habitat is present for all three bat species: NLEB, Little brown bat, and Tri-colored bat. Based upon an analysis of land cover types using NLCD data, deciduous forest, evergreen forest, mixed forest, scrub shrub, and woody wetlands were identified as suitable roosting habitat for the species within all four build alternatives. All potential roosting habitat for the bats is depicted on the Bat Habitat Map (**Appendix G**). This method was used for a broad comparison of habitat between the alternatives and does not include all forested areas that may provide roosting potential. Based upon this analysis, the estimation of potential roosting habitat within the Study Area Corridor for each alignment is as shown in **Table 2-30**. Smaller fragmented areas of forest and individual trees may provide suitable roosting habitat, but in general would be considered suboptimal habitat. Aquatic resources provide sources of water for the bats and habitat for insects used as forage. Forested areas, easements, road edges, and waterways can provide corridors for movement between habitat areas. Fragmented communities surrounded by development are generally less suitable for use by the bats. Trees with suitable sized cavities, buildings and bridges may provide suitable habitat for maternity roosts. These areas may also provide suitable day and night roosts for bats. Bridges over wetlands or aquatic areas with sufficient prey are frequently utilized as night roosts for foraging. No suitable hibernacula are present for any of the species within the Study Area Corridors. The closest known NLEB maternity roost is located in Chesapeake approximately 16 miles from the Study Area Corridors, according to the VDGIF NLEB Winter and Roosting Habitat Map. The MYLU and PESU Habitat Application map does not display any maternity roosts for the Little brown bat and the Tri-colored bat (VDGIF, 2016d).

Atlantic Sturgeon

No habitat assessments were performed. Its distribution would be as noted previously in the Species Information section.

Sea Turtles

No habitat assessments were performed. Their distribution would be as noted previously in the Species Information section.

<u>Environmental Consequences</u>

Potential environmental consequences for Federally Threatened, State Endangered, and State Threatened species are described below.

The **No-Build Alternative** would not involve any construction or changes to the natural environment As a result, environmental effects to threatened and endangered species from the No-Build Alternative are not anticipated. Any current effects on threatened and endangered species, or lack thereof, would continue.

The four **build alternatives** could potentially impact threatened and endangered species and their habitat. The potential impacts to suitable habitat per alternative are discussed in the following sections. Additional details on general impacts to terrestrial habitat, landcover, and the aquatic environment as a result of the proposed build alternatives are provided in the Environmental Consequences portions of several sections, including Terrestrial Wildlife/Habitat, Waterbird Nesting, Benthic Species, Anadromous Fish, and Submerged Aquatic Vegetation.

Potential impacts to the habitat of the agreed upon listed terrestrial species within the LOD for each of the build alternatives are shown in **Table 2-32.**

Table 2-32: Terrestrial Threatened and Endangered Species Habitat within the LOD

Species	Alternative A (acres)	Alternative B (acres)	Alternative C (acres)	Alternative D (acres)
Shorebirds (Piping Plover, Wilson's Plover, Gull-billed Tern, Red Knot)	1	63	63	64
Canebrake Rattlesnake	0	21	37	37
Mabee's Salamander	0	0	0.02	0.02
Bats (NLEB, Little Brown Bat, Tri-colored Bat)	0	28	64	53

Alternative A is the shortest alternative and has the least potential to affect threatened and endangered species or habitat. The alternative intersects the Hampton Roads Bridge-Tunnel Island Conservation Site. Potential effects of proposed construction activities on the Gull-billed tern colony at this location are discussed in the Waterbird Nesting section. While foraging habitat for shorebirds is present within the Study Area Corridor, the majority of these intertidal areas have been fragmented or altered by the presence of the current roadways and development. A large portion of the estuarine habitat is dominated by common reed, rendering it unsuitable for foraging in its current vegetative state. Mudflats are generally limited to a few fragmented areas. Regardless, it is anticipated that the majority of these estuarine areas would be bridged. Therefore, the proposed activities would have minimal impact on the foraging habitat that is present. Based on this information and due to the presence of higher quality foraging habitat within the vicinity of Alternative A, bridge construction activities are expected to have little to no impact on the shorebird species. While summer roosting habitat has been confirmed for bat species within Alternative A (NLEB, Little brown bat, Tri-colored bat), forested habitat is very fragmented and proposed activities would not change the quality of the habitat. Furthermore, no confirmed maternity roosts or hibernacula are located within a 2-mile radius of the Study Area Corridor, further limiting the potential effects on the species. Foraging habitat for bats is also present within Alternative A, but effects of the proposed construction activities on food and aquatic resources can be minimized utilizing proper erosion and sediment control measures such as flagging or fencing to demarcate areas not to be disturbed, silt fence and straw bale installation, dust control, and vegetative streambank stabilization. No habitat for the Canebrake rattlesnake or Mabee's salamander is present within Alternative A and therefore construction should have no effect on these species. In addition, there are no records of Peregrine falcons utilizing the Study Area Corridor for Alternative A for breeding; therefore construction activities should have no effect on the species (Watts, 2015; Watts, 2016).

Atlantic sturgeon could potentially be affected by Alternative A construction activities due to their utilization of the area during seasonal breeding migrations. Their presence would most likely be in deep water habitat such as the federally maintained channels. They may also be found where suitable forage (e.g., benthic invertebrates such as mollusks and crustaceans) and appropriate habitat conditions are present (e.g., areas of SAV). Effects from the HRBT expansion to their prey species and foraging areas would be as described in the Environmental Consequences portions of the Benthic Species and Submerged Aquatic Vegetation sections. The physical disturbance of sediments and entrainment of associated benthic resources could reduce the availability of Atlantic sturgeon prey, but the impacted benthic habitat represents an insignificant amount of the available habitat in the region, and recolonization of the opportunistic benthic species would occur quickly as described in the Environmental Consequences portion of the Benthic Species section, making impacts to Atlantic sturgeon habitat and prey negligible.

Atlantic sturgeon may be susceptible to entrainment or impingement by dredge equipment that would be used for the HRBT tunnel construction. Adults and subadult Atlantic sturgeon are not known to be vulnerable to cutterhead or mechanical dredges (NMFS, 2014a). Hopper dredges have a higher likelihood of impinging or entraining Atlantic sturgeon; however, the mobility and ability of adult and sub-adult sturgeon to avoid the low intake velocities of the dredge makes impingement unlikely. Eggs and young of the year would be most vulnerable to entrainment, but these life stages are intolerant of the salinity within Hampton Roads so they would not be present. A study on the James River showed that dredging is not likely to adversely affect Atlantic sturgeon behavior, as Atlantic sturgeon showed no signs of avoidance or impeded movement due to operation of the dredge (Cameron, 2012), suggesting that they are unaffected and can adequately avoid the disturbance. Turbidity effects from dredging should be insignificant. The life stages most vulnerable to increased sediment are eggs and non-mobile larvae which would not be present in the vicinity. Any Atlantic sturgeon in the vicinity would be sufficiently mobile to avoid any sediment plume or reductions in dissolved oxygen (NMFS, 2012). In addition, Atlantic sturgeon are often documented in turbid water and are more active under lowered light conditions such as those in turbid waters (Dadswell, 1984). Strikes from construction vessels are extremely unlikely since construction vessels draw less than 8 feet of water and Atlantic sturgeon would typically be at greater depths, eliminating construction vessel strike risk (Balazik et al, 2012).

Sound created by the installation of marine pilings has been documented to impact fish, including Atlantic sturgeon. Effects from sound can include behavioral impacts (e.g. changes in foraging or movements) and physiological effects (injury or death). During Section 7 consultations for recent projects, NMFS has used a peak sound pressure level (SPL) of 150 decibels (dB) as a conservative indicator of the noise level at which there is the potential for behavioral effects to Atlantic sturgeon. A peak SPL of 206 dB or a cumulative sound exposure level (cSEL), which is the energy accumulated over multiple strikes, of 187 dB has been used as a conservative indicator of potential physiological effects (NMFS, 2012a; NMFS, 2016). If vibratory pile driving is used, none of these values are likely to be exceeded. If impact driving is used, the 150 dB peak SPL behavioral effects criteria and the 187 dB cSEL physiological effects criteria would likely be exceeded, and the 206 dB peak SPL physiological effects criteria may be exceeded. The distance of the sound effects would be dependent upon the pile size and material. Since Hampton Roads is approximately 3.5 miles wide at this point, it is expected that the majority of the waterway would be unaffected by the sound and Atlantic sturgeon would be able to avoid the affected area. Additionally, no pilings would be driven in the proximity of the deepest water within the habitat where Atlantic sturgeon would most likely occur since a tunnel would be constructed in the maintained channel.

Sea turtles could potentially be affected by Alternative A construction activities due to their utilization of the area (generally the warmer months of April to November). Their presence would most likely be where suitable forage (e.g., benthic invertebrates such as mollusks and crustaceans) and appropriate habitat conditions are present (e.g., areas of SAV). Effects from the HRBT expansion to their prey species and foraging areas would be as described in the Environmental Consequences portions of the Benthic Species and Submerged Aquatic Vegetation sections. The physical disturbance of sediments and entrainment of associated benthic resources could reduce the availability of sea turtle prey, but the impacted benthic habitat represents an insignificant amount of the available habitat in the region, and recolonization of the opportunistic benthic species would occur quickly as described in the Environmental Consequences portion of the Benthic Species section, making impacts to sea turtle habitat and prey negligible.

Turbidity effects to sea turtles from dredging at the HRBT expansion should be insignificant. One of the major issues associated with suspended sediments is its effect on the respiration of marine fauna. However, sea turtles breathe air and increased suspended sediments are not likely to have an effect on turtle respiration. The most likely effect is if a sediment plume causes a barrier to normal behaviors. As sea turtles are highly mobile, they are likely to be able to avoid any sediment plume, and they typically only last for a short duration near the bottom after the dredge passes (Nichols et al., 1990 and NMFS, 2014). Depending upon the type of dredging equipment employed to dredge the tunnel for the HRBT expansion, direct impacts to sea turtles by entrainment or impingement are possible, though sea turtles are strong enough swimmers to avoid most dredge equipment and Leatherbacks are often too large to become entrained or impinged (NMFS, 2014). Sea turtles are not known to be vulnerable to cutterhead or mechanical clamshell dredges; however hopper dredges have been known to entrain and impinge sea turtles. Measures described at the end of this section would minimize the potential for adverse effects to sea turtles.

Sea turtles would be more susceptible to vessel strikes from construction vessels than Atlantic sturgeon since sea turtles spend more time closer to the surface; however, sea turtles are more vulnerable to being struck by faster moving vessels. Typically dredges, barges, and support vessels that would be used for the project move at slow speeds (i.e., on average 8-10 knots) and have shallow drafts (NMFS, 2014a). Thus, it is extremely unlikely for sea turtles to be struck by vessels during construction.

Like Atlantic sturgeon, sea turtles can be adversely affected by noise; however, sea turtles have a higher threshold for behavior disturbance at 166 dB peak SPL. Therefore, if piles are driven using impact hammers, impacts to sea turtles would be less than to Atlantic sturgeon.

Alternative B intersects the Hampton Roads Bridge-Tunnel Island Conservation Site, as with Alternative A, and also traverses the eastern edge of the Craney Island Conservation Site. The effects of Alternative B on the Hampton Roads Bridge-Tunnel Island Conservation Site would have the same results as described for Alternative A. Alternative B would add the VA 164 Connector along the east side of CIDMMA. Breeding populations of Piping plover have been historically documented on CIDMMA, but were last observed breeding at this location in 1997 (Boettcher, 2016). This area is believed to be no longer suitable for nesting Piping plovers due to the presence of predators and human disturbance. However, future surveys may be required to confirm the absence of breeding populations of the plover. Minor impacts to foraging habitat for the Piping plover would occur on the eastern edge of CIDMMA, but would not diminish the overall foraging potential of the Craney Island Conservation Site. Foraging could temporarily be disrupted due to construction activities that generate noise, light, or sediment; however shorebirds on CIDMMA have demonstrated the ability to utilize other available suitable habitat on the island during construction activities. Upon completion of construction, the primary threat would remain predators, which should not be an increased concern during construction. Therefore, the proposed alternative should not adversely affect the Piping plover. The Gull-billed tern, Wilson's plover, and Red knot also utilize CIDMMA for foraging and should suffer no adverse effects from construction activities similar to the Piping plover. Potential effects to additional areas of foraging habitat along Alternative B are as described for Alternative A. No habitat for the Mabee's salamander is present within Alternative B and there are no records of Peregrine falcons utilizing the Study Area Corridor for breeding; therefore, construction activities should have no effect on either species.

Summer roosting bat habitat within Alternative B is more extensive than in Alternative A and while many areas are similar in character, there are some larger contiguous tracts of forest within the alignment. Foraging habitat is also present throughout the alternative. Despite some differences in the characteristics of forested habitat within Alternative B, potential effects from construction activities on bat roosting and foraging habitat are the same as those described for Alternative A.

The proposed construction activities for Alternative B would impact Canebrake rattlesnake habitat that is located north of VA 164 and bisected by Coast Guard Boulevard. This habitat area is a tract of forest >100 acres in size that is connected to additional forested areas on the Coast Guard property. The additional forest areas are somewhat fragmented, but still accessible over a railroad and secondary roads. Proposed construction activities would reduce the large forested track to < 100 acres, which is the minimal threshold for suitable Canebrake rattlesnake habitat. It would also serve as a barrier for any resident snakes to access forested habitat on either side of the highway. This could lead to mortality of the snakes attempting to cross the highway to reach previously accessible forested habitat. However, this habitat area is currently isolated from adjacent forested land by heavy development. Even in its current condition the habitat could not support a viable population of the species long term. In addition, the current habitat area was completely clear cut in 1990, which left no suitable habitat within the Study Area Corridor or vicinity at the time. It is highly unlikely that any Canebrake rattlesnakes, if present at the time of the clearing, would have remained or survived at this location. Therefore it is unlikely that construction activities for Alternative B would adversely affect the Canebrake rattlesnake.

Implementation of Alternative B would affect Atlantic sturgeon and sea turtles in ways similar to those described for Alternative A. Alternative B also includes the addition of the bridge-tunnel construction for the I-564 Connector across the Elizabeth River. The result would be a greater amount of dredging, pile driving, and longer duration of construction, but potential effects should remain insignificant as described in Alternative A.

Alternative C has the potential to affect the most threatened and endangered species and/or habitat of all the build alternatives. Alternative C intersects the Craney Island Conservation Site and therefore would have the same effects on shorebirds at this location as described for Alternative B, but does not intersect the Hampton Roads Bridge-Tunnel Island Conservation Site. Impacts to potential foraging habitat within other portions of Alternative C would have little to no effect on shorebirds, as described for Alternative A. Construction of Alternative C would result in the reduction of forested buffers of the Mabee's salamander habitat on either side of I-664, as well as impact the aquatic habitat (pond) west of I-664. The VDGIF recommends maintaining undisturbed natural vegetated buffers of at least 1000 feet from aquatic Mabee's salamander habitat. Construction activities would reduce the forested buffer between the eastern pond and I-664 from approximately 90 feet to 45 feet. The forested buffer between the western pond and I-664 (approximately 50 feet) would be removed and approximately 15 feet of the aquatic habitat would be impacted. The reduction in forested buffers due to construction could have an effect on the vegetative community and hydrology of the area due to increased light and temperatures. Hydrology and water quality could also be affected depending on the proximity of road embankments, stormwater management, erosion and sediment controls, and application of herbicides in the vicinity of the habitat. VDGIF considers impacts to aquatic habitat to be an impact to the species, unless the absence of the species is confirmed. Surveys are required for 2 consecutive years to prove absence of Mabee's salamander from suitable habitat.

Summer roosting bat habitat within Alternative C is more extensive than the other alternatives because of the area along the I-564 Connector near the proposed interchange with I-564. This area is not within the LOD of any other alternative. Foraging habitat is also present throughout the alternative. Despite some differences in the characteristics of forested habitat within Alternative C, potential effects of construction on bat roosting and foraging habitat are the same as those described for Alternatives A and B.

Alternative C would intersect the Canebrake rattlesnake habitat north of VA 164 and potential effects of the alternative on this habitat area are the same as those detailed for Alternative B. In addition, Alternative C would result in impacts to the margins of Canebrake rattlesnake habitat on the east and west side of I-664. It does not appear that construction would increase fragmentation of the habitat, or that any corridors connecting the forested habitat on each side of I-664 currently exist. The Great Dismal Swamp National Wildlife Refuge and Great Dismal Swamp: Northwest Section Conservation Site are located within the vicinity of Alternative C (**Figure 2-7**) would. There would be no impacts to the Wildlife Refuge. The I-664 and U.S. 58 interchange at the southern terminus of the alternative is within the Conservation Site, though the forested areas are already fragmented by the roadways in the interchange. Implementation of Alternative C should not reduce the overall quality of Canebrake rattlesnake habitat within the vicinity. There are no records of Peregrine falcons utilizing the Study Area Corridor for breeding, therefore Alternative C should have no effect on the species.

Implementation of Alternative C would affect Atlantic sturgeon and sea turtles in ways similar to those described for Alternatives A and B. Less SAV habitat would be impacted by Alternative C than for Alternatives A or B. The additional bridge length for Alternative C would require more pile driving, however as described previously, the width of the open water in the Hampton Roads area provides ample room for avoidance. Potential effects should remain insignificant as described in Alternative A.

Alternative D is a combination of the sections that comprise Alternatives B and C. The impacts would be as previously described for those alternatives minus the bat habitat impacts along the I-564 Connector near the proposed interchange with I-564.

The presence of federal and state threatened or endangered species within the build alternatives would require special consideration and coordination with various federal and state agencies. Through the coordination with these agencies, potential impacts to species and their habitats can be evaluated and minimized by implementing various practices as part of the alternatives design. Every attempt should be made to incorporate the preliminary recommendations into the design as much as possible. However, certain recommendations may not be practicable. Specific agency coordination should be conducted during the final design and permitting stage of the project, at which time more detailed agency recommendations would be determined.

In order to reduce potential impacts to terrestrial threatened and endangered species and their habitat, efforts to minimize the construction footprint can be considered. Construction practices would avoid the removal of existing vegetation to the greatest extent possible and include the implementation of best management practices for erosion and sediment control as well as stormwater management to reduce potential impacts to adjacent habitats and properties. Practices such as silt fence and straw bales, diversion ditches, sediment traps and basins, culvert outlet protection, vegetative streambank stabilization, dewatering structures, temporary and permanent seeding, and flagging or fencing of areas not to be disturbed would minimize impacts to both terrestrial and aquatic species. Passageways beneath bridges and elevated structures, fencing to direct wildlife to these passageways, and avoiding the use of plants with high feed value that may attract wildlife could all reduce wildlife encounters within the travel lanes of the alternatives.

Minimization techniques are typically recommended and could be employed to minimize impacts to the threatened and endangered aquatic species (Atlantic sturgeon and sea turtles). The time of year and length of dredging may need to be considered. Certain dredging methods, such as hopper dredging, may increase the likelihood of entrainment and incidental take. The use of sea turtle deflectors on hopper dredges, small cutterhead dredges, or mechanical bucket dredges would reduce the likelihood of entrainment. As stated previously, Atlantic sturgeon are not averse to turbid waters and sea turtles breathe air, however turbidity curtains could further minimize impacts to them as well as their prey species. Construction vessels typically move at slow speeds and have shallow drafts and are more likely to strike sea turtles than Atlantic sturgeon (NMFS, 2014). The combination of a maximum speed for construction related vessels and an endangered species observer/spotter could further reduce the potential risk of vessel strikes. In order to further minimize the risk of potential impacts to Atlantic sturgeon and sea turtles from underwater noise, staging of pile driving activities and utilizing vibratory hammers could be employed. Additional measures that could be incorporated into the project to reduce the noise levels associated with pile driving activities below behavioral and injury thresholds include cushion blocks, ramp-up or soft strike procedures, and bubble curtains.

Upon final selection of an alternative, additional coordination would be required with the appropriate agencies for all species identified within the two mile radius of the Study Area Corridors. Where suitable habitat is present, due to the potential presence of the species, performing presence/absence surveys may be required by the agencies. If presence of any species is confirmed the agencies may recommend a TOYR for activities within occupied habitat and these restrictions would be determined through the permitting process. Additional measures may include practices such as education requirements for the construction contractors. A summary of current applicable TOYRs for specific species currently listed as threatened or endangered is provided in **Table 2-33**.

Table 2-33: Threatened and Endangered Species Time of Year Restrictions

Species	Time of Year Restrictions
Piping Plover	15 Mar – 31 August; TOYR ends when last brood fledges as determined during most recent monitoring activity.
Wilson's Plover	01 April – 31 August; TOYR ends when last brood fledges as determined during most recent monitoring activity.
Gull-billed Tern	01 April – 31 August; TOYR ends when last brood fledges as determined during most recent monitoring activity.
Peregrine Falcon	15 February – 15 July for activities within 600 feet of nest.
Northern Long-eared Bat [1]	15 Apr – 15 Sep for tree removal activities.
Sea Turtles[2]	01 April – 30 November for hydraulic hopper dredging
Atlantic Sturgeon	15 February – 30 June for instream construction within channel habitat

Source and notes: VDGIF, 2016c. 1. TOYR for avoidance of incidental take in summer roosting habitat. USFWS IPaC Online Project Review Step 7b - Northern long-eared bats in Virginia. 2. July 2000 Biological Assessment, October 2000 NMFS letter, and March 2001 FEIS concluded not likely to adversely affect if TOYR is followed.

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APPENDIX A:

ALIGNMENT SEGMENTS &

OPERATIONALLY INDEPENDENT SECTIONS

ALIGNMENT SEGMENTS & OPERATIONALLY INDEPENDENT SECTIONS

Given the magnitude and scope of the alternatives, it is expected that a Preferred Alternative would be constructed in stages or operationally independent sections (OIS). An OIS is a portion of an alternative that could be built and function as a viable transportation facility even if other portions of the alternative are not advanced (FHWA, 2007). The OISs are comprised of various roadway alignments and were developed by identifying sections of roadway improvements that if constructed, could function independently. Additionally, different sections within an OIS also could be replaced with another.

Following the release of the Draft SEIS and an opportunity for public review and comment, the independent sections could ultimately be combined to form “hybrid” alternatives. The OIS strategy allows for the identification of a “hybrid” alternative in addition to the alternatives described in this Draft SEIS that could reduce impacts and costs while achieving purpose and need. Depending on the nature of a hybrid alternative, if selected, public involvement opportunities may be offered to solicit additional public comment.

If a hybrid is identified as the Preferred Alternative, it would be fully documented in the Final SEIS; however, this OIS strategy allows impacts and costs to be summarized in this Draft SEIS.

The alignment segments that make up each Build Alternative are shown on **Figure A-1** and summarized in **Table A-1. Figures A-2 through A-5** show each Build Alternative broken down by alignment segment. For the alignment segments that are included under two or more alternatives, **Figure A-1** lists the letter of the corresponding alternatives with the numbered segment. The OISs are shown on **Figure A-6**. Environmental impacts have been quantified by roadway alignment segment and are presented in detail in **Table A-2**.

Table A-1: Alternative Alignment Segments

Segment	Roadway Segment Description
Alternative A	
8	I-64 north of HRBT
9	I-64 from HRBT to I-564
Alternative B	
8	I-64 north of HRBT
9	I-64 from HRBT to I-564
10	I-564 and I-564 Connector
12	I-564 Connector and VA 164 Connector Interchange
13	VA 164 Connector
14	VA 164
3	I-664 and VA 164 Interchange
Alternative C	
7	I-664 from I-64 to and including Terminal Avenue Interchange. Proposed design includes 8 lanes plus 2 transit only lanes
6	Terminal Avenue Interchange. Proposed interchange to connect with I-664 design that includes 8 lanes plus 2 transit only lanes
5	I-664 from Terminal Avenue Interchange to I-664 Connector. Proposed design includes 8 lanes plus 2 transit only lanes

Segment	Roadway Segment Description
11	I-664 Connector including I-664 interchange. Proposed interchange to connect with I-664 design that includes 8 lanes plus 2 transit only lanes
4	I-664 from I-664 Connector to VA 164
3	I-664 and VA 164 Interchange
2	I-664 from VA 164 to US 58 (Bowers Hill)
1	I-664 from US 58 (Bowers Hill) to I-264
13	VA 164 Connector
12	I-564 Connector, I-664 Connector, and VA 164 Connector Interchange. Proposed interchange to connect with I-564 design that includes 4 lanes plus 2 transit only lanes
10	I-564 and I-564 Connector. Proposed design includes 8 lanes plus 2 transit only lanes
Alternative D	
8	I-64 north of HRBT
9	I-64 from HRBT to I-564
7	I-664 from I-64 to and including Terminal Avenue Interchange. Proposed design includes 8 lanes
6	Terminal Avenue Interchange. Proposed interchange to connect with I-664 design that includes 8 lanes
5	I-664 from Terminal Avenue Interchange to I-664 Connector. Proposed design includes 8 lanes
11	I-664 Connector including I-664 interchange. Proposed interchange to connect with I-664 design that includes 8 lanes
4	I-664 from I-664 Connector to VA 164
3	I-664 and VA 164 Interchange
2	I-664 from VA 164 to US 58 (Bowers Hill)
1	I-664 from US 58 (Bowers Hill) to I-264
14	VA 164
13	VA 164 Connector
12	I-564 Connector, I-664 Connector, and VA 164 Connector Interchange. Proposed interchange to connect with I-564 design that includes 4 lanes
10	I-564 and I-564 Connector. Proposed design includes 8 lanes

Figure A-1: Alignment Segments

Figure A-2: Alternative A Segments

Figure A-3: Alternative B Segments

Figure A-4: Alternative C Segments

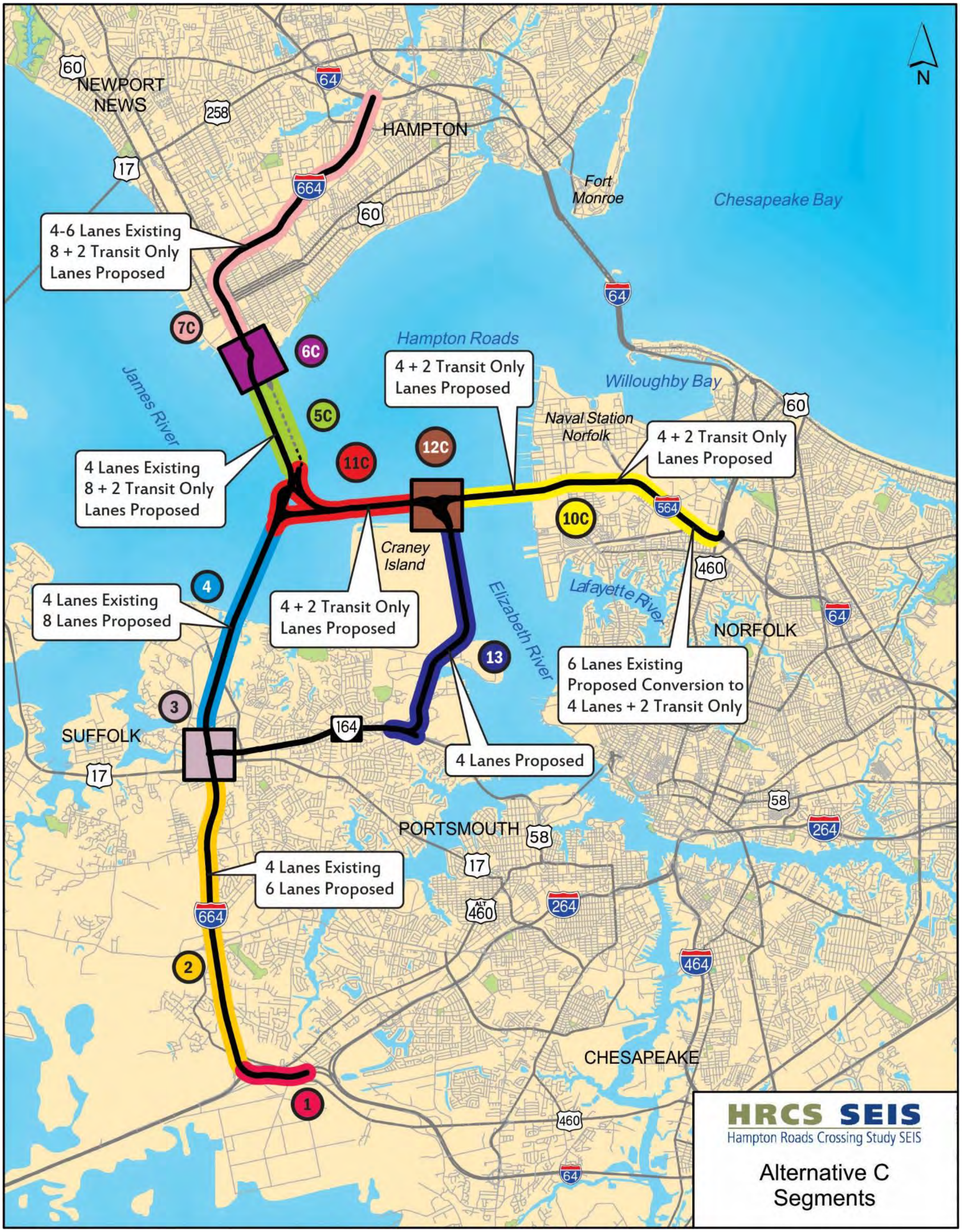
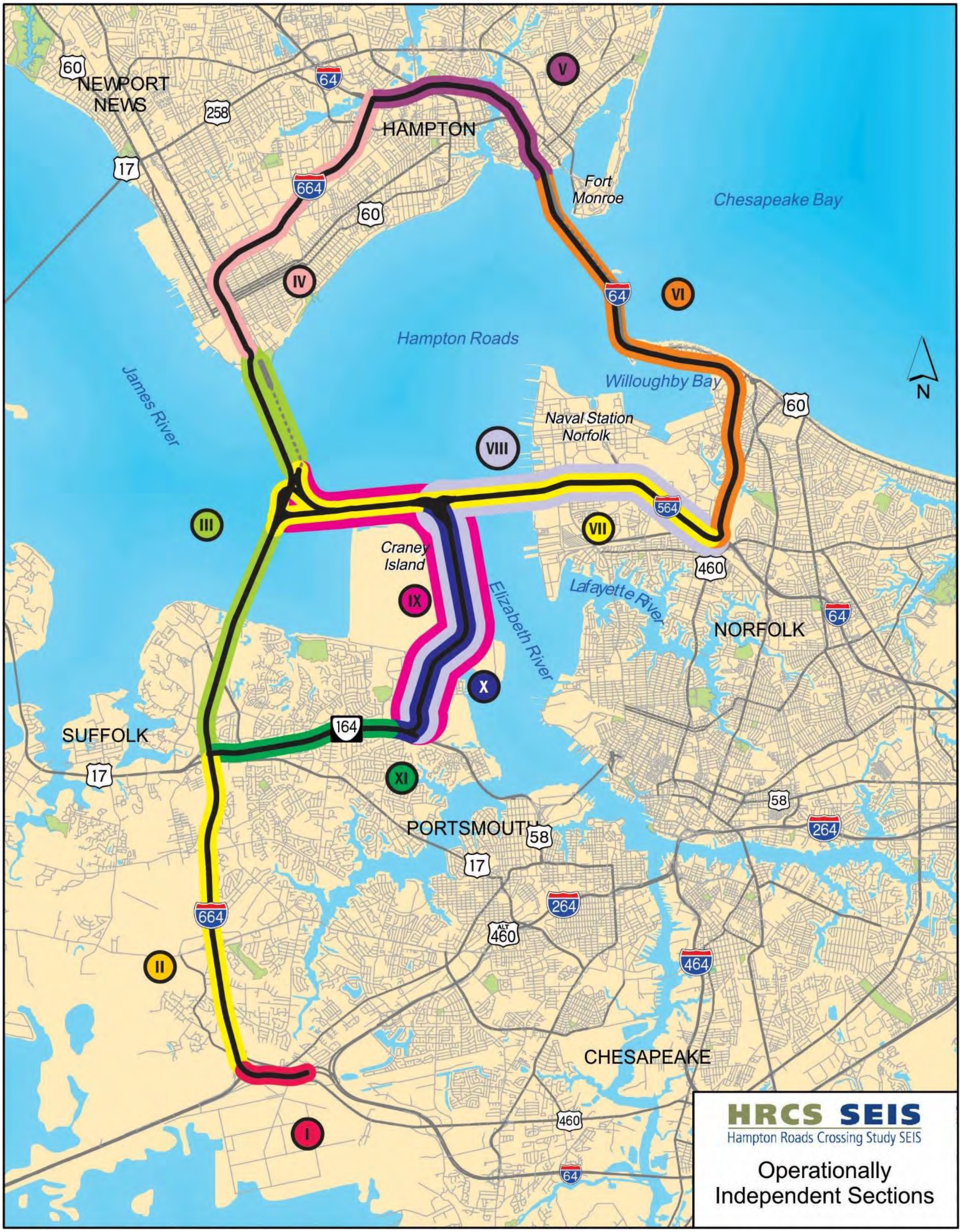


Figure A-5: Alternative D Segments

Figure A-6: Operationally Independent Sections



Resource	Segment 1	Segment 2	Segment 3	Segment 4	Segment 5C	Segment 5D	Segment 6C	Segment 6D	Segment 7C	Segment 7D	Segment 8	Segment 9	Segment 10BD	Segment 10C	Segment 11C	Segment 11D	Segment 12B	Segment 12C	Segment 12D	Segment 13	Segment 14
Stream Impacts (linear feet)	**292.7**	**143.0**	**0**	**112.2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Navigable Waters (acres)	**0**	**0.6**	**0**	**26.7**	**97.2**	**97.2**	**0.2**	**0.2**	**0**	**0**	**0.1**	**147.3**	**44.4**	**53.9**	**116.8**	**95.7**	**20.5**	**71.3**	**65.6**	**3.4**	**0**
Wetlands (acres)	**23.6**	**5.8**	**4.8**	**7.8**	**0**	**0**	**0**	**0**	**5.7**	**5.3**	**0.6**	**7.2**	**0.2**	**1.9**	**0**	**0**	**0**	**0**	**0**	**61.6**	**3.0**
Resource Protection Areas (acres)	**17.8**	**13.6**	**0**	**27.3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**64.8**	**52.1**	**1.0**	**1.3**	**1.3**	**15.0**	**0**
Floodplains (acres)	**0**	**3.5**	**0**	**4.0**	**23.6**	**25.0**	**5.6**	**4.5**	**0.4**	**0.4**	**3.3**	**109.3**	**25.4**	**31.1**	**43.5**	**38.7**	**10.3**	**36.8**	**34.4**	**64.9**	**0**
Hampton Roads Aquatic Habitat (acres)	**0**	**0**	**0**	**27.4**	**249.0**	**227.8**	**2.5**	**2.4**	**0**	**0**	**0**	**155.7**	**45.5**	**57.8**	**151.7**	**123.5**	**30.7**	**79.9**	**74.1**	**4.4**	**0**
Benthic Communities	**0**	**0**	**0**	**15.1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**180.0**	**149.0**	**5.4**	**50.0**	**44.2**	**0**	**0**
Essential Fish Habitat, Habitat Areas of Particular Concern, and Anadromous Fish Use Areas (acres)	**0**	**0**	**0**	**26.1**	**247.7**	**226.4**	**2.9**	**2.7**	**0**	**0**	**0**	**138.4**	**45.4**	**57.4**	**151.7**	**123.5**	**30.5**	**79.7**	**73.9**	**0**	**0**
Threatened & Endangered Species Habitat (acres)	**22.2**	**4.2**	**1.2**	**13.5**	**0**	**0**	**0.4**	**0.0**	**0.6**	**0.6**	**0**	**1.0**	**3.0**	**14.1**	**0**	**0**	**6.3**	**7.0**	**7.0**	**101.7**	**0**
Submerged Aquatic Vegetation (acres)	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1.8**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Terrestrial Habitat (Forested Area) (acres)	**54.6**	**12.3**	**6.6**	**13.6**	**0**	**0**	**0**	**0**	**18.2**	**17.3**	**0**	**14.9**	**7.2**	**23.1**	**0**	**0**	**0**	**0**	**0**	**51.0**	**0**
Water Quality	**Short-term and minor, beneficial long-term impacts**																				

APPENDIX B:

PHOTO INTERPRETATION MAPS

WETLAND MAPPING IN SUPPORT OF THE SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT

I. INTRODUCTION

This summary describes the remote sensing methods and specialized mapping used to create wetland maps and associated GIS data in support of the Hampton Roads Crossing Study Supplemental Environmental Impact Statement (SEIS). Wetland mapping was accomplished for this project using a combination of geospatial datasets, expert photo interpretation, field work, and input by stakeholders. Digital aerial imagery was used as the primary source from which to photo interpret the extent of wetland habitat occurring within a 500 foot corridor along proposed roadway corridors. Wetland mapping was accomplished via photo interpretation of the aerial imagery by experienced wetland photo interpreters familiar with Virginia vegetation, land cover and wetland habitats. Additional collateral data were also used to assist with the accurate delineation of wetlands.

Ground truthing field work was accomplished to both refine wetland delineations during map creation and to ensure the accuracy of delineated wetlands on the final maps. Several field visits were accomplished during the course of the project to ensure that the maps reflected field conditions and that wetland boundaries were placed according to both wetland signatures appearing in the aerial imagery and according to wetland indicators in the field.

The wetland map was delivered within an ArcGIS geodatabase allowing for the analysis and quantification of wetlands occurring along proposed alignments. In addition, PDF maps were generated and distributed to a multitude of stakeholders in draft format for them to review and inspect the accuracy of the mapping. This important step ensured that local agency stakeholders and wetland experts reviewed the mapping before it was finalized.

The wetland mapping conducted for this project will be used to provide an accurate identification of wetlands based on photo interpretation, field work and GIS. The resultant data can be used at a planning-level to support an informed decision during the comparison of multiple large-scale planning corridors.

A more thorough discussion of project, methodology and deliverables is provided below.

II. FGDC WETLAND MAPPING STANDARD AND WETLAND DEFINITION

Wetlands were mapped according to the Federal Geographic Data Committee's (FGDC) Wetland Mapping Standard. The objective of the FGDC Wetlands Mapping Standard is to support the accurate mapping and classification of wetlands while ensuring mechanisms for their revision and update as directed under OMB Circular A-16 (Revised). The FGDC Standard is designed to direct the current and future digital mapping of wetlands.

According to the FGDC: *"This Standard is intended for all Federal or federally-funded wetlands inventory mapping including those activities conducted by Federal agencies, states, and federally-recognized tribal entities, non-governmental organizations, universities, and others. Specifically, if Federal funding is used in support of wetlands inventory mapping activities, then use of this standard is mandatory. The adoption of* *the standard for all other wetlands inventory mapping efforts (non-federally funded) is strongly encouraged to maintain and expand the wetland layer of the NSDI".*

The FGDC Wetlands Mapping Standard is based upon the definition of a wetland as described within the Cowardin et al. system entitled "Classification of Wetlands and Deepwater Habitats of the United States". The mapping conducted for this project conformed to the definition of a wetland therein. Therefore, the definition of a wetland for the Hampton Roads Crossing Study is as follows:

"WETLANDS are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. For purposes of this classification wetlands must have one or more of the following three attributes: (1) at least periodically, the land supports predominantly hydrophytes; (2) the substrate is predominantly undrained hydric soil; and (3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of each year."

The FGDC Wetlands Mapping Standard does not attempt to differentiate between regulatory and non-regulatory wetlands. Instead, it focuses on the scientific aspect of wetland definition.

The classification system that was applied during mapping is summarized below.

WETLAND CLASSIFICATION CODE	**WETLAND CLASSIFICATION DESCRIPTION**
PUB	Palustrine, Unconsolidated Bottom (open water)
PUBF	Palustrine, Unconsolidated Bottom (open water), Semi-permanently or Permanently Flooded
PEM	Palustrine, Emergent,
PEMF	Palustrine, Emergent, Semi-permanently or Permanently Flooded
PSS	Palustrine, Scrub-shrub
PFO	Palustrine, Forested,
PFOF	Palustrine, Forested, Semi-permanently or Permanently Flooded
E1UB	Estuarine, Subtidal, Unconsolidated Bottom (open water)
E2US	Estuarine, Intertidal, Unconsolidated Shore
E2EM	Estuarine, Intertidal, Emergent
x	Excavated modifier. The excavated modifier is applied to any wetland types that were historically excavated. The modifier is applied to roadside ditches, ditches bisecting the corridor, excavated

	ponds and retention ponds. Excavated ditches were additionally classified as occurring within either a “Roadside” area or an “Interchange” area.
R3	Riverine, Perennial <u>Notes:</u> 1. The Riverine classes (R3, R4) are used only for naturally occurring stream channels and not excavated ditches. Excavated ditches are classified as Palustrine with the “x” modifier applied. 2. Duration of flow is determined by using USGS’ National Hydrography Dataset (NHD).
R4	Riverine, Intermittent
U	Upland, Non-wetland,

III. SOURCE IMAGERY

The Virginia Base Mapping Program (VBMP) acquires statewide aerial photography on a four year cycle for Virginia. Between March 10 and April 21, 2013, the Virginia Geographic Information Network (VGIN) acquired the eastern half of Virginia in support of VBMP. VGIN’s imagery is collected to support of the agency’s digital orthophoto program. The orthophotos produced from this imagery and distributed by VGIN, possess a 1-foot ground sample distance (GSD), 4 discrete bands (R, G, B, NIR) with a 200 scale spatial accuracy. The orthophotos were used as one input to accomplish wetland mapping.

For highly accurate wetland mapping, stereo aerial imagery is the preferred source. VGIN does not normally distribute the raw imagery required for use within stereo photogrammetric workstations. In addition, the aerial triangulation solution necessary for the creation of stereo models is not a normally distributed product. However, Dewberry requested that VGIN supply both the raw imagery and the associated aerial triangulation solution for this project so that Dewberry, working on behalf of VDOT’s best interests, could view and delineate wetland habitats in stereo. This methodology facilitated the accurate identification of wetland habitats. Ultimately, it helped ensure the accuracy of wetland-upland boundaries on the map.

IV. ANCILLARY DATA

The use of ancillary data is important for accurate wetland mapping. It helps increase accuracy and decision making during photo interpretation. Below is a partial list of ancillary data used for the project during photo interpretation:

- Existing land cover map products
- National Wetlands Inventory data
- SSURGO mapped soils data
- Historical orthophotography available from VGIN

- National Hydrography Dataset (NHD)
- LiDAR-derived digital elevation model (DEM)
- Delineation of WOUS including wetlands on the I564 project

V. FIELD RECONNAISSANCE

Dewberry's fieldwork process allowed the photo interpreters to correlate signatures (i.e. colors, tones, and textures) on the aerial photography with in-field conditions in order to determine exact cover-type classification. The task was necessary in order to correlate aerial imagery signatures with field conditions so that accurate aerial wetland delineation could be accomplished. The process required the selection of a sample of wetlands occurring within a project area and subsequent field inspections aimed at increasing the accuracy of photo interpretation.

Dewberry began this task by preparing a field work ArcGIS shapefile showing the locations for which field visits were required to support the mapping. The ArcGIS file contained the following fields:

- A unique Sampling Point number (e.g., 1-15)
- Coordinate locations of each field site
- The photo interpreter's question regarding the site
- A blank field answering the question as to whether the sampled area was within a wetland

In addition to the above, draft photo interpreted linework was included within the geodatabase. The draft linework showed where the photointerpreter believed the wetland or stream boundary existed based solely on geospatial products and ancillary information.

Fieldwork to correlate photo interpretation with wetlands was conducted by Dewberry staff completely familiar with wetland identification in Virginia. RK&K was responsible for receiving the intended field locations from Dewberry, contacting property owners, and ensuring that Dewberry staff had access upon arrival to the field work locations.

Dewberry field staff then visited the field sites in order to populate the field work feature class with answers to the mapping related questions posed during photo interpretation. The information gained in the field was used to either improve delineations on the map or to verify map accuracy. The following information was gathered at selected field sites, included within the geodatabase's feature class and documented on Wetland Determination Data Forms.

a. **Vegetation**: A list of the dominant plant species occurring at the site in question was documented along with the Indicator Status from the April 2014 list. Where the canopy was monotypic such as Sweet Gum, the understory species was listed. Vegetation was recorded within the Tree, Sapling, Shrub, Herb, and/or Woody Vine Stratums appearing on the Wetland Determination Data Form.

b. **Soil**: Soil characteristics were used to assist with determining the extent of the wetlands. Any visible hydric soil indicators within the upper 12-18 inches were listed and reported within the Hydric Soils Indicators section of the Wetland Determination Data Form.

c. **Hydrology**: Any signs of past or present flooding, ponding or seasonally high groundwater tables was noted at the field site. Hydrology observations were recorded within the Wetland Hydrology Indicators section of the Wetland Determination Data Form. Potential visible modifications to hydrology and any potential zone of influence these modifications may have in the area were noted.

d. **Cowardin Classification**: The correct Cowardin classification based on field work was noted.

e. **Wetland or Upland Determination**: The final determination as to whether the sampled field location was a wetland/WOUS or not was recorded. The wetland classification type was determined in the field and was then attributed within the geodatabase.

Selected wetland/WOUS boundaries were surveyed using a GPS enabled Toughbook PC with ArcMap and all draft and ancillary data while in the field. This equipment enables defining the wetland/WOUS boundary in selected areas so that the photo interpreter can use the surveyed line along with aerial imagery and other ancillary geospatial data products to identify and classify wetland/upland signatures.

Prior to commencing with field work, paper field maps were be generated by Dewberry at appropriate scales. The maps contained VGIN orthophotography, alignment boundary, sample points, preliminary wetland/WOUS boundaries, roads, and road names. A draft was circulated to the agencies for review and comment prior to any field activities.

Fieldwork was completed on two separate trips, January 11-15 and February 23-24, 2016. For each trip Dewberry deployed two personnel for field work, one photo interpreter and one certified wetland delineator. Additional collaboration was provided by personnel from Stantec. The trip on Feb 23 and 24 was conducted with agency stakeholders including representatives from the US Army Corps of Engineers, VMRC, VIMS, NRCS, and the US Navy.

A brief field summary report was completed that describes the field work accomplished on each individual day. The report contains the following information:

- Date of fieldwork
- Field personnel
- Sampling points/locations visited
- Brief narrative describing locations visited along with any general observations

VI. PHOTO INTERPRETATION

Stereo photo interpretation has proven to yield a cost effective and highly accurate wetland map product. Photo interpretation for this project was accomplished in stereo using Dewberry's highly efficient SOCET GXP softcopy photogrammetry workstations which are interfaced with the SOCET for ArcGIS software module. SOCET for ArcGIS works with the geodatabase and takes care of versioning and topology. This platform facilitates an efficient and cost effective work flow aimed at delivering GIS maps.

As Dewberry's photo interpretation commenced, vegetation signatures were carefully analyzed by the photo interpreter in stereo. Viewing the imagery in stereo provides the photo interpreters the ability to see height and texture. Height and texture enhances the vegetation signatures resulting in more accurate photo interpretation. Slight differences in vegetation species height can be detected via zoom functions and texture is greatly enhanced during the process. In addition, the software allows the photo interpreters to quickly adjust each image's tonal and color characteristics for the best possible signature identification of wetland communities by adjusting histogram values on-the-fly during photo interpretation.

The decision to classify an area as wetland or upland was made by Dewberry's experienced wetland photo interpreters on a site specific basis. During photo interpretation sessions, historical imagery and other ancillary data were used or displayed as sources to assist with aerial wetland delineation. The photo interpretation sessions enabled the superimposition of multiple imagery sets so that photo interpreters compare wetland signatures from multiple timeframes. Field work information was constantly used during photo interpretation.

VII. GIS DATA

The wetland mapping data was delivered as a draft within an Esri ArcGIS geodatabase version 10.3.

The following spatial referencing system was used for the mapped data:

Projection: Virginia State Plane Coordinate System

Datum: NAD83/93 HARN

Units: US Survey Feet

The spatial accuracy of the mapped data was wholly dependent upon the spatial accuracy inherent within the aerial triangulation solution and imagery supplied for the project by VGIN. Both products had been accepted by VGIN as conforming to their spatial accuracy specification which is stated follows: *NSSDA accuracy shall meet the criteria of 1.73*RMSEr <4.9 feet.*

VIII. DRAFT MAP DELIVERY AND REVIEW

Prior to finalization of the wetland maps, draft maps were delivered for agency review. Agencies including the US Army Corps of Engineers, VMRC, VIMS, NRCS, US Navy and others were provided with the draft maps and asked to review and comment on the accuracy of classification and the delineated wetland boundaries.

In addition to the above draft map dissemination, the project team invited agencies to a meeting (attended both in person and via teleconference) in order to explain the methodology used for the project. During this meeting, the project team solicited comments from the agencies regarding the accuracy of the mapping. At the conclusion of the meeting, agency personnel were asked provide comments back to the project team within a specified timeframe so that potential improvements to the maps could be accomplished.

After the above draft map review task and subsequent agency meeting, selected agencies were also invited to participate with the project team on field work conducted on February 23rd and 24th. This field trip was designed to further explain the mapping methods and also to ground truth the maps in the field with agency collaboration.

IX. DELIVERY SCHEDULE

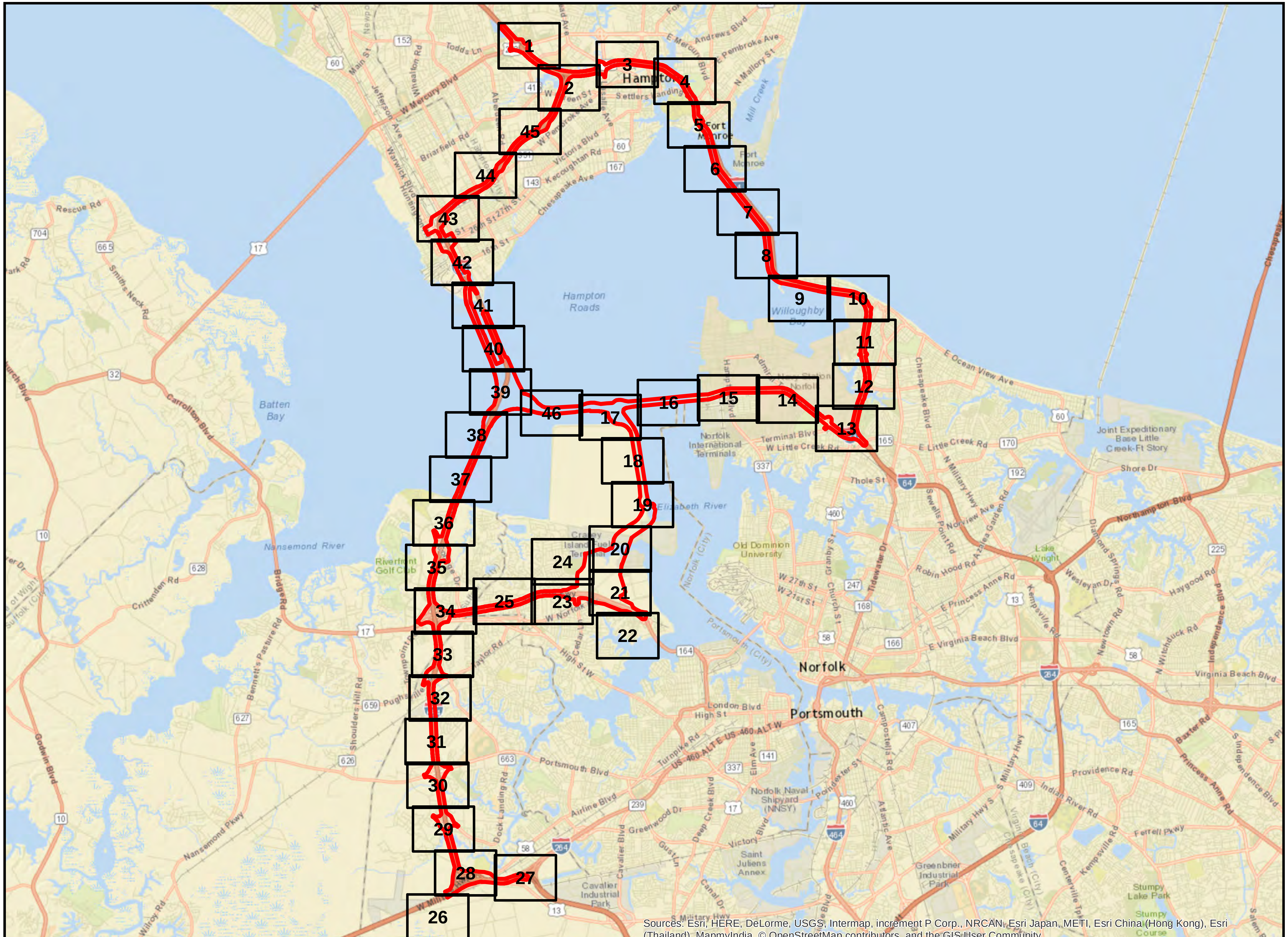
The following outlines Dewberry's schedule and the timeframe for deliverables.

Task	Due Date
Project Kick-Off Meeting	7/7/2015
Preliminary PDF Plots and Geodatabase Containing Initial Mapping and Dewberry's Proposed Field Points/Questions	11/27/2015
Coordination Meeting with Agencies, Draft Map Review	12/16/2015
Feedback from Draft Map Reviews	1/8/2016
Field Work Completed	1/15/2016
Field Work Completed with Agencies	2/24/2016
Draft Plots and Maps	3/4/2016
Final Plots and Maps	3/25/2016
Final Project Report	3/31/2016

X. CONCLUSION

A combination of geospatial data, photo interpretation, field work, and stakeholder collaboration were implemented for this project. The project was completed according to schedule and all deliverables were submitted within the designated timeframe.

The wetland mapping completed for Hampton Roads Crossing Study proved to be highly accurate according to agency feedback and according to in-field ground-truthing exercises. The GIS-based wetland maps generated for the project can be used as a reliable source to quantify the extent and distribution of wetlands along planned VDOT roadway corridors.



VDOT

0 0.5 1 2 Miles

1 in = 2 miles

Hampton Roads Crossing Study

Virginia DOT

Chesapeake, Hampton, Newport News, Norfolk, Portsmouth, and Suffolk, Virginia

Legend

VDOT_HRCS_Map_Sheets

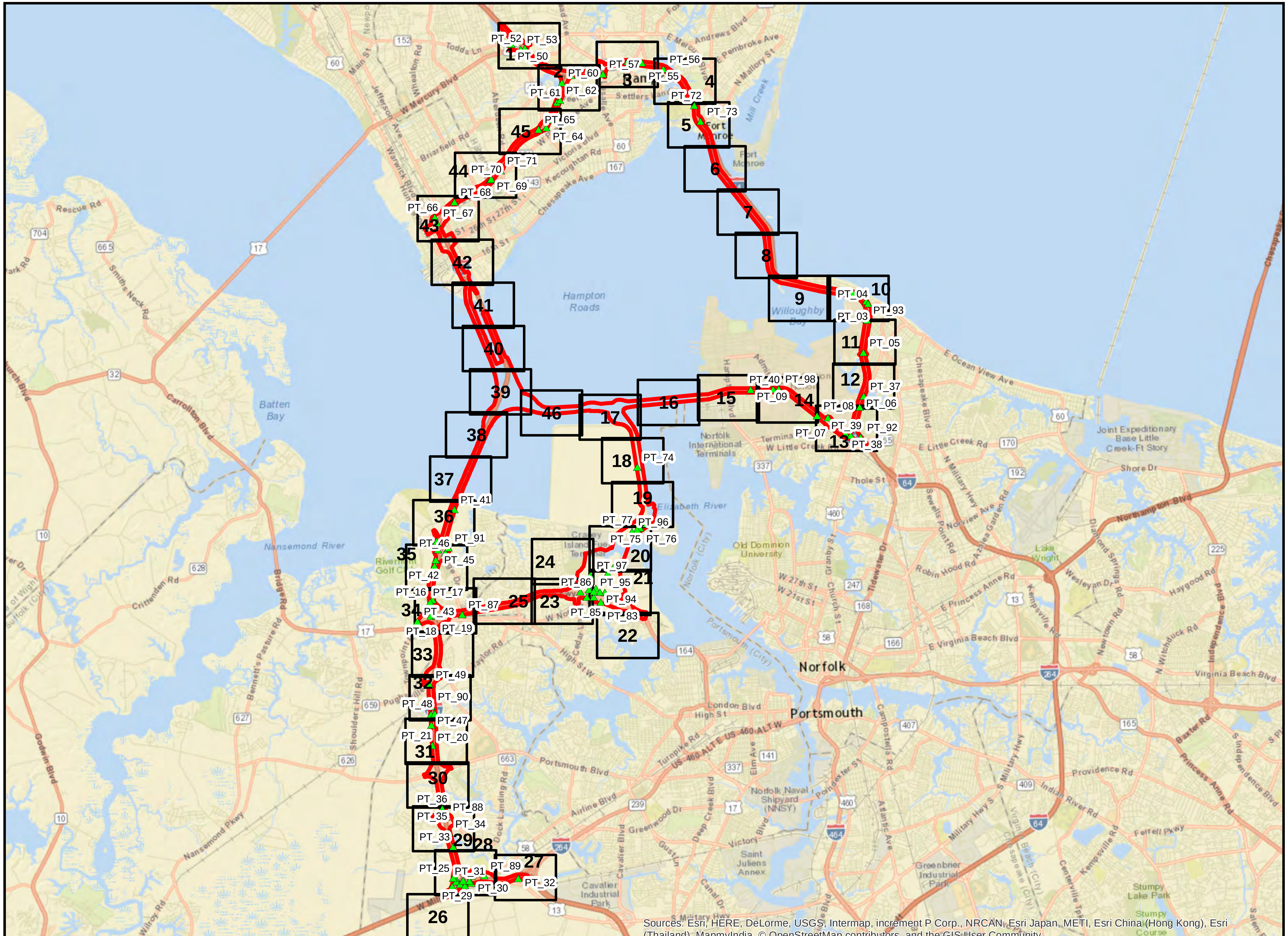
Study Area Corridors

Date: 7/25/2016

TITLE

MAP INDEX

SHEET NO. MAP INDEX



VDOT

0 0.5 1 2 Miles

1 in = 2 miles

Hampton Roads Crossing Study

Virginia DOT

Chesapeake, Hampton, Newport News, Norfolk, Portsmouth, and Suffolk, Virginia

Legend

- VDOT_HRCS_Map_Sheets
- Study Area Corridors
- Groundtruthing- 1/11/16-1/15/16

Date: 7/25/2016

TITLE
MAP INDEX

SHEET NO. MAP INDEX

VDOT

0 125 250 500 Feet

1 in = 500 ft

DATA SOURCES: USGS, VDOT, VGIN (2013 RGB AERIAL)

Hampton Roads Crossing Study
Virginia DOT
Hampton, Virginia

Legend

- Groundtruthing- 1/11/16-1/15/16
- Study Area Corridors

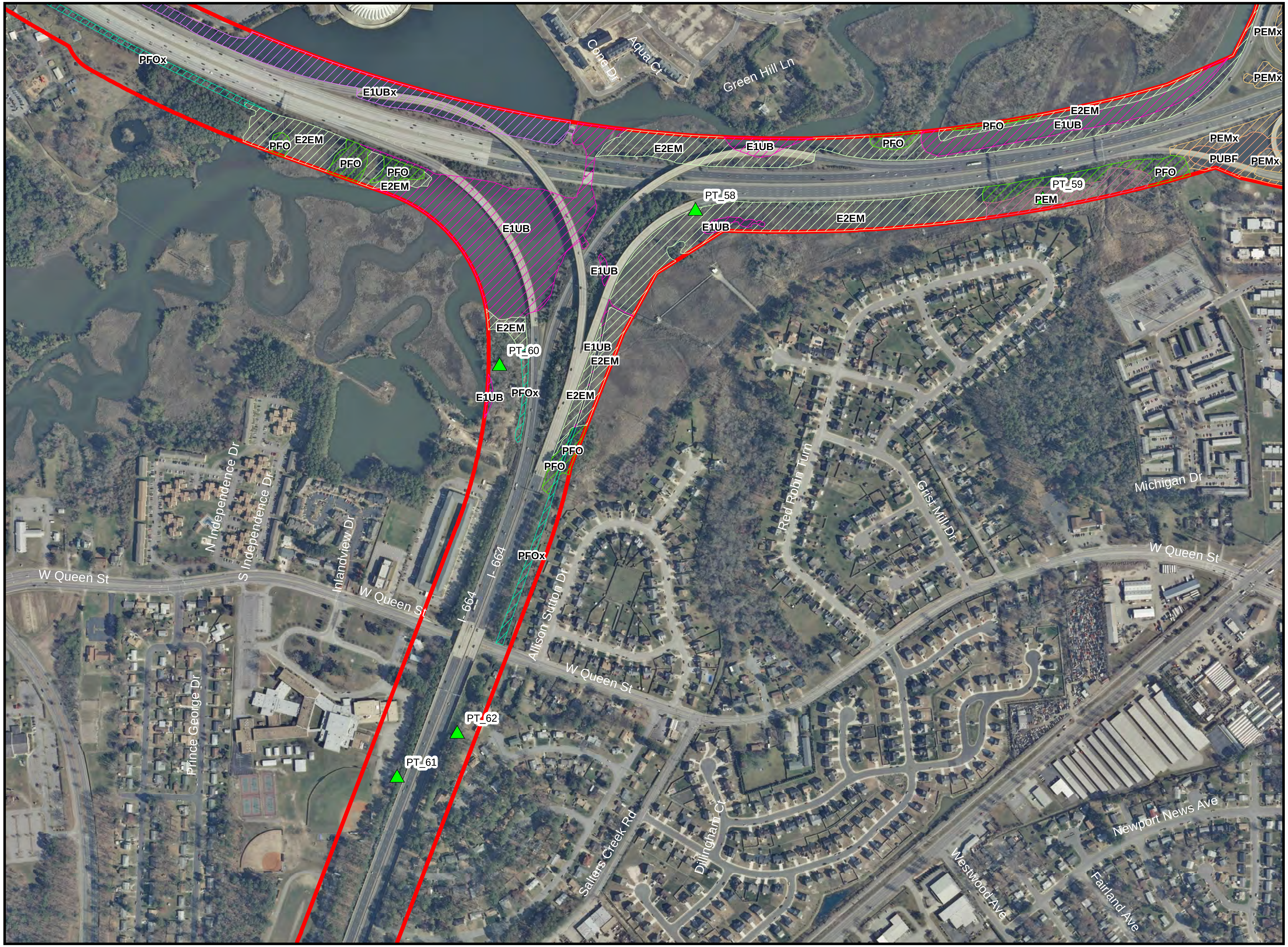
Photointerpreted Wetlands Cowardin Classification

- E1UB- Estuarine, Subtidal, Unconsolidated Bottom (open water)
- E1UBx- Excavated
- E2EM- Estuarine, Intertidal, Emergent
- E2EMx- Excavated
- E2US- Estuarine, Intertidal, Unconsolidated Shore
- E2USx- Excavated
- PEM- Palustrine, Emergent
- PEMF- Palustrine, Emergent, Semi-permanently or Permanently Flooded
- PEMFx- Excavated
- PEMx- Excavated
- PFO- Palustrine, Forested
- PFOF- Palustrine, Forested, Semi-permanently or Permanently Flooded
- PFOFx- Excavated
- PFOx- Excavated
- PSS- Palustrine, Scrub-shrub
- PSSx- Excavated
- PUB- Palustrine, Unconsolidated Bottom (open water)
- PUBF- Palustrine, Unconsolidated Bottom (open water), Semi or Permanently Flooded
- PUBFx- Excavated
- PUBx- Excavated
- R3- Riverine, Perennial
- R4- Riverine, Intermittent

Date: 7/25/2016

TITLE
MAP-1

SHEET NO. 1 OF 46



0 125 250 500 Feet

1 in = 500 ft

DATA SOURCES: USGS, VDOT, VGIN (2013 RGB AERIAL)

Hampton Roads Crossing Study
Virginia DOT
Hampton, Virginia

Legend

- Groundtruthing- 1/11/16-1/15/16
- Study Area Corridors

Photointerpreted Wetlands Cowardin Classification

- E1UB- Estuarine, Subtidal, Unconsolidated Bottom (open water)
- E1UBx- Excavated
- E2EM- Estuarine, Intertidal, Emergent
- E2EMx- Excavated
- E2US- Estuarine, Intertidal, Unconsolidated Shore
- E2USx- Excavated
- PEM- Palustrine, Emergent
- PEMF- Palustrine, Emergent, Semi-permanently or Permanently Flooded
- PEMFx- Excavated
- PEMx- Excavated
- PFO- Palustrine, Forested
- PFOF- Palustrine, Forested, Semi-permanently or Permanently Flooded
- PFOFx- Excavated
- PFOx- Excavated
- PSS- Palustrine, Scrub-shrub
- PSSx- Excavated
- PUB- Palustrine, Unconsolidated Bottom (open water)
- PUBF- Palustrine, Unconsolidated Bottom (open water), Semi or Permanently Flooded
- PUBFx- Excavated
- PUBx- Excavated
- R3- Riverine, Perennial
- R4- Riverine, Intermittent

Date: 7/25/2016

TITLE
MAP-2

SHEET NO. 2 OF 46

VDOT

0 125 250 500 Feet

1 in = 500 ft

DATA SOURCES: USGS, VDOT, VGIN (2013 RGB AERIAL)

Hampton Roads Crossing Study
Virginia DOT
Hampton, Virginia

Legend

- Groundtruthing- 1/11/16-1/15/16
- Study Area Corridors

Photointerpreted Wetlands
Cowardin Classification

- E1UB- Estuarine, Subtidal, Unconsolidated Bottom (open water)
- E1UBx- Excavated
- E2EM- Estuarine, Intertidal, Emergent
- E2EMx- Excavated
- E2US- Estuarine, Intertidal, Unconsolidated Shore
- E2USx- Excavated
- PEM- Palustrine, Emergent
- PEMF- Palustrine, Emergent, Semi-permanently or Permanently Flooded
- PEMFx- Excavated
- PEMx- Excavated
- PFO- Palustrine, Forested
- PFOF- Palustrine, Forested, Semi-permanently or Permanently Flooded
- PFOFx- Excavated
- PFOx- Excavated
- PSS- Palustrine, Scrub-shrub
- PSSx- Excavated
- PUB- Palustrine, Unconsolidated Bottom (open water)
- PUBF- Palustrine, Unconsolidated Bottom (open water), Semi or Permanently Flooded
- PUBFx- Excavated
- PUBx- Excavated
- R3- Riverine, Perennial
- R4- Riverine, Intermittent

Date: 7/25/2016

TITLE
MAP-3

SHEET NO. 3 OF 46

VDOT

0 125 250 500 Feet

1 in = 500 ft

DATA SOURCES: USGS, VDOT, VGIN (2013 RGB AERIAL)

Hampton Roads Crossing Study
Virginia DOT
Hampton, Virginia

Legend

- Groundtruthing- 1/11/16-1/15/16
- Study Area Corridors

Photointerpreted Wetlands Cowardin Classification

- E1UB- Estuarine, Subtidal, Unconsolidated Bottom (open water)
- E1UBx- Excavated
- E2EM- Estuarine, Intertidal, Emergent
- E2EMx- Excavated
- E2US- Estuarine, Intertidal, Unconsolidated Shore
- E2USx- Excavated
- PEM- Palustrine, Emergent
- PEMF- Palustrine, Emergent, Semi-permanently or Permanently Flooded
- PEMFx- Excavated
- PEMx- Excavated
- PFO- Palustrine, Forested
- PFOF- Palustrine, Forested, Semi-permanently or Permanently Flooded
- PFOFx- Excavated
- PFOx- Excavated
- PSS- Palustrine, Scrub-shrub
- PSSx- Excavated
- PUB- Palustrine, Unconsolidated Bottom (open water)
- PUBF- Palustrine, Unconsolidated Bottom (open water), Semi or Permanently Flooded
- PUBFx- Excavated
- PUBx- Excavated
- R3- Riverine, Perennial
- R4- Riverine, Intermittent

Date: 7/25/2016

TITLE
MAP-4

SHEET NO. 4 OF 46

VDOT

0 125 250 500 Feet

1 in = 500 ft

DATA SOURCES: USGS, VDOT, VGIN (2013 RGB AERIAL)

Hampton Roads Crossing Study
Virginia DOT
Hampton, Virginia

Legend

- Groundtruthing- 1/11/16-1/15/16
- Study Area Corridors

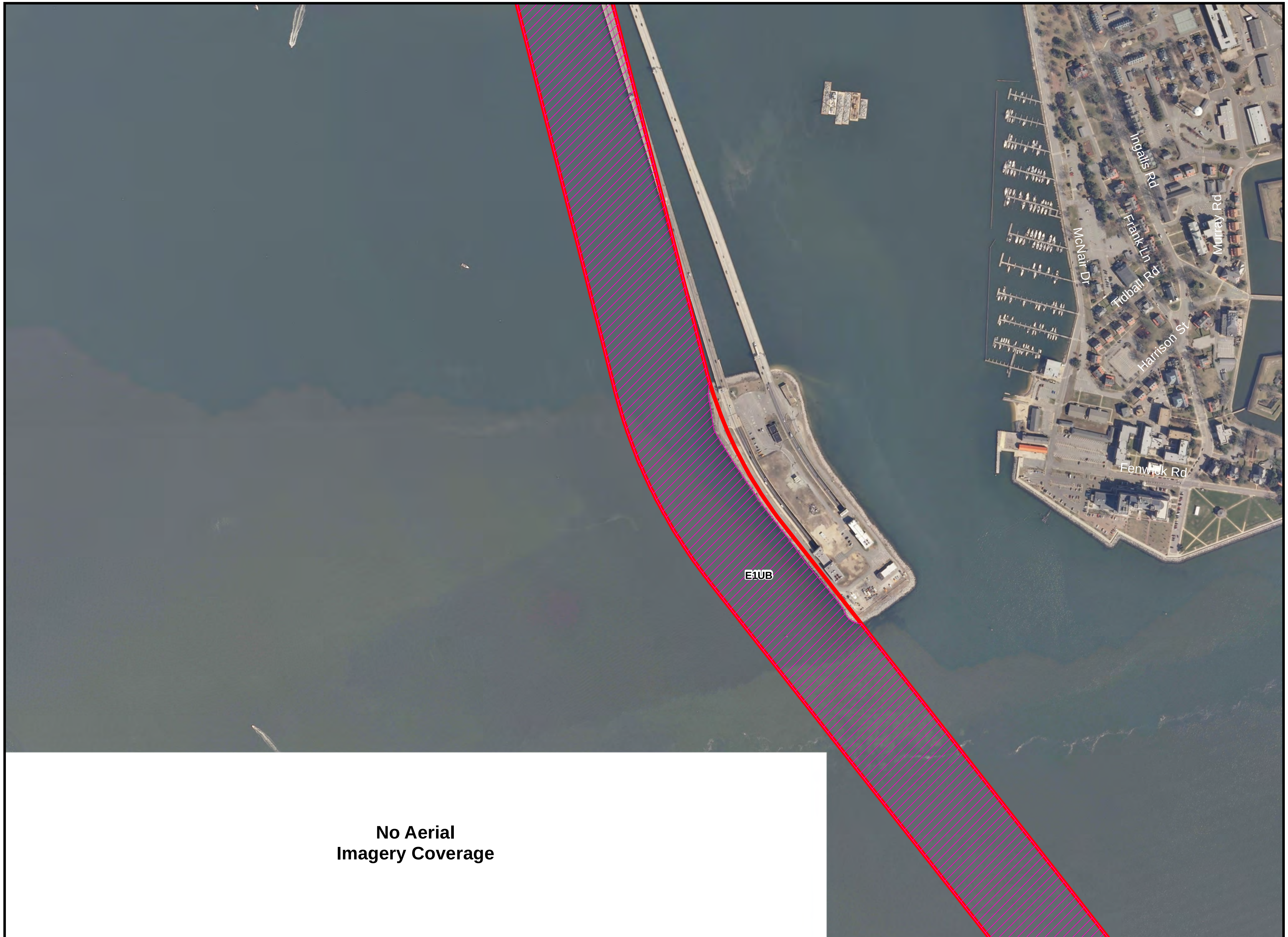
Photointerpreted Wetlands Cowardin Classification

- E1UB- Estuarine, Subtidal, Unconsolidated Bottom (open water)
- E1UBx- Excavated
- E2EM- Estuarine, Intertidal, Emergent
- E2EMx- Excavated
- E2US- Estuarine, Intertidal, Unconsolidated Shore
- E2USx- Excavated
- PEM- Palustrine, Emergent
- PEMF- Palustrine, Emergent, Semi-permanently or Permanently Flooded
- PEMFx- Excavated
- PEMx- Excavated
- PFO- Palustrine, Forested
- PFOF- Palustrine, Forested, Semi-permanently or Permanently Flooded
- PFOFx- Excavated
- PFOx- Excavated
- PSS- Palustrine, Scrub-shrub
- PSSx- Excavated
- PUB- Palustrine, Unconsolidated Bottom (open water)
- PUBF- Palustrine, Unconsolidated Bottom (open water), Semi or Permanently Flooded
- PUBFx- Excavated
- PUBx- Excavated
- R3- Riverine, Perennial
- R4- Riverine, Intermittent

Date: 7/25/2016

TITLE
MAP-5

SHEET NO. 5 OF 46



VDOT

0 125 250 500 Feet

1 in = 500 ft

DATA SOURCES: USGS, VDOT, VGIN (2013 RGB AERIAL)

Hampton Roads Crossing Study
Virginia DOT
Hampton, Virginia

Legend

Groundtruthing- 1/11/16-1/15/16

Study Area Corridors

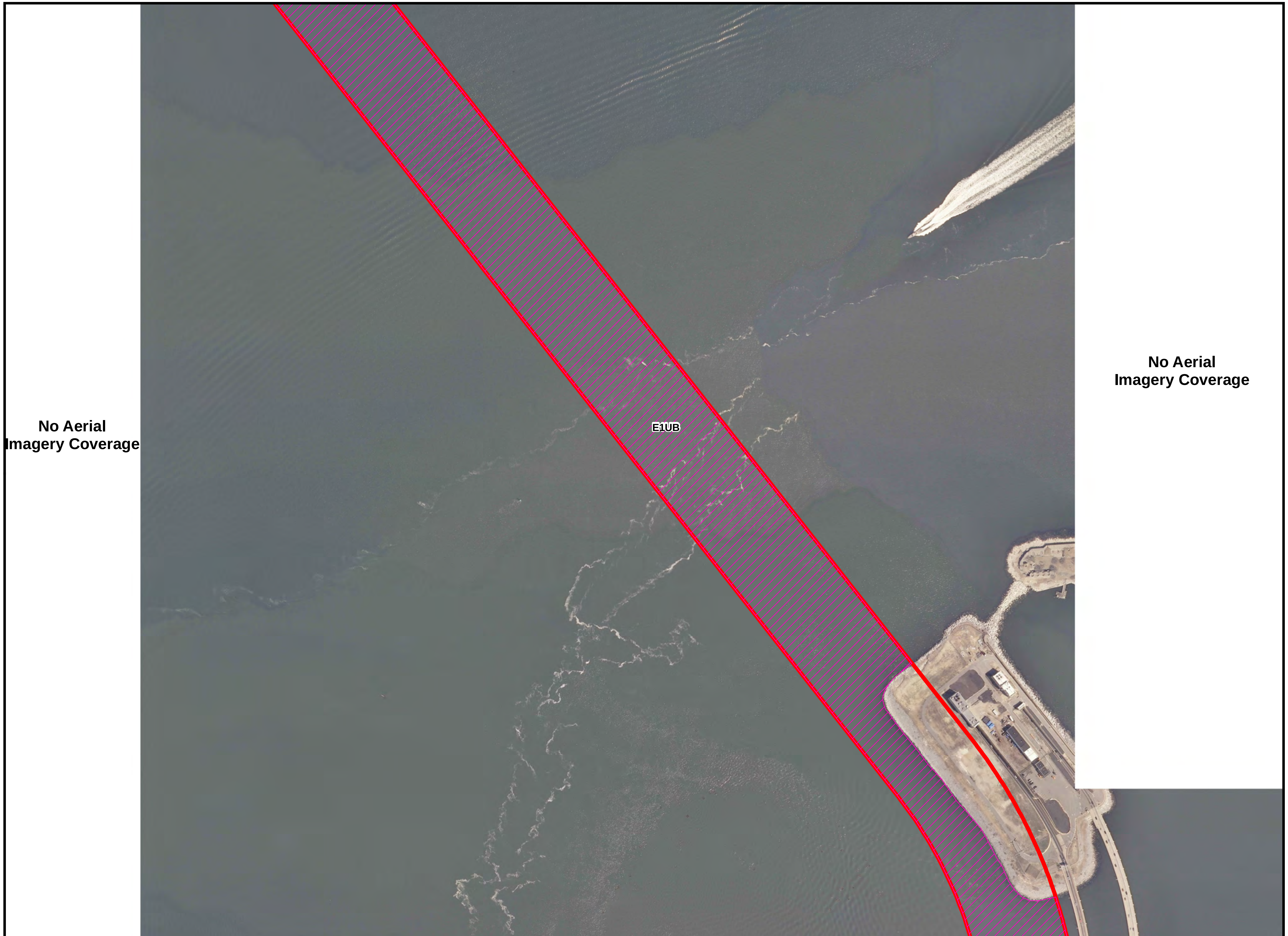
Photointerpreted Wetlands
Cowardin Classification

- E1UB- Estuarine, Subtidal, Unconsolidated Bottom (open water)
- E1UBx- Excavated
- E2EM- Estuarine, Intertidal, Emergent
- E2EMx- Excavated
- E2US- Estuarine, Intertidal, Unconsolidated Shore
- E2USx- Excavated
- PEM- Palustrine, Emergent
- PEMF- Palustrine, Emergent, Semi-permanently or Permanently Flooded
- PEMFx- Excavated
- PEMx- Excavated
- PFO- Palustrine, Forested
- PFOF- Palustrine, Forested, Semi-permanently or Permanently Flooded
- PFOFx- Excavated
- PFOx- Excavated
- PSS- Palustrine, Scrub-shrub
- PSSx- Excavated
- PUB- Palustrine, Unconsolidated Bottom (open water)
- PUBF- Palustrine, Unconsolidated Bottom (open water), Semi or Permanently Flooded
- PUBFx- Excavated
- PUBx- Excavated
- R3- Riverine, Perennial
- R4- Riverine, Intermittent

Date: 7/25/2016

TITLE
MAP-6

SHEET NO. 6 OF 46



VDOT

0 125 250 500 Feet

1 in = 500 ft

DATA SOURCES: USGS, VDOT, VGIN (2013 RGB AERIAL)

Hampton Roads Crossing Study
Virginia DOT
Hampton, Virginia

Legend

- Groundtruthing- 1/11/16-1/15/16
- Study Area Corridors

Photointerpreted Wetlands
Cowardin Classification

- E1UB- Estuarine, Subtidal, Unconsolidated Bottom (open water)
- E1UBx- Excavated
- E2EM- Estuarine, Intertidal, Emergent
- E2EMx- Excavated
- E2US- Estuarine, Intertidal, Unconsolidated Shore
- E2USx- Excavated
- PEM- Palustrine, Emergent
- PEMF- Palustrine, Emergent, Semi-permanently or Permanently Flooded
- PEMFx- Excavated
- PEMx- Excavated
- PFO- Palustrine, Forested
- PFOF- Palustrine, Forested, Semi-permanently or Permanently Flooded
- PFOFx- Excavated
- PFOx- Excavated
- PSS- Palustrine, Scrub-shrub
- PSSx- Excavated
- PUB- Palustrine, Unconsolidated Bottom (open water)
- PUBF- Palustrine, Unconsolidated Bottom (open water), Semi or Permanently Flooded
- PUBFx- Excavated
- PUBx- Excavated
- R3- Riverine, Perennial
- R4- Riverine, Intermittent

Date: 7/25/2016

TITLE
MAP-7

SHEET NO. 7 OF 46

VDOT

0 125 250 500 Feet

1 in = 500 ft

DATA SOURCES: USGS, VDOT, VGIN (2013 RGB AERIAL)

Hampton Roads Crossing Study
Virginia DOT
Norfolk, Virginia

Legend

- Groundtruthing- 1/11/16-1/15/16
- Study Area Corridors

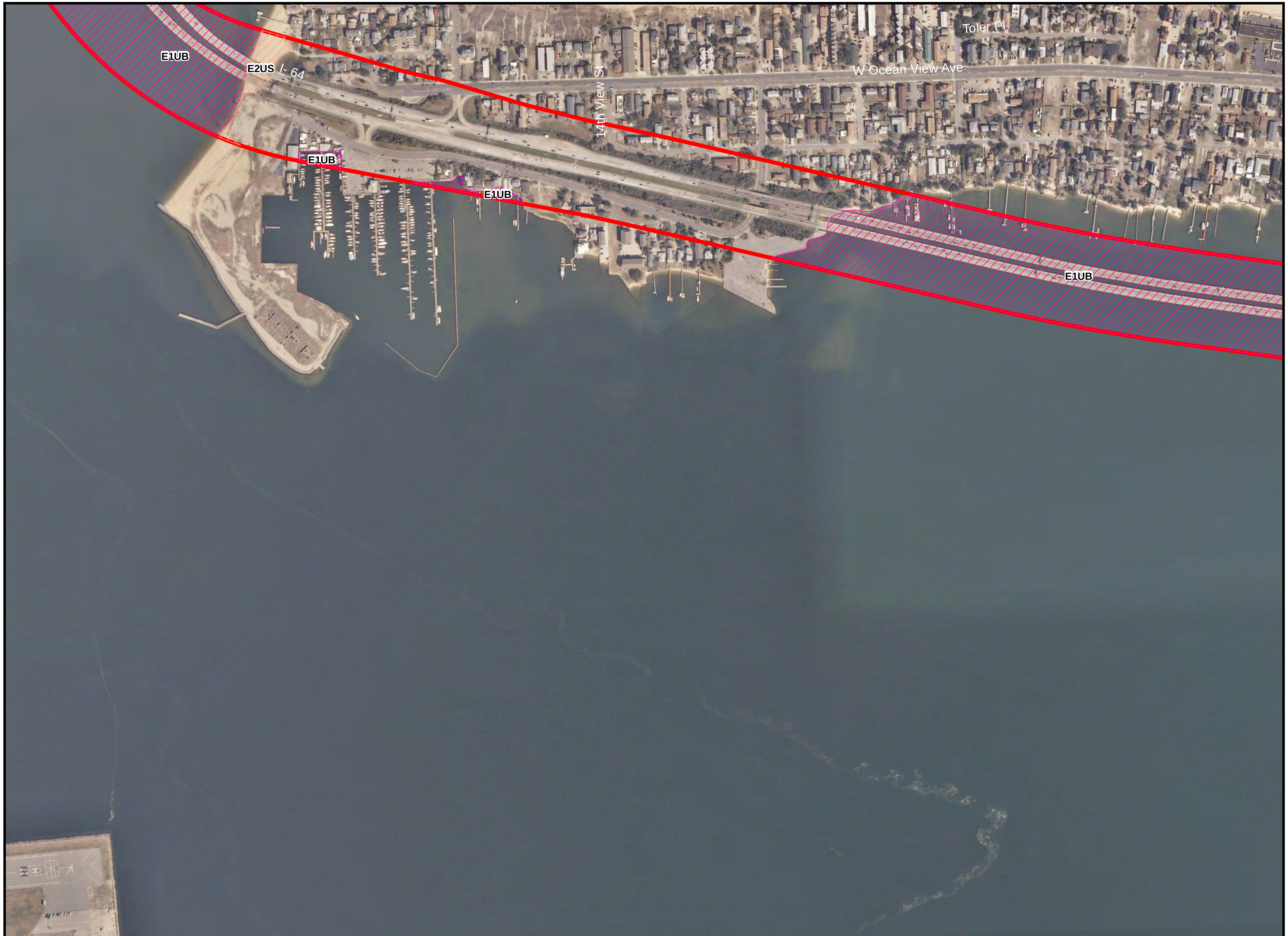
Photointerpreted Wetlands
Cowardin Classification

- E1UB- Estuarine, Subtidal, Unconsolidated Bottom (open water)
- E1UBx- Excavated
- E2EM- Estuarine, Intertidal, Emergent
- E2EMx- Excavated
- E2US- Estuarine, Intertidal, Unconsolidated Shore
- E2USx- Excavated
- PEM- Palustrine, Emergent
- PEMF- Palustrine, Emergent, Semi-permanently or Permanently Flooded
- PEMFx- Excavated
- PEMx- Excavated
- PFO- Palustrine, Forested
- PFOF- Palustrine, Forested, Semi-permanently or Permanently Flooded
- PFOFx- Excavated
- PFOx- Excavated
- PSS- Palustrine, Scrub-shrub
- PSSx- Excavated
- PUB- Palustrine, Unconsolidated Bottom (open water)
- PUBF- Palustrine, Unconsolidated Bottom (open water), Semi or Permanently Flooded
- PUBFx- Excavated
- PUBx- Excavated
- R3- Riverine, Perennial
- R4- Riverine, Intermittent

Date: 7/25/2016

TITLE
MAP-8

SHEET NO. 8 OF 46



VDOT

0 125 250 500 Feet

1 in = 500 ft

DATA SOURCES: USGS, VDOT, VGIN (2013 RGB AERIAL)

Hampton Roads Crossing Study
Virginia DOT
Norfolk, Virginia

Legend

Groundtruthing- 1/11/16-1/15/16

Study Area Corridors

Photointerpreted Wetlands Cowardin Classification

E1UB- Estuarine, Subtidal, Unconsolidated Bottom (open water)
E1UBx- Excavated
E2EM- Estuarine, Intertidal, Emergent
E2EMx- Excavated
E2US- Estuarine, Intertidal, Unconsolidated Shore
E2USx- Excavated
PEM- Palustrine, Emergent
PEMF- Palustrine, Emergent, Semi-permanently or Permanently Flooded
PEMFx- Excavated
PEMx- Excavated
PFO- Palustrine, Forested
PFOF- Palustrine, Forested, Semi-permanently or Permanently Flooded
PFOFx- Excavated
PFOx- Excavated
PSS- Palustrine, Scrub-shrub
PSSx- Excavated
PUB- Palustrine, Unconsolidated Bottom (open water)
PUBF- Palustrine, Unconsolidated Bottom (open water), Semi or Permanently Flooded
PUBFx- Excavated
PUBx- Excavated
R3- Riverine, Perennial
R4- Riverine, Intermittent

Date: 7/25/2016

TITLE
MAP-9

SHEET NO. 9 OF 46

0 125 250 500 Feet

1 in = 500 ft

DATA SOURCES: USGS, VDOT, VGIN (2013 RGB AERIAL)

Hampton Roads Crossing Study
Virginia DOT
Norfolk, Virginia

Legend

- Groundtruthing- 1/11/16-1/15/16
- Study Area Corridors

Photointerpreted Wetlands Cowardin Classification

- E1UB- Estuarine, Subtidal, Unconsolidated Bottom (open water)
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- E2EMx- Excavated
- E2US- Estuarine, Intertidal, Unconsolidated Shore
- E2USx- Excavated
- PEM- Palustrine, Emergent
- PEMF- Palustrine, Emergent, Semi-permanently or Permanently Flooded
- PEMFx- Excavated
- PEMx- Excavated
- PFO- Palustrine, Forested
- PFOF- Palustrine, Forested, Semi-permanently or Permanently Flooded
- PFOFx- Excavated
- PFOx- Excavated
- PSS- Palustrine, Scrub-shrub
- PSSx- Excavated
- PUB- Palustrine, Unconsolidated Bottom (open water)
- PUBF- Palustrine, Unconsolidated Bottom (open water), Semi or Permanently Flooded
- PUBFx- Excavated
- PUBx- Excavated
- R3- Riverine, Perennial
- R4- Riverine, Intermittent

Date: 7/25/2016

TITLE
MAP-10

SHEET NO. 10 OF 46

VDOT

0 125 250 500 Feet

1 in = 500 ft

DATA SOURCES: USGS, VDOT, VGIN (2013 RGB AERIAL)

Hampton Roads Crossing Study
Virginia DOT
Norfolk, Virginia

Legend

- Groundtruthing- 1/11/16-1/15/16
- Study Area Corridors

Photointerpreted Wetlands
Cowardin Classification

- E1UB- Estuarine, Subtidal, Unconsolidated Bottom (open water)
- E1UBx- Excavated
- E2EM- Estuarine, Intertidal, Emergent
- E2EMx- Excavated
- E2US- Estuarine, Intertidal, Unconsolidated Shore
- E2USx- Excavated
- PEM- Palustrine, Emergent
- PEMF- Palustrine, Emergent, Semi-permanently or Permanently Flooded
- PEMFx- Excavated
- PEMx- Excavated
- PFO- Palustrine, Forested
- PFOF- Palustrine, Forested, Semi-permanently or Permanently Flooded
- PFOFx- Excavated
- PFOx- Excavated
- PSS- Palustrine, Scrub-shrub
- PSSx- Excavated
- PUB- Palustrine, Unconsolidated Bottom (open water)
- PUBF- Palustrine, Unconsolidated Bottom (open water), Semi or Permanently Flooded
- PUBFx- Excavated
- PUBx- Excavated
- R3- Riverine, Perennial
- R4- Riverine, Intermittent

Date: 7/25/2016

TITLE
MAP-11

SHEET NO. 11 OF 46

VDOT

0 125 250 500 Feet

1 in = 500 ft

DATA SOURCES: USGS, VDOT, VGIN (2013 RGB AERIAL)

Hampton Roads Crossing Study
Virginia DOT
Norfolk, Virginia

Legend

- Groundtruthing- 1/11/16-1/15/16
- Study Area Corridors

Photointerpreted Wetlands Cowardin Classification

- E1UB- Estuarine, Subtidal, Unconsolidated Bottom (open water)
- E1UBx- Excavated
- E2EM- Estuarine, Intertidal, Emergent
- E2EMx- Excavated
- E2US- Estuarine, Intertidal, Unconsolidated Shore
- E2USx- Excavated
- PEM- Palustrine, Emergent
- PEMF- Palustrine, Emergent, Semi-permanently or Permanently Flooded
- PEMFx- Excavated
- PEMx- Excavated
- PFO- Palustrine, Forested
- PFOF- Palustrine, Forested, Semi-permanently or Permanently Flooded
- PFOFx- Excavated
- PFOx- Excavated
- PSS- Palustrine, Scrub-shrub
- PSSx- Excavated
- PUB- Palustrine, Unconsolidated Bottom (open water)
- PUBF- Palustrine, Unconsolidated Bottom (open water), Semi or Permanently Flooded
- PUBFx- Excavated
- PUBx- Excavated
- R3- Riverine, Perennial
- R4- Riverine, Intermittent

Date: 7/25/2016

TITLE

MAP-12

SHEET NO. 12 OF 46

VDOT

0 125 250 500 Feet

1 in = 500 ft

DATA SOURCES: USGS, VDOT, VGIN (2013 RGB AERIAL)

Hampton Roads Crossing Study
Virginia DOT
Norfolk, Virginia

Legend

- Groundtruthing- 1/11/16-1/15/16
- Study Area Corridors

Photointerpreted Wetlands Cowardin Classification

- E1UB- Estuarine, Subtidal, Unconsolidated Bottom (open water)
- E1UBx- Excavated
- E2EM- Estuarine, Intertidal, Emergent
- E2EMx- Excavated
- E2US- Estuarine, Intertidal, Unconsolidated Shore
- E2USx- Excavated
- PEM- Palustrine, Emergent
- PEMF- Palustrine, Emergent, Semi-permanently or Permanently Flooded
- PEMFx- Excavated
- PEMx- Excavated
- PFO- Palustrine, Forested
- PFOF- Palustrine, Forested, Semi-permanently or Permanently Flooded
- PFOFx- Excavated
- PFOx- Excavated
- PSS- Palustrine, Scrub-shrub
- PSSx- Excavated
- PUB- Palustrine, Unconsolidated Bottom (open water)
- PUBF- Palustrine, Unconsolidated Bottom (open water), Semi or Permanently Flooded
- PUBFx- Excavated
- PUBx- Excavated
- R3- Riverine, Perennial
- R4- Riverine, Intermittent

Date: 7/25/2016

TITLE
MAP-13

SHEET NO. 13 OF 46

VDOT

0 125 250 500 Feet

1 in = 500 ft

DATA SOURCES: USGS, VDOT, VGIN (2013 RGB AERIAL)

Hampton Roads Crossing Study
Virginia DOT
Norfolk, Virginia

Legend

- Groundtruthing- 1/11/16-1/15/16
- Study Area Corridors

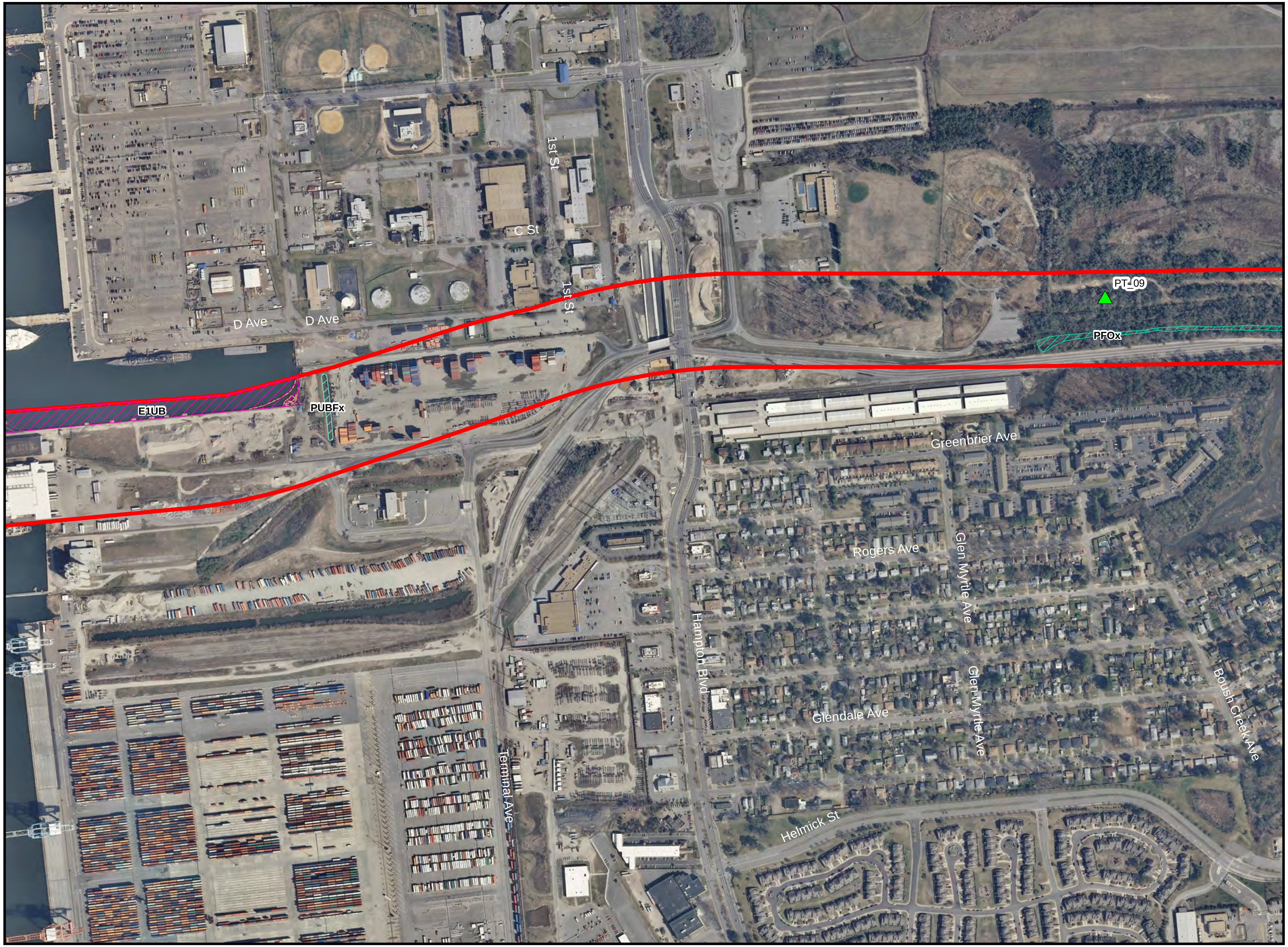
Photointerpreted Wetlands Cowardin Classification

- E1UB- Estuarine, Subtidal, Unconsolidated Bottom (open water)
- E1UBx- Excavated
- E2EM- Estuarine, Intertidal, Emergent
- E2EMx- Excavated
- E2US- Estuarine, Intertidal, Unconsolidated Shore
- E2USx- Excavated
- PEM- Palustrine, Emergent
- PEMF- Palustrine, Emergent, Semi-permanently or Permanently Flooded
- PEMFx- Excavated
- PEMx- Excavated
- PFO- Palustrine, Forested
- PFOF- Palustrine, Forested, Semi-permanently or Permanently Flooded
- PFOFx- Excavated
- PFOx- Excavated
- PSS- Palustrine, Scrub-shrub
- PSSx- Excavated
- PUB- Palustrine, Unconsolidated Bottom (open water)
- PUBF- Palustrine, Unconsolidated Bottom (open water), Semi or Permanently Flooded
- PUBFx- Excavated
- PUBx- Excavated
- R3- Riverine, Perennial
- R4- Riverine, Intermittent

Date: 7/25/2016

TITLE
MAP-14

SHEET NO. 14 OF 46



VDOT

0 125 250 500 Feet

1 in = 500 ft

DATA SOURCES: USGS, VDOT, VGIN (2013 RGB AERIAL)

Hampton Roads Crossing Study
Virginia DOT
Norfolk, Virginia

Legend

- Groundtruthing- 1/11/16-1/15/16
- Study Area Corridors

Photointerpreted Wetlands
Cowardin Classification

- E1UB- Estuarine, Subtidal, Unconsolidated Bottom (open water)
- E1UBx- Excavated
- E2EM- Estuarine, Intertidal, Emergent
- E2EMx- Excavated
- E2US- Estuarine, Intertidal, Unconsolidated Shore
- E2USx- Excavated
- PEM- Palustrine, Emergent
- PEMF- Palustrine, Emergent, Semi-permanently or Permanently Flooded
- PEMFx- Excavated
- PEMx- Excavated
- PFO- Palustrine, Forested
- PFOF- Palustrine, Forested, Semi-permanently or Permanently Flooded
- PFOFx- Excavated
- PFOx- Excavated
- PSS- Palustrine, Scrub-shrub
- PSSx- Excavated
- PUB- Palustrine, Unconsolidated Bottom (open water)
- PUBF- Palustrine, Unconsolidated Bottom (open water), Semi or Permanently Flooded
- PUBFx- Excavated
- PUBx- Excavated
- R3- Riverine, Perennial
- R4- Riverine, Intermittent

Date: 7/25/2016

TITLE
MAP-15

SHEET NO. 15 OF 46

VDOT

0 125 250 500 Feet

1 in = 500 ft

DATA SOURCES: USGS, VDOT, VGIN (2013 RGB AERIAL)

Hampton Roads Crossing Study
Virginia DOT
Norfolk, Virginia

Legend

- Groundtruthing- 1/11/16-1/15/16
- Study Area Corridors

Photointerpreted Wetlands Cowardin Classification

- E1UB- Estuarine, Subtidal, Unconsolidated Bottom (open water)
- E1UBx- Excavated
- E2EM- Estuarine, Intertidal, Emergent
- E2EMx- Excavated
- E2US- Estuarine, Intertidal, Unconsolidated Shore
- E2USx- Excavated
- PEM- Palustrine, Emergent
- PEMF- Palustrine, Emergent, Semi-permanently or Permanently Flooded
- PEMFx- Excavated
- PEMx- Excavated
- PFO- Palustrine, Forested
- PFOF- Palustrine, Forested, Semi-permanently or Permanently Flooded
- PFOFx- Excavated
- PFOx- Excavated
- PSS- Palustrine, Scrub-shrub
- PSSx- Excavated
- PUB- Palustrine, Unconsolidated Bottom (open water)
- PUBF- Palustrine, Unconsolidated Bottom (open water), Semi or Permanently Flooded
- PUBFx- Excavated
- PUBx- Excavated
- R3- Riverine, Perennial
- R4- Riverine, Intermittent

Date: 7/25/2016

TITLE

MAP-16

SHEET NO. 16 OF 46

VDOT

0 125 250 500 Feet

1 in = 500 ft

DATA SOURCES: USGS, VDOT, VGIN (2013 RGB AERIAL)

Hampton Roads Crossing Study
Virginia DOT
Portsmouth, Virginia

Legend

Groundtruthing- 1/11/16-1/15/16

Study Area Corridors

Photointerpreted Wetlands Cowardin Classification

E1UB- Estuarine, Subtidal, Unconsolidated Bottom (open water)
E1UBx- Excavated
E2EM- Estuarine, Intertidal, Emergent
E2EMx- Excavated
E2US- Estuarine, Intertidal, Unconsolidated Shore
E2USx- Excavated
PEM- Palustrine, Emergent
PEMF- Palustrine, Emergent, Semi-permanently or Permanently Flooded
PEMFx- Excavated
PEMx- Excavated
PFO- Palustrine, Forested
PFOF- Palustrine, Forested, Semi-permanently or Permanently Flooded
PFOFx- Excavated
PFOx- Excavated
PSS- Palustrine, Scrub-shrub
PSSx- Excavated
PUB- Palustrine, Unconsolidated Bottom (open water)
PUBF- Palustrine, Unconsolidated Bottom (open water), Semi or Permanently Flooded
PUBFx- Excavated
PUBx- Excavated
R3- Riverine, Perennial
R4- Riverine, Intermittent

Date: 7/25/2016

TITLE

MAP-17

SHEET NO. 17 OF 46

VDOT

0 125 250 500 Feet

1 in = 500 ft

DATA SOURCES: USGS, VDOT, VGIN (2013 RGB AERIAL)

Hampton Roads Crossing Study
Virginia DOT
Portsmouth, Virginia

Legend

- Groundtruthing- 1/11/16-1/15/16
- Study Area Corridors

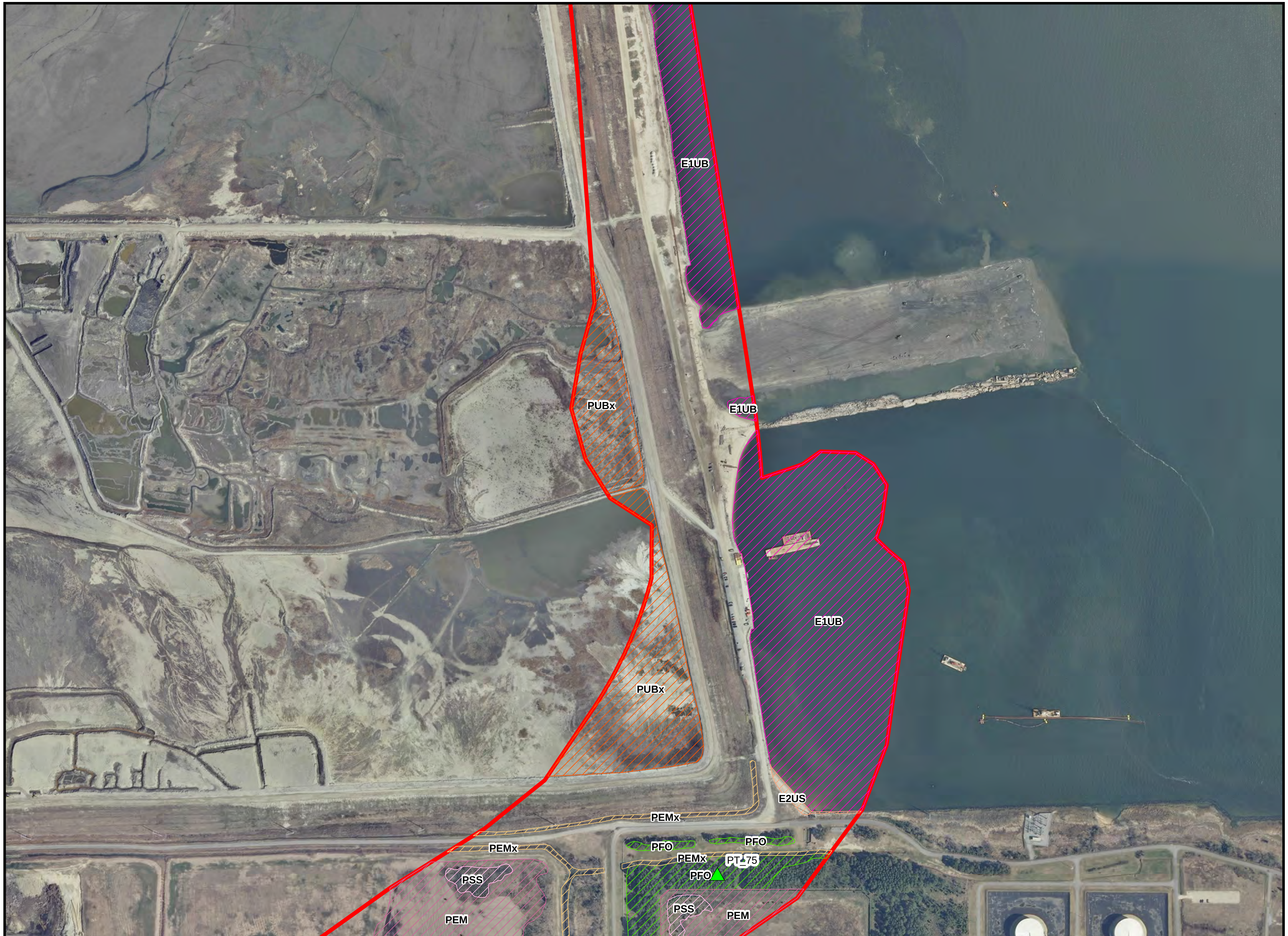
Photointerpreted Wetlands Cowardin Classification

- E1UB- Estuarine, Subtidal, Unconsolidated Bottom (open water)
- E1UBx- Excavated
- E2EM- Estuarine, Intertidal, Emergent
- E2EMx- Excavated
- E2US- Estuarine, Intertidal, Unconsolidated Shore
- E2USx- Excavated
- PEM- Palustrine, Emergent
- PEMF- Palustrine, Emergent, Semi-permanently or Permanently Flooded
- PEMFx- Excavated
- PEMx- Excavated
- PFO- Palustrine, Forested
- PFOF- Palustrine, Forested, Semi-permanently or Permanently Flooded
- PFOFx- Excavated
- PFOx- Excavated
- PSS- Palustrine, Scrub-shrub
- PSSx- Excavated
- PUB- Palustrine, Unconsolidated Bottom (open water)
- PUBF- Palustrine, Unconsolidated Bottom (open water), Semi or Permanently Flooded
- PUBFx- Excavated
- PUBx- Excavated
- R3- Riverine, Perennial
- R4- Riverine, Intermittent

Date: 7/25/2016

TITLE
MAP-18

SHEET NO. 18 OF 46



VDOT

0 125 250 500 Feet

1 in = 500 ft

DATA SOURCES: USGS, VDOT, VGIN (2013 RGB AERIAL)

Hampton Roads Crossing Study
Virginia DOT
Portsmouth, Virginia

Legend

- Groundtruthing- 1/11/16-1/15/16
- Study Area Corridors

Photointerpreted Wetlands Cowardin Classification

- E1UB- Estuarine, Subtidal, Unconsolidated Bottom (open water)
- E1UBx- Excavated
- E2EM- Estuarine, Intertidal, Emergent
- E2EMx- Excavated
- E2US- Estuarine, Intertidal, Unconsolidated Shore
- E2USx- Excavated
- PEM- Palustrine, Emergent
- PEMF- Palustrine, Emergent, Semi-permanently or Permanently Flooded
- PEMFx- Excavated
- PEMx- Excavated
- PFO- Palustrine, Forested
- PFOF- Palustrine, Forested, Semi-permanently or Permanently Flooded
- PFOFx- Excavated
- PFOx- Excavated
- PSS- Palustrine, Scrub-shrub
- PSSx- Excavated
- PUB- Palustrine, Unconsolidated Bottom (open water)
- PUBF- Palustrine, Unconsolidated Bottom (open water), Semi or Permanently Flooded
- PUBFx- Excavated
- PUBx- Excavated
- R3- Riverine, Perennial
- R4- Riverine, Intermittent

Date: 7/25/2016

TITLE
MAP-19

SHEET NO. 19 OF 46

0 125 250 500 Feet

1 in = 500 ft

DATA SOURCES: USGS, VDOT, VGIN (2013 RGB AERIAL)

Hampton Roads Crossing Study
Virginia DOT
Portsmouth, Virginia

Legend

Groundtruthing- 1/11/16-1/15/16

Study Area Corridors

Photointerpreted Wetlands Cowardin Classification

- E1UB- Estuarine, Subtidal, Unconsolidated Bottom (open water)
- E1UBx- Excavated
- E2EM- Estuarine, Intertidal, Emergent
- E2EMx- Excavated
- E2US- Estuarine, Intertidal, Unconsolidated Shore
- E2USx- Excavated
- PEM- Palustrine, Emergent
- PEMF- Palustrine, Emergent, Semi-permanently or Permanently Flooded
- PEMFx- Excavated
- PEMx- Excavated
- PFO- Palustrine, Forested
- PFOF- Palustrine, Forested, Semi-permanently or Permanently Flooded
- PFOFx- Excavated
- PFOx- Excavated
- PSS- Palustrine, Scrub-shrub
- PSSx- Excavated
- PUB- Palustrine, Unconsolidated Bottom (open water)
- PUBF- Palustrine, Unconsolidated Bottom (open water), Semi or Permanently Flooded
- PUBFx- Excavated
- PUBx- Excavated
- R3- Riverine, Perennial
- R4- Riverine, Intermittent

Date: 7/25/2016

TITLE

MAP-20

SHEET NO. 20 OF 46

VDOT

0 125 250 500 Feet

1 in = 500 ft

DATA SOURCES: USGS, VDOT, VGIN (2013 RGB AERIAL)

Hampton Roads Crossing Study
Virginia DOT
Portsmouth, Virginia

Legend

- Groundtruthing- 1/11/16-1/15/16
- Study Area Corridors

Photointerpreted Wetlands
Cowardin Classification

- E1UB- Estuarine, Subtidal, Unconsolidated Bottom (open water)
- E1UBx- Excavated
- E2EM- Estuarine, Intertidal, Emergent
- E2EMx- Excavated
- E2US- Estuarine, Intertidal, Unconsolidated Shore
- E2USx- Excavated
- PEM- Palustrine, Emergent
- PEMF- Palustrine, Emergent, Semi-permanently or Permanently Flooded
- PEMFx- Excavated
- PEMx- Excavated
- PFO- Palustrine, Forested
- PFOF- Palustrine, Forested, Semi-permanently or Permanently Flooded
- PFOFx- Excavated
- PFOx- Excavated
- PSS- Palustrine, Scrub-shrub
- PSSx- Excavated
- PUB- Palustrine, Unconsolidated Bottom (open water)
- PUBF- Palustrine, Unconsolidated Bottom (open water), Semi or Permanently Flooded
- PUBFx- Excavated
- PUBx- Excavated
- R3- Riverine, Perennial
- R4- Riverine, Intermittent

Date: 7/25/2016

TITLE
MAP-21

SHEET NO. 21 OF 46

VDOT

0 125 250 500 Feet

1 in = 500 ft

DATA SOURCES: USGS, VDOT, VGIN (2013 RGB AERIAL)

Hampton Roads Crossing Study
Virginia DOT
Portsmouth, Virginia

Legend

- Groundtruthing- 1/11/16-1/15/16
- Study Area Corridors

Photointerpreted Wetlands Cowardin Classification

- E1UB- Estuarine, Subtidal, Unconsolidated Bottom (open water)
- E1UBx- Excavated
- E2EM- Estuarine, Intertidal, Emergent
- E2EMx- Excavated
- E2US- Estuarine, Intertidal, Unconsolidated Shore
- E2USx- Excavated
- PEM- Palustrine, Emergent
- PEMF- Palustrine, Emergent, Semi-permanently or Permanently Flooded
- PEMFx- Excavated
- PEMx- Excavated
- PFO- Palustrine, Forested
- PFOF- Palustrine, Forested, Semi-permanently or Permanently Flooded
- PFOFx- Excavated
- PFOx- Excavated
- PSS- Palustrine, Scrub-shrub
- PSSx- Excavated
- PUB- Palustrine, Unconsolidated Bottom (open water)
- PUBF- Palustrine, Unconsolidated Bottom (open water), Semi or Permanently Flooded
- PUBFx- Excavated
- PUBx- Excavated
- R3- Riverine, Perennial
- R4- Riverine, Intermittent

Date: 7/25/2016

TITLE

MAP-22

SHEET NO. 22 OF 46

VDOT

0 125 250 500 Feet

1 in = 500 ft

DATA SOURCES: USGS, VDOT, VGIN (2013 RGB AERIAL)

Hampton Roads Crossing Study
Virginia DOT
Portsmouth, Virginia

Legend

- Groundtruthing- 1/11/16-1/15/16
- Study Area Corridors

Photointerpreted Wetlands Cowardin Classification

- E1UB- Estuarine, Subtidal, Unconsolidated Bottom (open water)
- E1UBx- Excavated
- E2EM- Estuarine, Intertidal, Emergent
- E2EMx- Excavated
- E2US- Estuarine, Intertidal, Unconsolidated Shore
- E2USx- Excavated
- PEM- Palustrine, Emergent
- PEMF- Palustrine, Emergent, Semi-permanently or Permanently Flooded
- PEMFx- Excavated
- PEMx- Excavated
- PFO- Palustrine, Forested
- PFOF- Palustrine, Forested, Semi-permanently or Permanently Flooded
- PFOFx- Excavated
- PFOx- Excavated
- PSS- Palustrine, Scrub-shrub
- PSSx- Excavated
- PUB- Palustrine, Unconsolidated Bottom (open water)
- PUBF- Palustrine, Unconsolidated Bottom (open water), Semi or Permanently Flooded
- PUBFx- Excavated
- PUBx- Excavated
- R3- Riverine, Perennial
- R4- Riverine, Intermittent

Date: 7/25/2016

TITLE

MAP-23

SHEET NO. 23 OF 46

VDOT

0 125 250 500 Feet

1 in = 500 ft

DATA SOURCES: USGS, VDOT, VGIN (2013 RGB AERIAL)

Hampton Roads Crossing Study
Virginia DOT
Portsmouth, Virginia

Legend

- Groundtruthing- 1/11/16-1/15/16
- Study Area Corridors

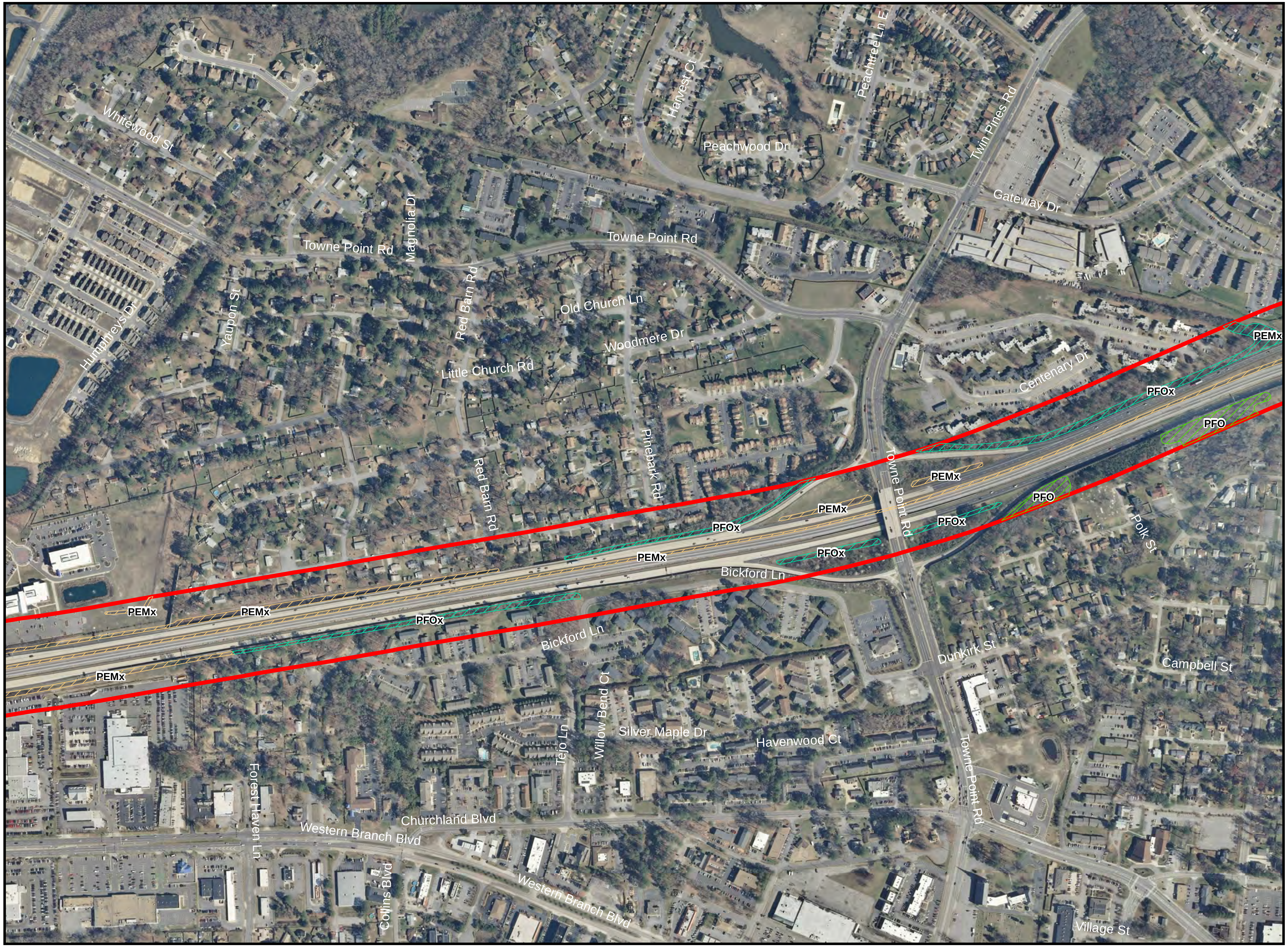
Photointerpreted Wetlands Cowardin Classification

- E1UB- Estuarine, Subtidal, Unconsolidated Bottom (open water)
- E1UBx- Excavated
- E2EM- Estuarine, Intertidal, Emergent
- E2EMx- Excavated
- E2US- Estuarine, Intertidal, Unconsolidated Shore
- E2USx- Excavated
- PEM- Palustrine, Emergent
- PEMF- Palustrine, Emergent, Semi-permanently or Permanently Flooded
- PEMFx- Excavated
- PEMx- Excavated
- PFO- Palustrine, Forested
- PFOF- Palustrine, Forested, Semi-permanently or Permanently Flooded
- PFOFx- Excavated
- PFOx- Excavated
- PSS- Palustrine, Scrub-shrub
- PSSx- Excavated
- PUB- Palustrine, Unconsolidated Bottom (open water)
- PUBF- Palustrine, Unconsolidated Bottom (open water), Semi or Permanently Flooded
- PUBFx- Excavated
- PUBx- Excavated
- R3- Riverine, Perennial
- R4- Riverine, Intermittent

Date: 7/25/2016

TITLE
MAP-24

SHEET NO. 24 OF 46



VDOT

0 125 250 500 Feet

1 in = 500 ft

DATA SOURCES: USGS, VDOT, VGIN (2013 RGB AERIAL)

Hampton Roads Crossing Study
Virginia DOT
Chesapeake, Portsmouth, and Suffolk, Virginia

Legend

- Groundtruthing- 1/11/16-1/15/16
- Study Area Corridors

Photointerpreted Wetlands Cowardin Classification

- E1UB- Estuarine, Subtidal, Unconsolidated Bottom (open water)
- E1UBx- Excavated
- E2EM- Estuarine, Intertidal, Emergent
- E2EMx- Excavated
- E2US- Estuarine, Intertidal, Unconsolidated Shore
- E2USx- Excavated
- PEM- Palustrine, Emergent
- PEMF- Palustrine, Emergent, Semi-permanently or Permanently Flooded
- PEMFx- Excavated
- PEMx- Excavated
- PFO- Palustrine, Forested
- PFOF- Palustrine, Forested, Semi-permanently or Permanently Flooded
- PFOFx- Excavated
- PFOx- Excavated
- PSS- Palustrine, Scrub-shrub
- PSSx- Excavated
- PUB- Palustrine, Unconsolidated Bottom (open water)
- PUBF- Palustrine, Unconsolidated Bottom (open water), Semi or Permanently Flooded
- PUBFx- Excavated
- PUBx- Excavated
- R3- Riverine, Perennial
- R4- Riverine, Intermittent

Date: 7/25/2016

TITLE
MAP-25

SHEET NO. 25 OF 46

VDOT

0 125 250 500 Feet

1 in = 500 ft

DATA SOURCES: USGS, VDOT, VGIN (2013 RGB AERIAL)

Hampton Roads Crossing Study
Virginia DOT
Chesapeake, Virginia

Legend

- Groundtruthing- 1/11/16-1/15/16
- Study Area Corridors

Photointerpreted Wetlands
Cowardin Classification

- E1UB- Estuarine, Subtidal, Unconsolidated Bottom (open water)
- E1UBx- Excavated
- E2EM- Estuarine, Intertidal, Emergent
- E2EMx- Excavated
- E2US- Estuarine, Intertidal, Unconsolidated Shore
- E2USx- Excavated
- PEM- Palustrine, Emergent
- PEMF- Palustrine, Emergent, Semi-permanently or Permanently Flooded
- PEMFx- Excavated
- PEMx- Excavated
- PFO- Palustrine, Forested
- PFOF- Palustrine, Forested, Semi-permanently or Permanently Flooded
- PFOFx- Excavated
- PFOx- Excavated
- PSS- Palustrine, Scrub-shrub
- PSSx- Excavated
- PUB- Palustrine, Unconsolidated Bottom (open water)
- PUBF- Palustrine, Unconsolidated Bottom (open water), Semi or Permanently Flooded
- PUBFx- Excavated
- PUBx- Excavated
- R3- Riverine, Perennial
- R4- Riverine, Intermittent

Date: 7/25/2016

TITLE

MAP-26

SHEET NO. 26 OF 46

VDOT

0 125 250 500 Feet

1 in = 500 ft

DATA SOURCES: USGS, VDOT, VGIN (2013 RGB AERIAL)

Hampton Roads Crossing Study
Virginia DOT
Chesapeake, Virginia

Legend

- Groundtruthing- 1/11/16-1/15/16
- Study Area Corridors

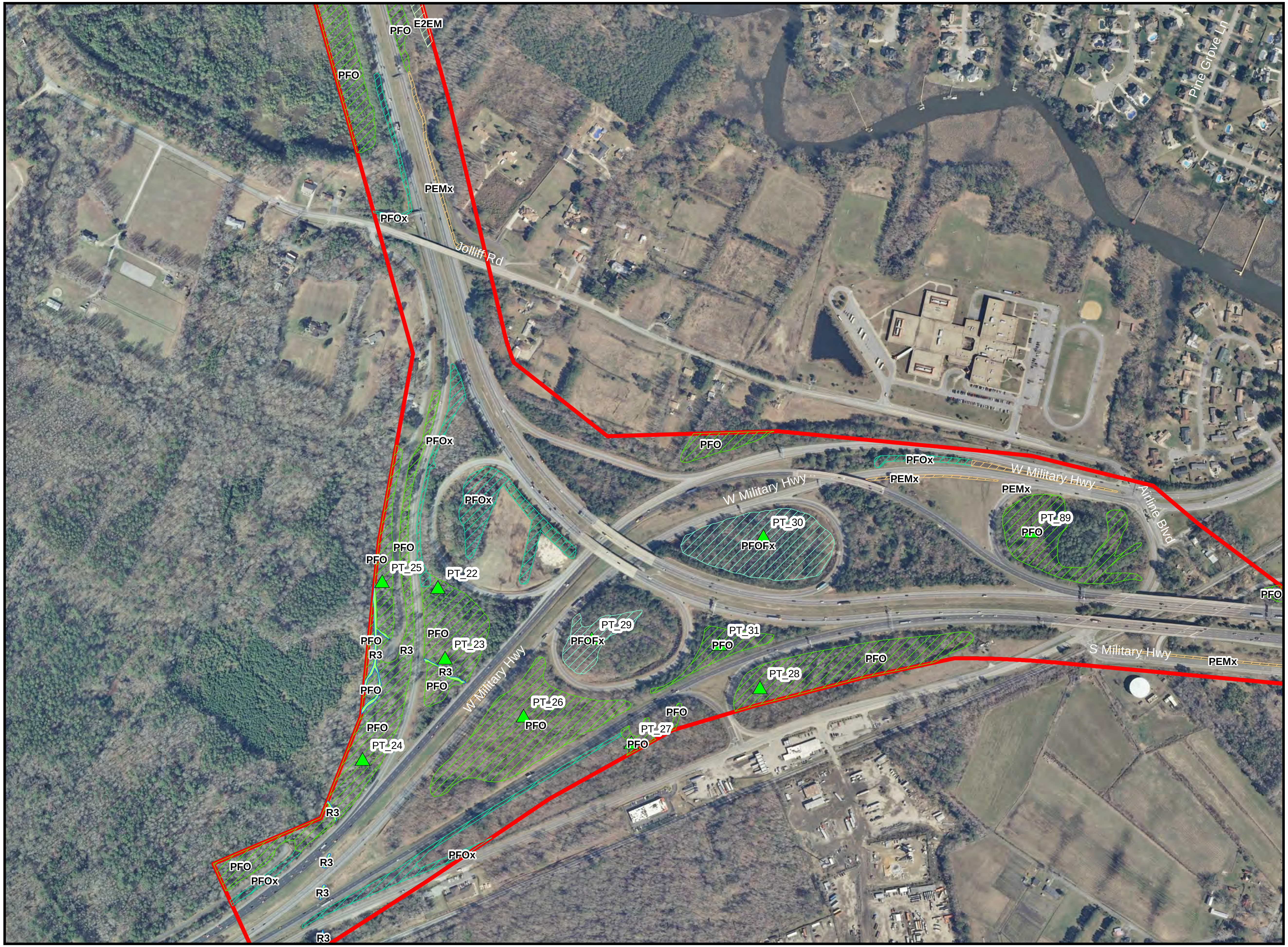
Photointerpreted Wetlands
Cowardin Classification

- E1UB- Estuarine, Subtidal, Unconsolidated Bottom (open water)
- E1UBx- Excavated
- E2EM- Estuarine, Intertidal, Emergent
- E2EMx- Excavated
- E2US- Estuarine, Intertidal, Unconsolidated Shore
- E2USx- Excavated
- PEM- Palustrine, Emergent
- PEMF- Palustrine, Emergent, Semi-permanently or Permanently Flooded
- PEMFx- Excavated
- PEMx- Excavated
- PFO- Palustrine, Forested
- PFOF- Palustrine, Forested, Semi-permanently or Permanently Flooded
- PFOFx- Excavated
- PFOx- Excavated
- PSS- Palustrine, Scrub-shrub
- PSSx- Excavated
- PUB- Palustrine, Unconsolidated Bottom (open water)
- PUBF- Palustrine, Unconsolidated Bottom (open water), Semi or Permanently Flooded
- PUBFx- Excavated
- PUBx- Excavated
- R3- Riverine, Perennial
- R4- Riverine, Intermittent

Date: 7/25/2016

TITLE
MAP-27

SHEET NO. 27 OF 46



VDOT

0 125 250 500 Feet

1 in = 500 ft

DATA SOURCES: USGS, VDOT, VGIN (2013 RGB AERIAL)

Hampton Roads Crossing Study
Virginia DOT
Chesapeake, Virginia

Legend

- Groundtruthing- 1/11/16-1/15/16
- Study Area Corridors

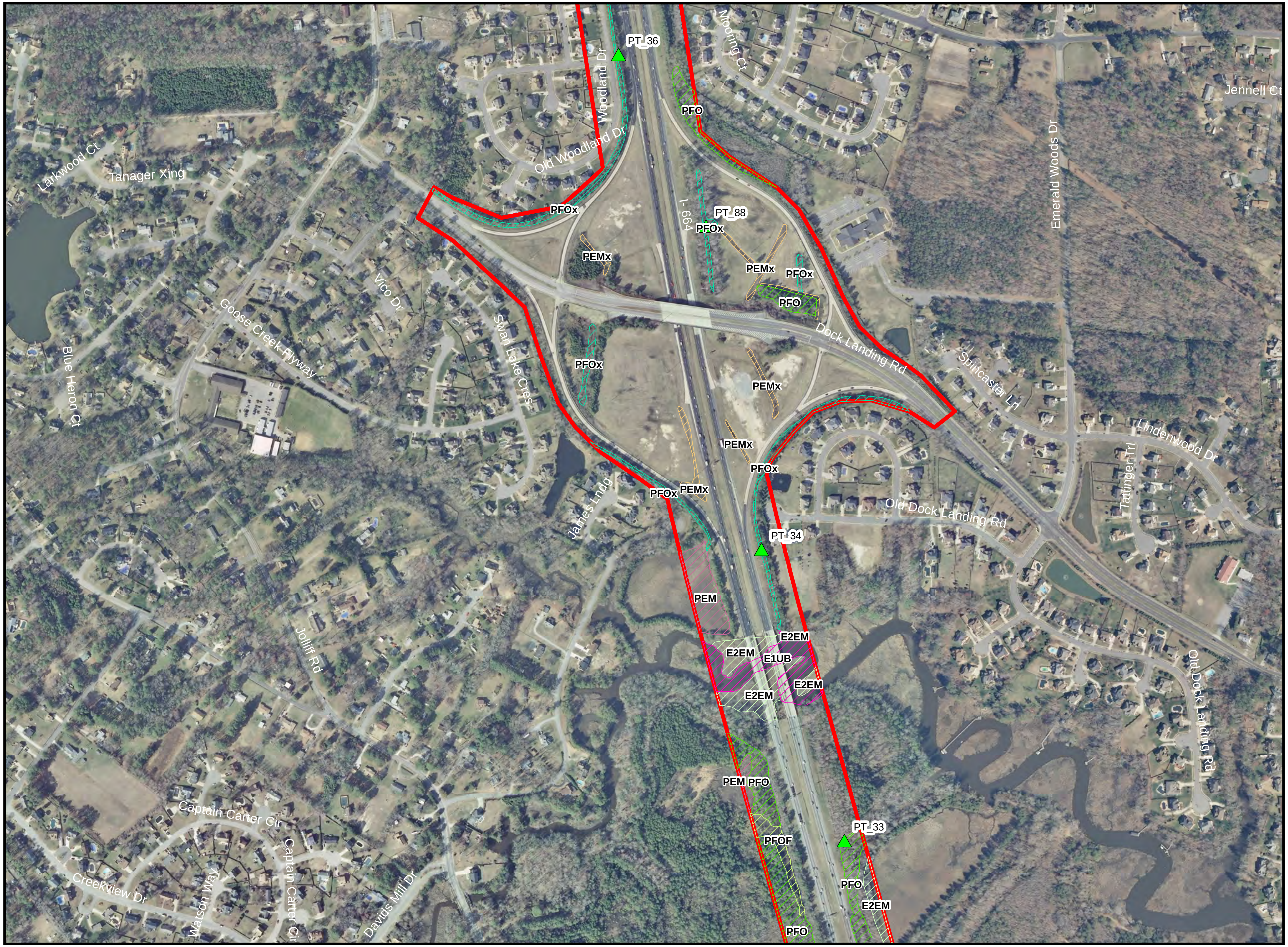
Photointerpreted Wetlands Cowardin Classification

- E1UB- Estuarine, Subtidal, Unconsolidated Bottom (open water)
- E1UBx- Excavated
- E2EM- Estuarine, Intertidal, Emergent
- E2EMx- Excavated
- E2US- Estuarine, Intertidal, Unconsolidated Shore
- E2USx- Excavated
- PEM- Palustrine, Emergent
- PEMF- Palustrine, Emergent, Semi-permanently or Permanently Flooded
- PEMFx- Excavated
- PEMx- Excavated
- PFO- Palustrine, Forested
- PFOF- Palustrine, Forested, Semi-permanently or Permanently Flooded
- PFOFx- Excavated
- PFOx- Excavated
- PSS- Palustrine, Scrub-shrub
- PSSx- Excavated
- PUB- Palustrine, Unconsolidated Bottom (open water)
- PUBF- Palustrine, Unconsolidated Bottom (open water), Semi or Permanently Flooded
- PUBFx- Excavated
- PUBx- Excavated
- R3- Riverine, Perennial
- R4- Riverine, Intermittent

Date: 7/25/2016

TITLE
MAP-28

SHEET NO. 28 OF 46



VDOT

0 125 250 500 Feet

1 in = 500 ft

DATA SOURCES: USGS, VDOT, VGIN (2013 RGB AERIAL)

Hampton Roads Crossing Study
Virginia DOT
Chesapeake, Virginia

Legend

- Groundtruthing- 1/11/16-1/15/16
- Study Area Corridors

Photointerpreted Wetlands Cowardin Classification

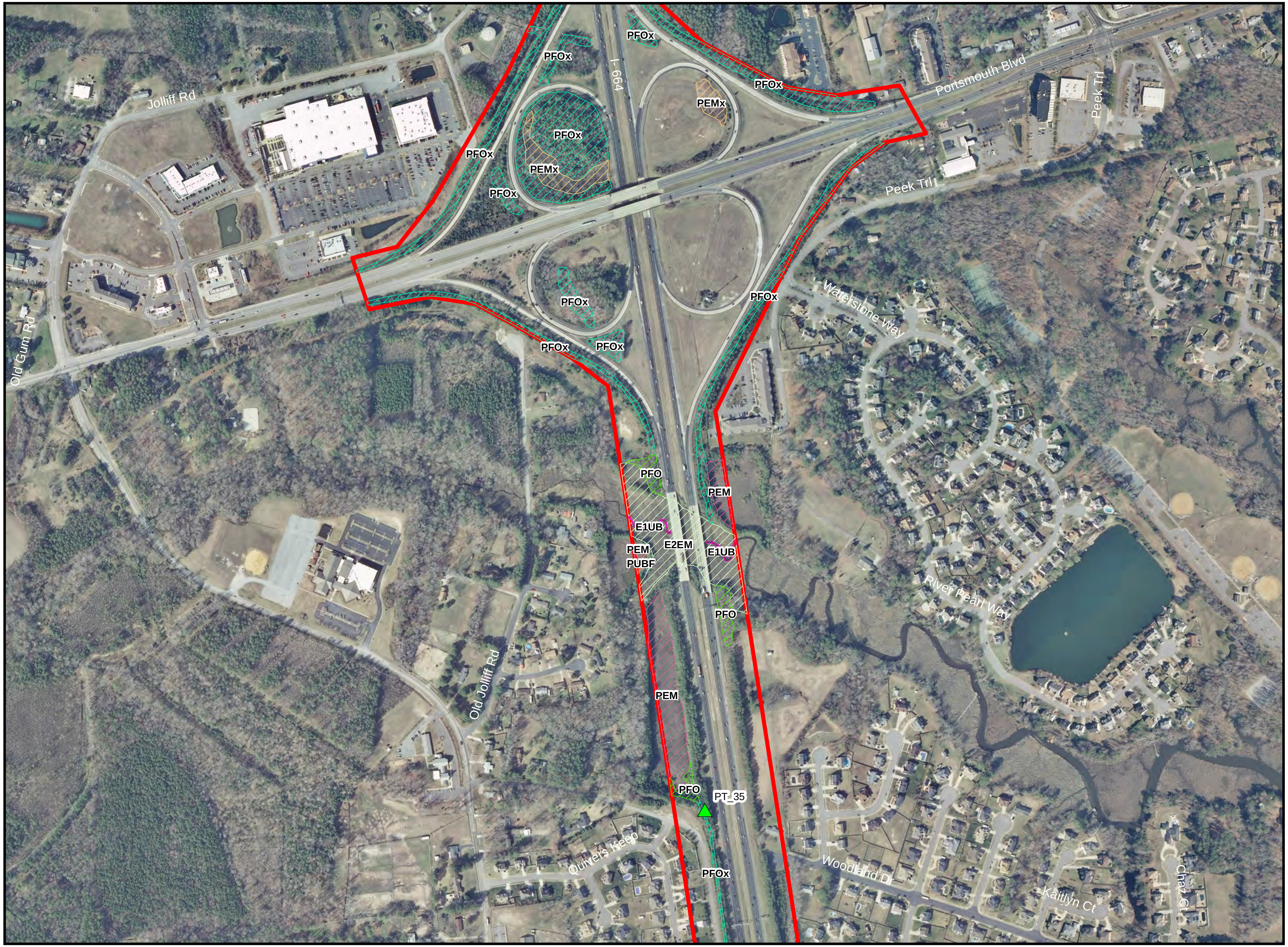
- E1UB- Estuarine, Subtidal, Unconsolidated Bottom (open water)
- E1UBx- Excavated
- E2EM- Estuarine, Intertidal, Emergent
- E2EMx- Excavated
- E2US- Estuarine, Intertidal, Unconsolidated Shore
- E2USx- Excavated
- PEM- Palustrine, Emergent
- PEMF- Palustrine, Emergent, Semi-permanently or Permanently Flooded
- PEMFx- Excavated
- PEMx- Excavated
- PFO- Palustrine, Forested
- PFOF- Palustrine, Forested, Semi-permanently or Permanently Flooded
- PFOFx- Excavated
- PFOx- Excavated
- PSS- Palustrine, Scrub-shrub
- PSSx- Excavated
- PUB- Palustrine, Unconsolidated Bottom (open water)
- PUBF- Palustrine, Unconsolidated Bottom (open water), Semi or Permanently Flooded
- PUBFx- Excavated
- PUBx- Excavated
- R3- Riverine, Perennial
- R4- Riverine, Intermittent

Date: 7/25/2016

TITLE

MAP-29

SHEET NO. 29 OF 46



VDOT

0 125 250 500 Feet

1 in = 500 ft

DATA SOURCES: USGS, VDOT, VGIN (2013 RGB AERIAL)

Hampton Roads Crossing Study
Virginia DOT
Chesapeake, Virginia

Legend

- Groundtruthing- 1/11/16-1/15/16
- Study Area Corridors

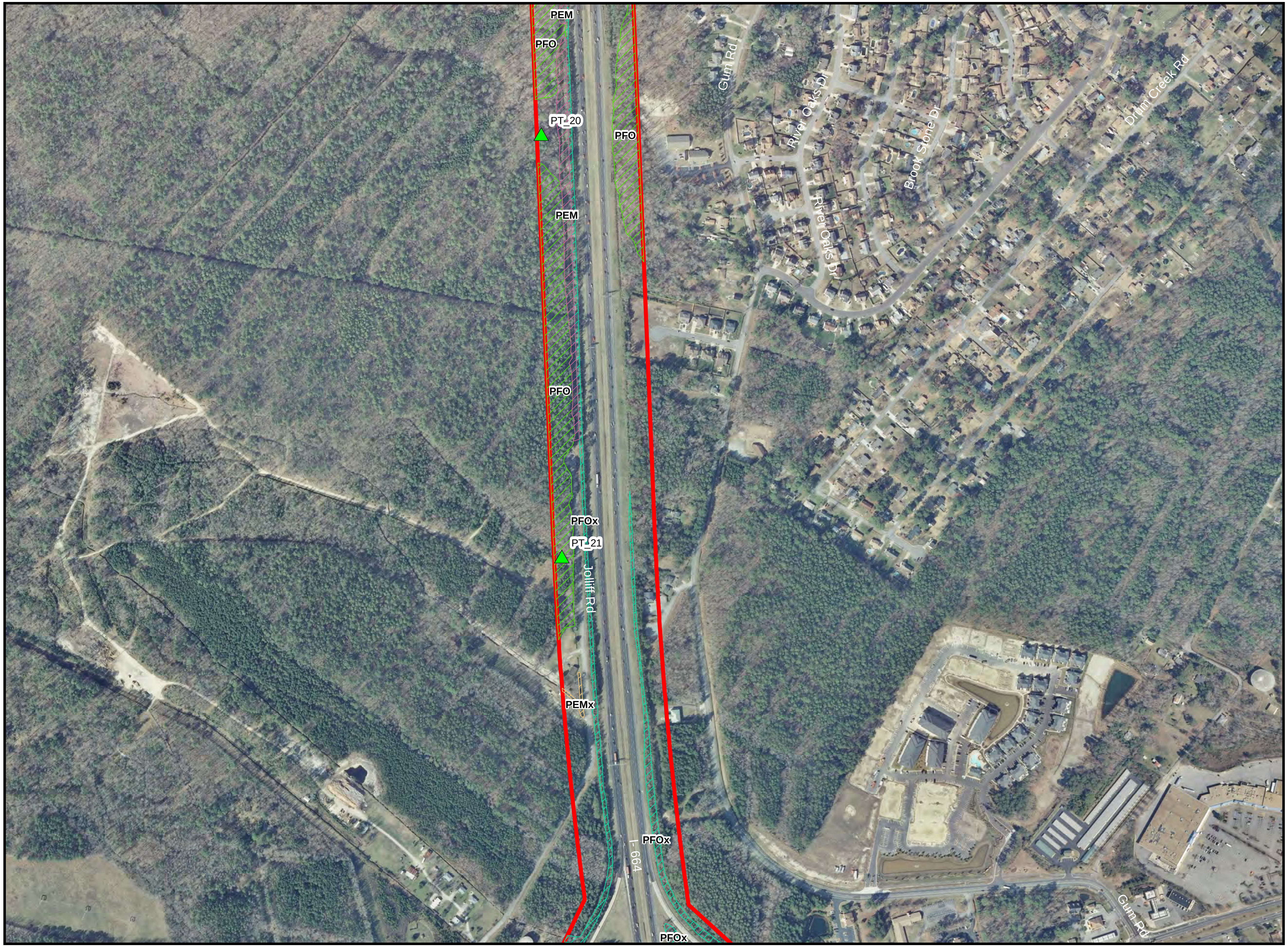
Photointerpreted Wetlands Cowardin Classification

- E1UB- Estuarine, Subtidal, Unconsolidated Bottom (open water)
- E1UBx- Excavated
- E2EM- Estuarine, Intertidal, Emergent
- E2EMx- Excavated
- E2US- Estuarine, Intertidal, Unconsolidated Shore
- E2USx- Excavated
- PEM- Palustrine, Emergent
- PEMF- Palustrine, Emergent, Semi-permanently or Permanently Flooded
- PEMFx- Excavated
- PEMx- Excavated
- PFO- Palustrine, Forested
- PFOF- Palustrine, Forested, Semi-permanently or Permanently Flooded
- PFOFx- Excavated
- PFOx- Excavated
- PSS- Palustrine, Scrub-shrub
- PSSx- Excavated
- PUB- Palustrine, Unconsolidated Bottom (open water)
- PUBF- Palustrine, Unconsolidated Bottom (open water), Semi or Permanently Flooded
- PUBFx- Excavated
- PUBx- Excavated
- R3- Riverine, Perennial
- R4- Riverine, Intermittent

Date: 7/25/2016

TITLE
MAP-30

SHEET NO. 30 OF 46



VDOT

0 125 250 500 Feet

1 in = 500 ft

DATA SOURCES: USGS, VDOT, VGIN (2013 RGB AERIAL)

Hampton Roads Crossing Study
Virginia DOT
Chesapeake, Virginia

Legend

Groundtruthing- 1/11/16-1/15/16

Study Area Corridors

Photointerpreted Wetlands
Cowardin Classification

- E1UB- Estuarine, Subtidal, Unconsolidated Bottom (open water)
- E1UBx- Excavated
- E2EM- Estuarine, Intertidal, Emergent
- E2EMx- Excavated
- E2US- Estuarine, Intertidal, Unconsolidated Shore
- E2USx- Excavated
- PEM- Palustrine, Emergent
- PEMF- Palustrine, Emergent, Semi-permanently or Permanently Flooded
- PEMFx- Excavated
- PEMx- Excavated
- PFO- Palustrine, Forested
- PFOF- Palustrine, Forested, Semi-permanently or Permanently Flooded
- PFOFx- Excavated
- PFOx- Excavated
- PSS- Palustrine, Scrub-shrub
- PSSx- Excavated
- PUB- Palustrine, Unconsolidated Bottom (open water)
- PUBF- Palustrine, Unconsolidated Bottom (open water), Semi or Permanently Flooded
- PUBFx- Excavated
- PUBx- Excavated
- R3- Riverine, Perennial
- R4- Riverine, Intermittent

Date: 7/25/2016

TITLE
MAP-31

SHEET NO. 31 OF 46

VDOT

0 125 250 500 Feet

1 in = 500 ft

DATA SOURCES: USGS, VDOT, VGIN (2013 RGB AERIAL)

Hampton Roads Crossing Study
Virginia DOT
Chesapeake and Suffolk, Virginia

Legend

- Groundtruthing- 1/11/16-1/15/16
- Study Area Corridors

Photointerpreted Wetlands
Cowardin Classification

- E1UB- Estuarine, Subtidal, Unconsolidated Bottom (open water)
- E1UBx- Excavated
- E2EM- Estuarine, Intertidal, Emergent
- E2EMx- Excavated
- E2US- Estuarine, Intertidal, Unconsolidated Shore
- E2USx- Excavated
- PEM- Palustrine, Emergent
- PEMF- Palustrine, Emergent, Semi-permanently or Permanently Flooded
- PEMFx- Excavated
- PEMx- Excavated
- PFO- Palustrine, Forested
- PFOF- Palustrine, Forested, Semi-permanently or Permanently Flooded
- PFOFx- Excavated
- PFOx- Excavated
- PSS- Palustrine, Scrub-shrub
- PSSx- Excavated
- PUB- Palustrine, Unconsolidated Bottom (open water)
- PUBF- Palustrine, Unconsolidated Bottom (open water), Semi or Permanently Flooded
- PUBFx- Excavated
- PUBx- Excavated
- R3- Riverine, Perennial
- R4- Riverine, Intermittent

Date: 7/25/2016

TITLE

MAP-32

SHEET NO. 32 OF 46

VDOT

0 125 250 500 Feet

1 in = 500 ft

DATA SOURCES: USGS, VDOT, VGIN (2013 RGB AERIAL)

Hampton Roads Crossing Study
Virginia DOT
Chesapeake and Suffolk, Virginia

Legend

- Groundtruthing- 1/11/16-1/15/16
- Study Area Corridors

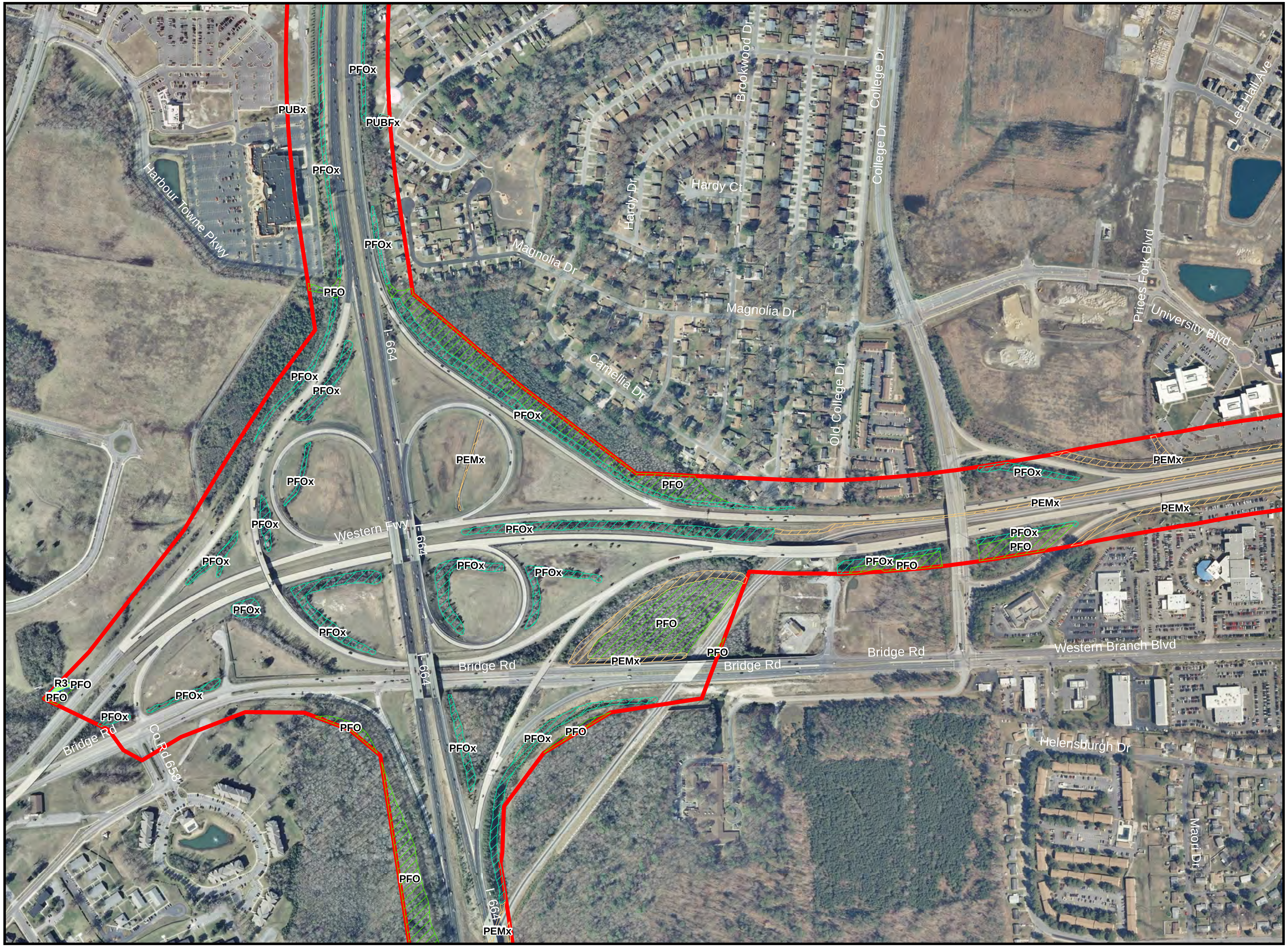
Photointerpreted Wetlands
Cowardin Classification

- E1UB- Estuarine, Subtidal, Unconsolidated Bottom (open water)
- E1UBx- Excavated
- E2EM- Estuarine, Intertidal, Emergent
- E2EMx- Excavated
- E2US- Estuarine, Intertidal, Unconsolidated Shore
- E2USx- Excavated
- PEM- Palustrine, Emergent
- PEMF- Palustrine, Emergent, Semi-permanently or Permanently Flooded
- PEMFx- Excavated
- PEMx- Excavated
- PFO- Palustrine, Forested
- PFOF- Palustrine, Forested, Semi-permanently or Permanently Flooded
- PFOFx- Excavated
- PFOx- Excavated
- PSS- Palustrine, Scrub-shrub
- PSSx- Excavated
- PUB- Palustrine, Unconsolidated Bottom (open water)
- PUBF- Palustrine, Unconsolidated Bottom (open water), Semi or Permanently Flooded
- PUBFx- Excavated
- PUBx- Excavated
- R3- Riverine, Perennial
- R4- Riverine, Intermittent

Date: 7/25/2016

TITLE
MAP-33

SHEET NO. 33 OF 46



0 125 250 500 Feet

1 in = 500 ft

DATA SOURCES: USGS, VDOT, VGIN (2013 RGB AERIAL)

Hampton Roads Crossing Study
Virginia DOT
Chesapeake and Suffolk, Virginia

Legend

- Groundtruthing- 1/11/16-1/15/16
- Study Area Corridors

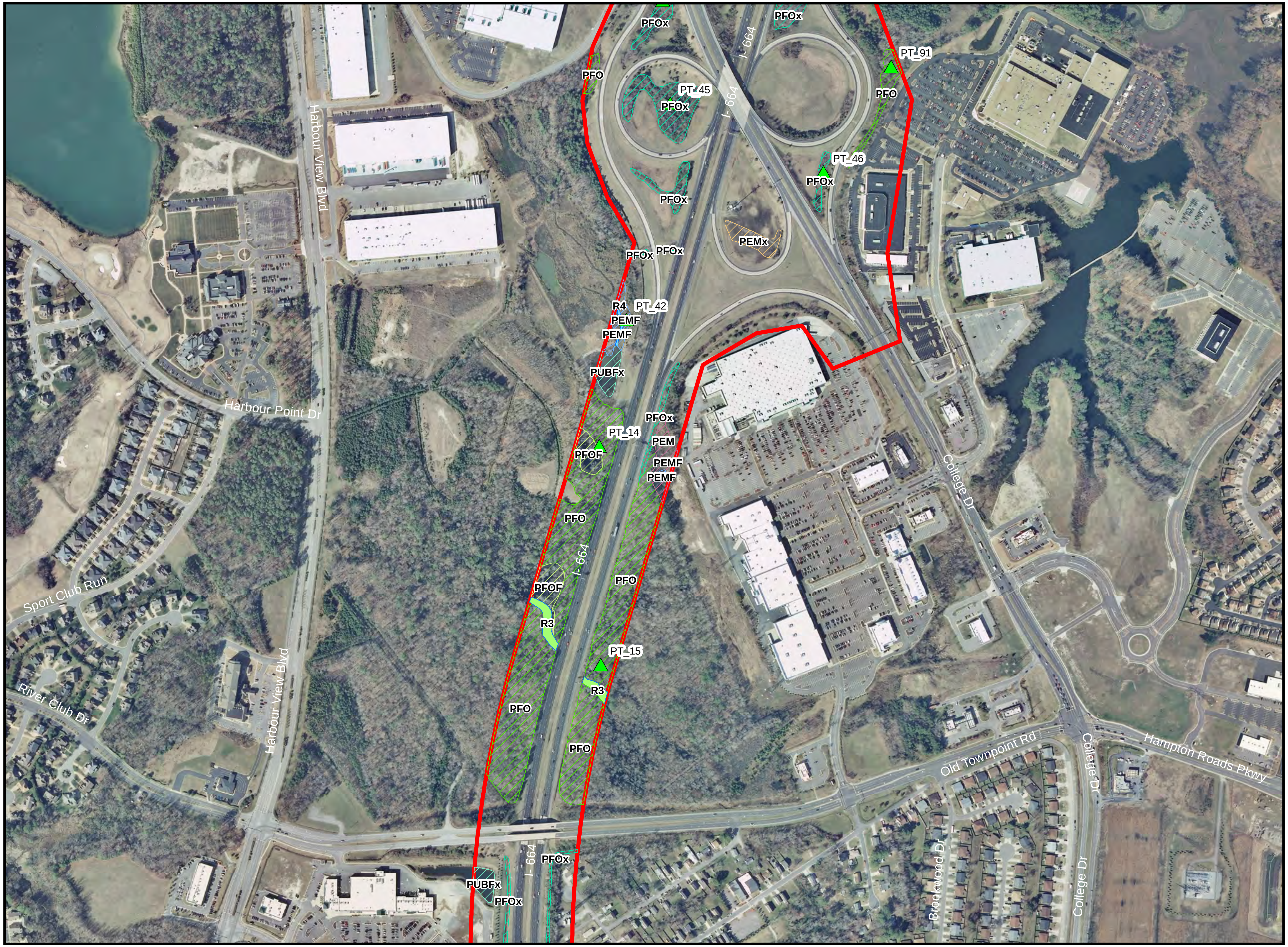
Photointerpreted Wetlands Cowardin Classification

- E1UB- Estuarine, Subtidal, Unconsolidated Bottom (open water)
- E1UBx- Excavated
- E2EM- Estuarine, Intertidal, Emergent
- E2EMx- Excavated
- E2US- Estuarine, Intertidal, Unconsolidated Shore
- E2USx- Excavated
- PEM- Palustrine, Emergent
- PEMF- Palustrine, Emergent, Semi-permanently or Permanently Flooded
- PEMFx- Excavated
- PEMx- Excavated
- PFO- Palustrine, Forested
- PFOF- Palustrine, Forested, Semi-permanently or Permanently Flooded
- PFOFx- Excavated
- PFOx- Excavated
- PSS- Palustrine, Scrub-shrub
- PSSx- Excavated
- PUB- Palustrine, Unconsolidated Bottom (open water)
- PUBF- Palustrine, Unconsolidated Bottom (open water), Semi or Permanently Flooded
- PUBFx- Excavated
- PUBx- Excavated
- R3- Riverine, Perennial
- R4- Riverine, Intermittent

Date: 7/25/2016

TITLE
MAP-34

SHEET NO. 34 OF 46



VDOT

0 125 250 500 Feet

1 in = 500 ft

DATA SOURCES: USGS, VDOT, VGIN (2013 RGB AERIAL)

Hampton Roads Crossing Study
Virginia DOT
Suffolk, Virginia

Legend

- Groundtruthing- 1/11/16-1/15/16
- Study Area Corridors

Photointerpreted Wetlands Cowardin Classification

- E1UB- Estuarine, Subtidal, Unconsolidated Bottom (open water)
- E1UBx- Excavated
- E2EM- Estuarine, Intertidal, Emergent
- E2EMx- Excavated
- E2US- Estuarine, Intertidal, Unconsolidated Shore
- E2USx- Excavated
- PEM- Palustrine, Emergent
- PEMF- Palustrine, Emergent, Semi-permanently or Permanently Flooded
- PEMFx- Excavated
- PEMx- Excavated
- PFO- Palustrine, Forested
- PFOF- Palustrine, Forested, Semi-permanently or Permanently Flooded
- PFOFx- Excavated
- PFOx- Excavated
- PSS- Palustrine, Scrub-shrub
- PSSx- Excavated
- PUB- Palustrine, Unconsolidated Bottom (open water)
- PUBF- Palustrine, Unconsolidated Bottom (open water), Semi or Permanently Flooded
- PUBFx- Excavated
- PUBx- Excavated
- R3- Riverine, Perennial
- R4- Riverine, Intermittent

Date: 7/25/2016

TITLE
MAP-35

SHEET NO. 35 OF 46

VDOT

0 125 250 500 Feet

1 in = 500 ft

DATA SOURCES: USGS, VDOT, VGIN (2013 RGB AERIAL)

Hampton Roads Crossing Study
Virginia DOT
Suffolk, Virginia

Legend

- Groundtruthing- 1/11/16-1/15/16
- Study Area Corridors

Photointerpreted Wetlands Cowardin Classification

- E1UB- Estuarine, Subtidal, Unconsolidated Bottom (open water)
- E1UBx- Excavated
- E2EM- Estuarine, Intertidal, Emergent
- E2EMx- Excavated
- E2US- Estuarine, Intertidal, Unconsolidated Shore
- E2USx- Excavated
- PEM- Palustrine, Emergent
- PEMF- Palustrine, Emergent, Semi-permanently or Permanently Flooded
- PEMFx- Excavated
- PEMx- Excavated
- PFO- Palustrine, Forested
- PFOF- Palustrine, Forested, Semi-permanently or Permanently Flooded
- PFOFx- Excavated
- PFOx- Excavated
- PSS- Palustrine, Scrub-shrub
- PSSx- Excavated
- PUB- Palustrine, Unconsolidated Bottom (open water)
- PUBF- Palustrine, Unconsolidated Bottom (open water), Semi or Permanently Flooded
- PUBFx- Excavated
- PUBx- Excavated
- R3- Riverine, Perennial
- R4- Riverine, Intermittent

Date: 7/25/2016

TITLE
MAP-36

SHEET NO. 36 OF 46

VDOT

0 125 250 500 Feet

1 in = 500 ft

DATA SOURCES: USGS, VDOT,
VGIN (2013 RGB AERIAL)

Hampton Roads Crossing Study
Virginia DOT
Suffolk, Virginia

Legend

- Groundtruthing- 1/11/16-1/15/16
- Study Area Corridors

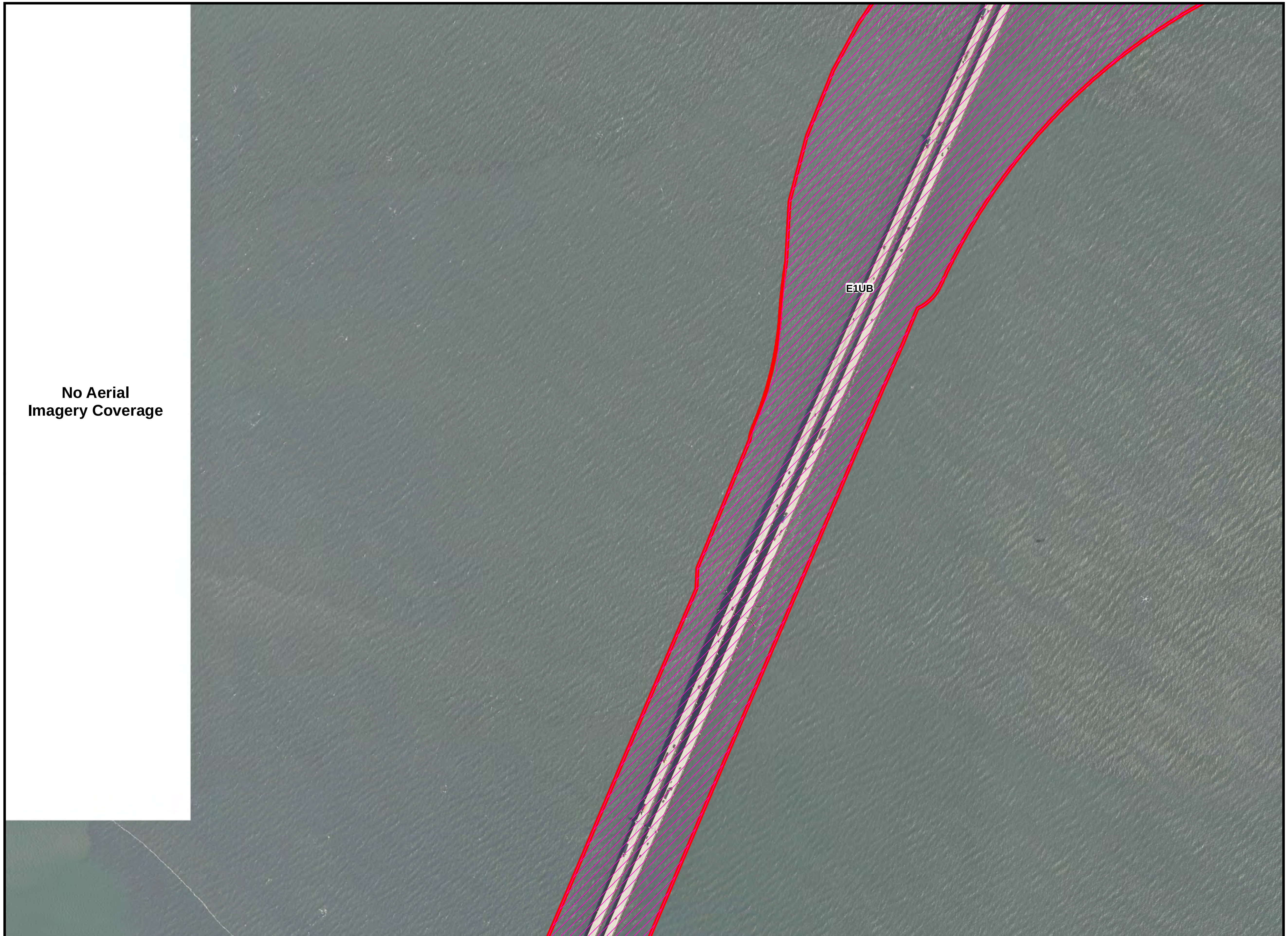
Photointerpreted Wetlands
Cowardin Classification

- E1UB- Estuarine, Subtidal, Unconsolidated Bottom (open water)
- E1UBx- Excavated
- E2EM- Estuarine, Intertidal, Emergent
- E2EMx- Excavated
- E2US- Estuarine, Intertidal, Unconsolidated Shore
- E2USx- Excavated
- PEM- Palustrine, Emergent
- PEMF- Palustrine, Emergent, Semi-permanently or Permanently Flooded
- PEMFx- Excavated
- PEMx- Excavated
- PFO- Palustrine, Forested
- PFOF- Palustrine, Forested, Semi-permanently or Permanently Flooded
- PFOFx- Excavated
- PFOx- Excavated
- PSS- Palustrine, Scrub-shrub
- PSSx- Excavated
- PUB- Palustrine, Unconsolidated Bottom (open water)
- PUBF- Palustrine, Unconsolidated Bottom (open water), Semi or Permanently Flooded
- PUBFx- Excavated
- PUBx- Excavated
- R3- Riverine, Perennial
- R4- Riverine, Intermittent

Date: 7/25/2016

TITLE
MAP-37

SHEET NO. 37 OF 46



0 125 250 500 Feet

1 in = 500 ft

DATA SOURCES: USGS, VDOT, VGIN (2013 RGB AERIAL)

Hampton Roads Crossing Study
Virginia DOT
Suffolk, Virginia

Legend

Groundtruthing- 1/11/16-1/15/16

Study Area Corridors

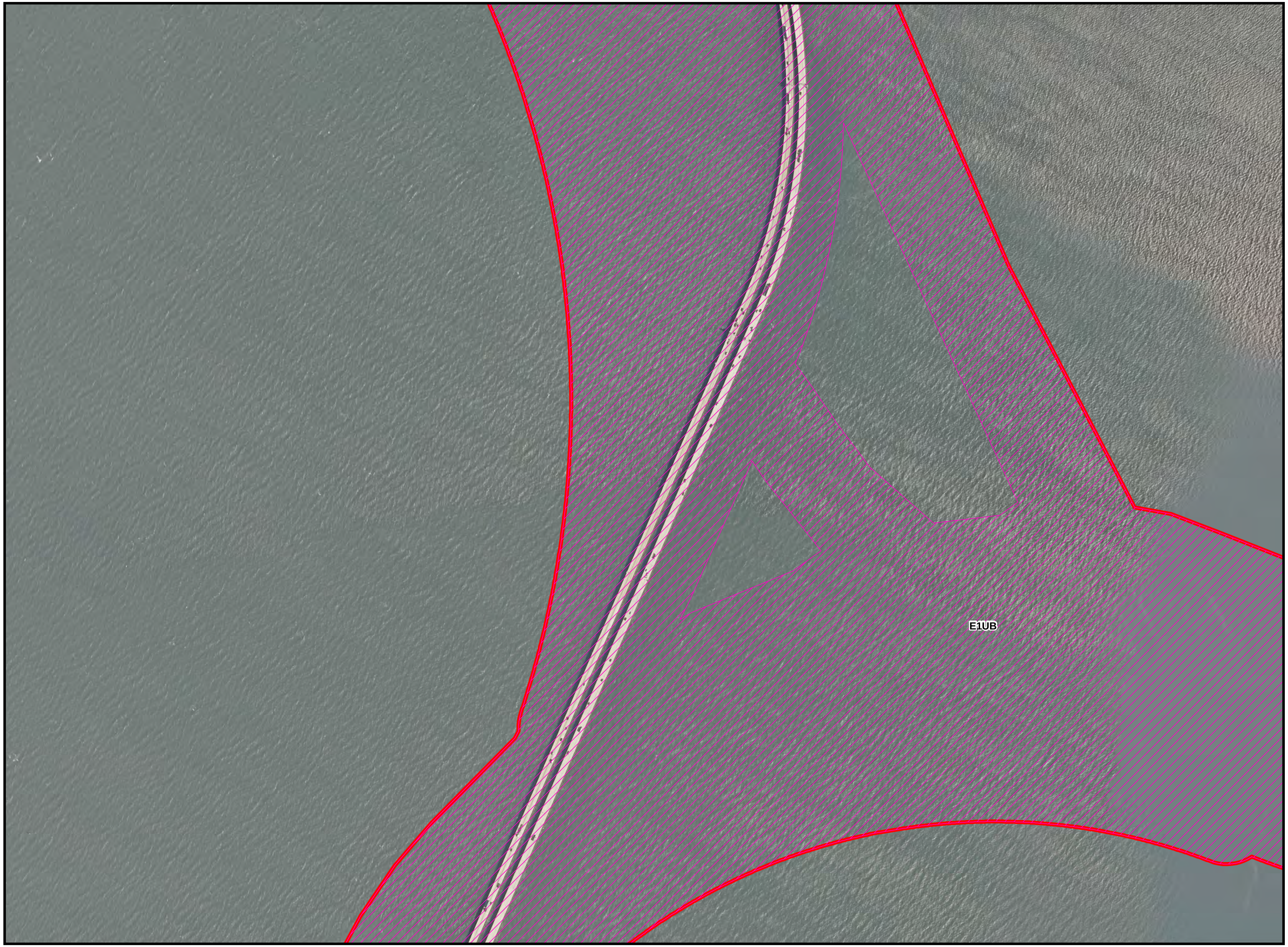
Photointerpreted Wetlands Cowardin Classification

E1UB- Estuarine, Subtidal, Unconsolidated Bottom (open water)
E1UBx- Excavated
E2EM- Estuarine, Intertidal, Emergent
E2EMx- Excavated
E2US- Estuarine, Intertidal, Unconsolidated Shore
E2USx- Excavated
PEM- Palustrine, Emergent
PEMF- Palustrine, Emergent, Semi-permanently or Permanently Flooded
PEMFx- Excavated
PEMx- Excavated
PFO- Palustrine, Forested
PFOF- Palustrine, Forested, Semi-permanently or Permanently Flooded
PFOFx- Excavated
PFOx- Excavated
PSS- Palustrine, Scrub-shrub
PSSx- Excavated
PUB- Palustrine, Unconsolidated Bottom (open water)
PUBF- Palustrine, Unconsolidated Bottom (open water), Semi or Permanently Flooded
PUBFx- Excavated
PUBx- Excavated
R3- Riverine, Perennial
R4- Riverine, Intermittent

Date: 7/25/2016

TITLE
MAP-38

SHEET NO. 38 OF 46



VDOT

0 125 250 500 Feet

1 in = 500 ft

DATA SOURCES: USGS, VDOT, VGIN (2013 RGB AERIAL)

Hampton Roads Crossing Study
Virginia DOT
Suffolk, Virginia

Legend

Groundtruthing- 1/11/16-1/15/16

Study Area Corridors

Photointerpreted Wetlands
Cowardin Classification

- E1UB- Estuarine, Subtidal, Unconsolidated Bottom (open water)
- E1UBx- Excavated
- E2EM- Estuarine, Intertidal, Emergent
- E2EMx- Excavated
- E2US- Estuarine, Intertidal, Unconsolidated Shore
- E2USx- Excavated
- PEM- Palustrine, Emergent
- PEMF- Palustrine, Emergent, Semi-permanently or Permanently Flooded
- PEMFx- Excavated
- PEMx- Excavated
- PFO- Palustrine, Forested
- PFOF- Palustrine, Forested, Semi-permanently or Permanently Flooded
- PFOFx- Excavated
- PFOx- Excavated
- PSS- Palustrine, Scrub-shrub
- PSSx- Excavated
- PUB- Palustrine, Unconsolidated Bottom (open water)
- PUBF- Palustrine, Unconsolidated Bottom (open water), Semi or Permanently Flooded
- PUBFx- Excavated
- PUBx- Excavated
- R3- Riverine, Perennial
- R4- Riverine, Intermittent

Date: 7/25/2016

TITLE
MAP-39

SHEET NO. 39 OF 46

VDOT

0 125 250 500 Feet

1 in = 500 ft

DATA SOURCES: USGS, VDOT, VGIN (2013 RGB AERIAL)

Hampton Roads Crossing Study
Virginia DOT
Suffolk, Virginia

Legend

- Groundtruthing- 1/11/16-1/15/16
- Study Area Corridors

Photointerpreted Wetlands Cowardin Classification

- E1UB- Estuarine, Subtidal, Unconsolidated Bottom (open water)
- E1UBx- Excavated
- E2EM- Estuarine, Intertidal, Emergent
- E2EMx- Excavated
- E2US- Estuarine, Intertidal, Unconsolidated Shore
- E2USx- Excavated
- PEM- Palustrine, Emergent
- PEMF- Palustrine, Emergent, Semi-permanently or Permanently Flooded
- PEMFx- Excavated
- PEMx- Excavated
- PFO- Palustrine, Forested
- PFOF- Palustrine, Forested, Semi-permanently or Permanently Flooded
- PFOFx- Excavated
- PFOx- Excavated
- PSS- Palustrine, Scrub-shrub
- PSSx- Excavated
- PUB- Palustrine, Unconsolidated Bottom (open water)
- PUBF- Palustrine, Unconsolidated Bottom (open water), Semi or Permanently Flooded
- PUBFx- Excavated
- PUBx- Excavated
- R3- Riverine, Perennial
- R4- Riverine, Intermittent

Date: 7/25/2016

TITLE
MAP-40

SHEET NO. 40 OF 46

VDOT

0 125 250 500 Feet

1 in = 500 ft

DATA SOURCES: USGS, VDOT, VGIN (2013 RGB AERIAL)

Hampton Roads Crossing Study
Virginia DOT
Newport News, Virginia

Legend

- Groundtruthing- 1/11/16-1/15/16
- Study Area Corridors

Photointerpreted Wetlands Cowardin Classification

- E1UB- Estuarine, Subtidal, Unconsolidated Bottom (open water)
- E1UBx- Excavated
- E2EM- Estuarine, Intertidal, Emergent
- E2EMx- Excavated
- E2US- Estuarine, Intertidal, Unconsolidated Shore
- E2USx- Excavated
- PEM- Palustrine, Emergent
- PEMF- Palustrine, Emergent, Semi-permanently or Permanently Flooded
- PEMFx- Excavated
- PEMx- Excavated
- PFO- Palustrine, Forested
- PFOF- Palustrine, Forested, Semi-permanently or Permanently Flooded
- PFOFx- Excavated
- PFOx- Excavated
- PSS- Palustrine, Scrub-shrub
- PSSx- Excavated
- PUB- Palustrine, Unconsolidated Bottom (open water)
- PUBF- Palustrine, Unconsolidated Bottom (open water), Semi or Permanently Flooded
- PUBFx- Excavated
- PUBx- Excavated
- R3- Riverine, Perennial
- R4- Riverine, Intermittent

Date: 7/25/2016

TITLE
MAP-41

SHEET NO. 41 OF 46

VDOT

0 125 250 500 Feet

1 in = 500 ft

DATA SOURCES: USGS, VDOT, VGIN (2013 RGB AERIAL)

Hampton Roads Crossing Study
Virginia DOT
Newport News, Virginia

Legend

- Groundtruthing- 1/11/16-1/15/16
- Study Area Corridors

Photointerpreted Wetlands Cowardin Classification

- E1UB- Estuarine, Subtidal, Unconsolidated Bottom (open water)
- E1UBx- Excavated
- E2EM- Estuarine, Intertidal, Emergent
- E2EMx- Excavated
- E2US- Estuarine, Intertidal, Unconsolidated Shore
- E2USx- Excavated
- PEM- Palustrine, Emergent
- PEMF- Palustrine, Emergent, Semi-permanently or Permanently Flooded
- PEMFx- Excavated
- PEMx- Excavated
- PFO- Palustrine, Forested
- PFOF- Palustrine, Forested, Semi-permanently or Permanently Flooded
- PFOFx- Excavated
- PFOx- Excavated
- PSS- Palustrine, Scrub-shrub
- PSSx- Excavated
- PUB- Palustrine, Unconsolidated Bottom (open water)
- PUBF- Palustrine, Unconsolidated Bottom (open water), Semi or Permanently Flooded
- PUBFx- Excavated
- PUBx- Excavated
- R3- Riverine, Perennial
- R4- Riverine, Intermittent

Date: 7/25/2016

TITLE
MAP-42

SHEET NO. 42 OF 46

0 125 250 500 Feet

1 in = 500 ft

DATA SOURCES: USGS, VDOT, VGIN (2013 RGB AERIAL)

Hampton Roads Crossing Study
Virginia DOT
Newport News, Virginia

Legend

- Groundtruthing- 1/11/16-1/15/16
- Study Area Corridors

Photointerpreted Wetlands
Cowardin Classification

- E1UB- Estuarine, Subtidal, Unconsolidated Bottom (open water)
- E1UBx- Excavated
- E2EM- Estuarine, Intertidal, Emergent
- E2EMx- Excavated
- E2US- Estuarine, Intertidal, Unconsolidated Shore
- E2USx- Excavated
- PEM- Palustrine, Emergent
- PEMF- Palustrine, Emergent, Semi-permanently or Permanently Flooded
- PEMFx- Excavated
- PEMx- Excavated
- PFO- Palustrine, Forested
- PFOF- Palustrine, Forested, Semi-permanently or Permanently Flooded
- PFOFx- Excavated
- PFOx- Excavated
- PSS- Palustrine, Scrub-shrub
- PSSx- Excavated
- PUB- Palustrine, Unconsolidated Bottom (open water)
- PUBF- Palustrine, Unconsolidated Bottom (open water), Semi or Permanently Flooded
- PUBFx- Excavated
- PUBx- Excavated
- R3- Riverine, Perennial
- R4- Riverine, Intermittent

Date: 7/25/2016

TITLE
MAP-43

SHEET NO. 43 OF 46

VDOT

0 125 250 500 Feet

1 in = 500 ft

DATA SOURCES: USGS, VDOT, VGIN (2013 RGB AERIAL)

Hampton Roads Crossing Study
Virginia DOT
Newport News and Hampton, Virginia

Legend

- Groundtruthing- 1/11/16-1/15/16
- Study Area Corridors

Photointerpreted Wetlands Cowardin Classification

- E1UB- Estuarine, Subtidal, Unconsolidated Bottom (open water)
- E1UBx- Excavated
- E2EM- Estuarine, Intertidal, Emergent
- E2EMx- Excavated
- E2US- Estuarine, Intertidal, Unconsolidated Shore
- E2USx- Excavated
- PEM- Palustrine, Emergent
- PEMF- Palustrine, Emergent, Semi-permanently or Permanently Flooded
- PEMFx- Excavated
- PEMx- Excavated
- PFO- Palustrine, Forested
- PFOF- Palustrine, Forested, Semi-permanently or Permanently Flooded
- PFOFx- Excavated
- PFOx- Excavated
- PSS- Palustrine, Scrub-shrub
- PSSx- Excavated
- PUB- Palustrine, Unconsolidated Bottom (open water)
- PUBF- Palustrine, Unconsolidated Bottom (open water), Semi or Permanently Flooded
- PUBFx- Excavated
- PUBx- Excavated
- R3- Riverine, Perennial
- R4- Riverine, Intermittent

Date: 7/25/2016

TITLE
MAP-44

SHEET NO. 44 OF 46

VDOT

0 125 250 500 Feet

1 in = 500 ft

DATA SOURCES: USGS, VDOT, VGIN (2013 RGB AERIAL)

Hampton Roads Crossing Study
Virginia DOT
Hampton, Virginia

Legend

- Groundtruthing- 1/11/16-1/15/16
- Study Area Corridors

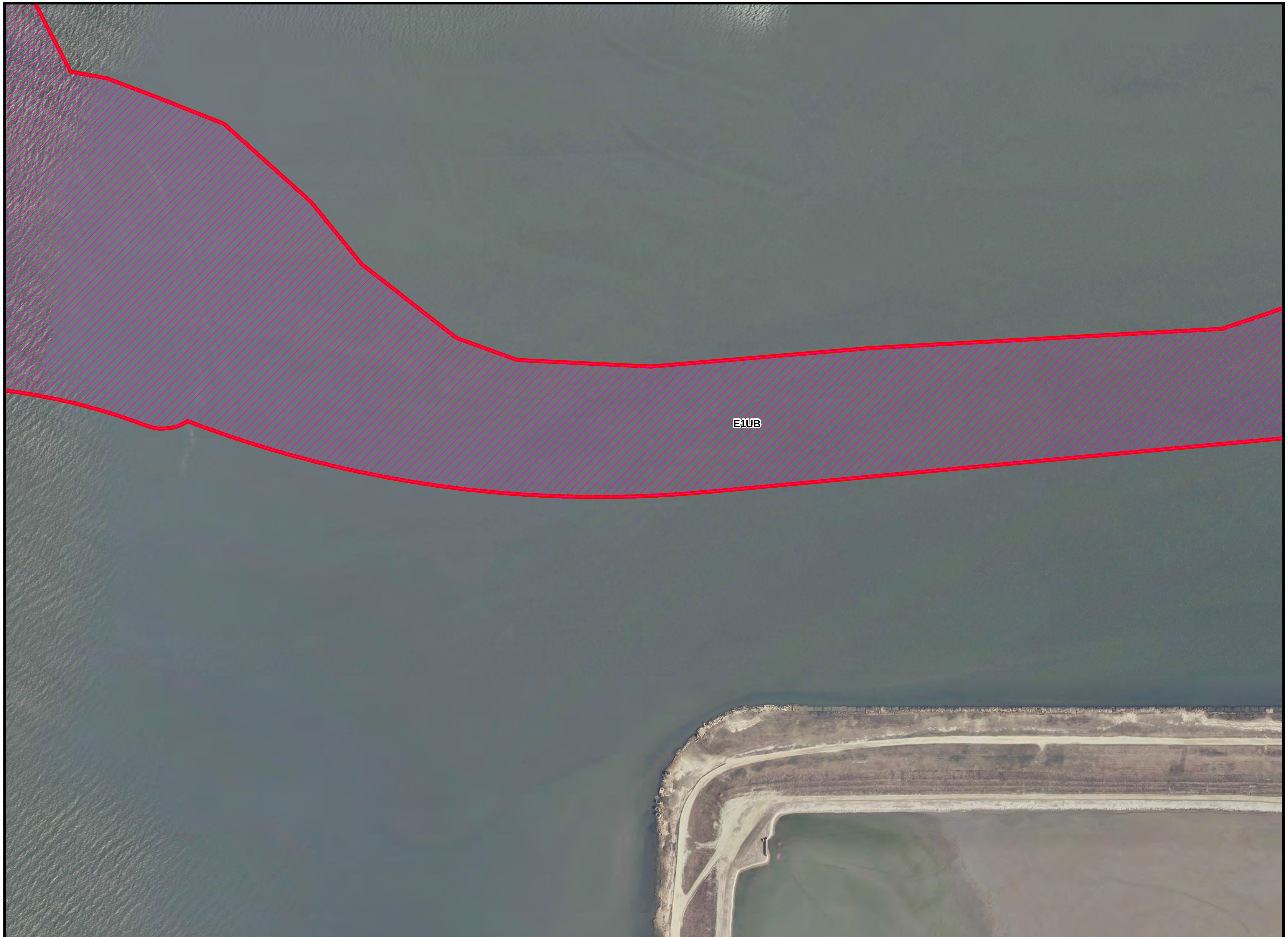
Photointerpreted Wetlands Cowardin Classification

- E1UB- Estuarine, Subtidal, Unconsolidated Bottom (open water)
- E1UBx- Excavated
- E2EM- Estuarine, Intertidal, Emergent
- E2EMx- Excavated
- E2US- Estuarine, Intertidal, Unconsolidated Shore
- E2USx- Excavated
- PEM- Palustrine, Emergent
- PEMF- Palustrine, Emergent, Semi-permanently or Permanently Flooded
- PEMFx- Excavated
- PEMx- Excavated
- PFO- Palustrine, Forested
- PFOF- Palustrine, Forested, Semi-permanently or Permanently Flooded
- PFOFx- Excavated
- PFOx- Excavated
- PSS- Palustrine, Scrub-shrub
- PSSx- Excavated
- PUB- Palustrine, Unconsolidated Bottom (open water)
- PUBF- Palustrine, Unconsolidated Bottom (open water), Semi or Permanently Flooded
- PUBFx- Excavated
- PUBx- Excavated
- R3- Riverine, Perennial
- R4- Riverine, Intermittent

Date: 7/25/2016

TITLE
MAP-45

SHEET NO. 45 OF 46



VDOT

0 125 250 500 Feet

1 in = 500 ft

DATA SOURCES: USGS, VDOT, VGIN (2013 RGB AERIAL)

Hampton Roads Crossing Study
Virginia DOT
Portsmouth, Virginia

Legend

- Groundtruthing- 1/11/16-1/15/16
- Study Area Corridors

Photointerpreted Wetlands Cowardin Classification

- E1UB- Estuarine, Subtidal, Unconsolidated Bottom (open water)
- E1UBx- Excavated
- E2EM- Estuarine, Intertidal, Emergent
- E2EMx- Excavated
- E2US- Estuarine, Intertidal, Unconsolidated Shore
- E2USx- Excavated
- PEM- Palustrine, Emergent
- PEMF- Palustrine, Emergent, Semi-permanently or Permanently Flooded
- PEMFx- Excavated
- PEMx- Excavated
- PFO- Palustrine, Forested
- PFOF- Palustrine, Forested, Semi-permanently or Permanently Flooded
- PFOFx- Excavated
- PFOx- Excavated
- PSS- Palustrine, Scrub-shrub
- PSSx- Excavated
- PUB- Palustrine, Unconsolidated Bottom (open water)
- PUBF- Palustrine, Unconsolidated Bottom (open water), Semi or Permanently Flooded
- PUBFx- Excavated
- PUBx- Excavated
- R3- Riverine, Perennial
- R4- Riverine, Intermittent

Date: 7/25/2016

TITLE
MAP-46

APPENDIX C:

USM FORMS

Stream Assessment Form (Form 1)

Unified Stream Methodology for use in Virginia

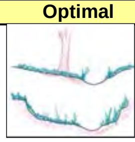
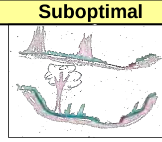
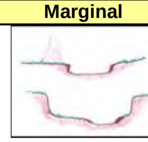
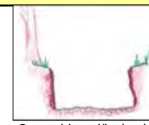
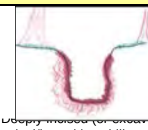
For use in wadeable channels classified as intermittent or perennial

Project #	Project Name	Locality	Cowardin Class.	HUC	Date	SAR #	Impact/SAR length	Impact Factor
00545	HRCS	Chesapeake	R3	02080208	02/10/16	R3	95	0

Name(s) of Evaluator(s)	Stream Name and Information
BWR	Unnamed Tributary to Goose Creek 1 - Maps 26 & 28

1. Channel Condition: Assess the cross-section of the stream and prevailing condition (erosion, aggradation)

Conditional Category

	Optimal	Suboptimal	Marginal	Poor	Severe	
						
Channel Condition	Very little incision or active erosion; 80-100% stable banks. Vegetative surface protection or natural rock, prominent (80-100%). AND/OR Stable point bars/bankfull benches are present. Access to their original floodplain or fully developed wide bankfull benches. Mid-channel bars, and transverse bars few. Transient sediment deposition covers less than 10% of bottom.	Slightly incised, few areas of active erosion or unprotected banks. Majority of banks are stable (60-80%). Vegetative protection or natural rock prominent (60-80%) AND/OR Depositional features contribute to stability. The bankfull and low flow channels are well defined. Stream likely has access to bankfull benches, or newly developed floodplains along portions of the reach. Transient sediment covers 10-40% of the stream bottom.	Often incised, but less than Severe or Poor. Banks more stable than Severe or Poor due to lower bank slopes. Erosion may be present on 40-60% of both banks. Vegetative protection on 40-60% of banks. Streambanks may be vertical or undercut. AND/OR 40-60% of stream is covered by sediment. Sediment may be temporary/transient, contribute instability. Deposition that contribute to stability, may be forming/present. AND/OR V-shaped channels have vegetative protection on > 40% of the banks and depositional features which	Over widened/incised. Vertically/laterally unstable. Likely to widen further. Majority of both banks are near vertical. Erosion present on 60-80% of banks. Vegetative protection present on 20-40% of banks, and is insufficient to prevent erosion. AND/OR 60-80% of the stream is covered by sediment. Sediment is temporary/transient in nature, and contributing to instability. AND/OR V-shaped channels have vegetative protection is present on > 40% of the banks and stable sediment deposition is absent.	vertical/lateral instability. Severe incision, flow contained within the banks. Streambed below average rooting depth, majority of banks vertical/undercut. Vegetative protection present on less than 20% of banks, is not preventing erosion. Obvious bank sloughing present. Erosion/raw banks on 80-100%. AND/OR Aggrading channel. Greater than 80% of stream bed is covered by deposition, contributing to instability. Multiple thread channels and/or subterranean flow.	CI
Score	3	2.4	2	1.6	1	2.4
NOTES>>	Slightly incised 80% of banks stable					

2. RIPARIAN BUFFERS: Assess both bank's 100 foot riparian areas along the entire SAR. (rough measurements of length & width may be acceptable)

Conditional Category

NOTES>> mature forest - 1.5

	Optimal	Suboptimal		Marginal		Poor	
Riparian Buffers	Tree stratum (dbh > 3 inches) present, with > 60% tree canopy cover and a non-maintained understory. Wetlands located within the riparian areas.	**High Suboptimal:** Riparian areas with tree stratum (dbh > 3 inches) present, with 30% to 60% tree canopy cover and containing both herbaceous and shrub layers or a non-maintained understory.	**Low Suboptimal:** Riparian areas with tree stratum (dbh > 3 inches) present, with > 30% tree canopy cover and a maintained understory. Recent cutover (dense vegetation).	**High Marginal:** Non-maintained, dense herbaceous vegetation with either a shrub layer or a tree layer (dbh > 3 inches) present, with <30% tree canopy cover.	**Low Marginal:** Non-maintained, dense herbaceous vegetation, riparian areas lacking shrub and tree stratum, hay production, ponds, open water. If present, tree stratum (dbh >3 inches) present, with <30% tree canopy cover with maintained understory.	**High Poor:** Lawns, mowed, and maintained areas, nurseries; no-till cropland; actively grazed pasture, sparsely vegetated non-maintained area, recently seeded and stabilized, or other comparable condition.	**Low Poor:** Impervious surfaces, mine spoil lands, denuded surfaces, row crops, active feed lots, trails, or other comparable conditions.
		High	Low	High	Low	High	Low
Condition Scores	1.5	1.2	1.1	0.85	0.75	0.6	0.5

1. Delineate riparian areas along each stream bank into Condition Categories and Condition Scores using the descriptors.
2. Determine square footage for each by measuring or estimating length and width. Calculators are provided for you below.
3. Enter the % Riparian Area and Score for each riparian category in the blocks below.

Ensure the sums of % Riparian Blocks equal 100

Right Bank	% Riparian Area>	100%						100%	
	Score >	1.5							
Left Bank	% Riparian Area>	100%						100%	Rt Bank CI > 1.50
	Score >	1.5							Lt Bank CI > 1.50

CI
1.50

3. INSTREAM HABITAT: Varied substrate sizes, water velocity and depths; woody and leafy debris; stable substrate; low embeddedness; shade; undercut banks; root mats; SAV; riffle pool complexes, stable features.

NOTES>> stable habitat riffle pool complex with sandy gravel substrate, over hanging vegetation and large woody debris

Conditional Category

	Optimal	Suboptimal	Marginal	Poor	
Instream Habitat/ Available Cover	Habitat elements are typically present in greater than 50% of the reach.	Stable habitat elements are typically present in 30-50% of the reach and are adequate for maintenance of populations.	Stable habitat elements are typically present in 10-30% of the reach and are adequate for maintenance of populations.	Habitat elements listed above are lacking or are unstable. Habitat elements are typically present in less than 10% of the reach.	CI
Score	1.5	1.2	0.9	0.5	1.20

Stream Impact Assessment Form Page 2

Project #	Applicant	Locality	Cowardin Class.	HUC	Date	Data Point	SAR length	Impact Factor
4917	US Route 460							

4. CHANNEL ALTERATION: Stream crossings, riprap, concrete, gabions, or concrete blocks, straightening of channel, channelization, embankments, spoil piles, constrictions, livestock

Ditched with culverts at both ends

	Conditional Category					
	Negligible	Minor		Moderate		Severe
Channel Alteration	Channelization, dredging, alteration, or hardening absent. Stream has an unaltered pattern or has naturalized.	Less than 20% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	20-40% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	40 - 60% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	60 - 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	Greater than 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines AND/OR 80% of banks shored with gabion, riprap, or cement.
SCORE	1.5	1.3	1.1	0.9	0.7	0.5

0.90

REACH CONDITION INDEX and STREAM CONDITION UNITS FOR THIS REACH

NOTE: **The CIs and RCI should be rounded to 2 decimal places. The CR should be rounded to a whole number.**

THE REACH CONDITION INDEX (RCI) >>	**1.20**
RCI= (Sum of all CI's)/5	
COMPENSATION REQUIREMENT (CR) >>	**0**
CR = RCI X LF X IF	

INSERT PHOTOS:

Stream Assessment Form (Form 1)

Unified Stream Methodology for use in Virginia

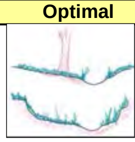
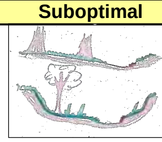
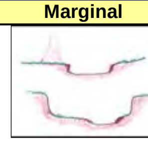
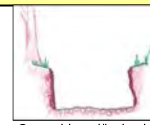
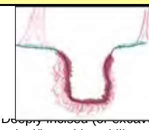
For use in wadeable channels classified as intermittent or perennial

Project #	Project Name	Locality	Cowardin Class.	HUC	Date	SAR #	Impact/SAR length	Impact Factor
00545	HRCS	Chesapeake	R3	02080208	02/10/16	R4	283	0

Name(s) of Evaluator(s)	Stream Name and Information
BWR	Unnamed Tributary to Goose Creek 1 - Map 28

1. Channel Condition: Assess the cross-section of the stream and prevailing condition (erosion, aggradation)

Conditional Category

	Optimal	Suboptimal	Marginal	Poor	Severe	
						
Channel Condition	Very little incision or active erosion; 80-100% stable banks. Vegetative surface protection or natural rock, prominent (80-100%). AND/OR Stable point bars/bankfull benches are present. Access to their original floodplain or fully developed wide bankfull benches. Mid-channel bars, and transverse bars few. Transient sediment deposition covers less than 10% of bottom.	Slightly incised, few areas of active erosion or unprotected banks. Majority of banks are stable (60-80%). Vegetative protection or natural rock prominent (60-80%) AND/OR Depositional features contribute to stability. The bankfull and low flow channels are well defined. Stream likely has access to bankfull benches, or newly developed floodplains along portions of the reach. Transient sediment covers 10-40% of the stream bottom.	Often incised, but less than Severe or Poor. Banks more stable than Severe or Poor due to lower bank slopes. Erosion may be present on 40-60% of both banks. Vegetative protection on 40-60% of banks. Streambanks may be vertical or undercut. AND/OR 40-60% of stream is covered by sediment. Sediment may be temporary/transient, contribute instability. Deposition that contribute to stability, may be forming/present. AND/OR V-shaped channels have vegetative protection on > 40% of the banks and depositional features which	Over widened/incised. Vertically/laterally unstable. Likely to widen further. Majority of both banks are near vertical. Erosion present on 60-80% of banks. Vegetative protection present on 20-40% of banks, and is insufficient to prevent erosion. AND/OR 60-80% of the stream is covered by sediment. Sediment is temporary/transient in nature, and contributing to instability. AND/OR V-shaped channels have vegetative protection is present on > 40% of the banks and stable sediment deposition is absent.	vertical/lateral instability. Severe incision, flow contained within the banks. Streambed below average rooting depth, majority of banks vertical/undercut. Vegetative protection present on less than 20% of banks, is not preventing erosion. Obvious bank sloughing present. Erosion/raw banks on 80-100%. AND/OR Aggrading channel. Greater than 80% of stream bed is covered by deposition, contributing to instability. Multiple thread channels and/or subterranean flow.	CI
Score	3	2.4	2	1.6	1	2.0
NOTES>>	Stable with maintained grass banks, in VDOT right of way for US 460					

2. RIPARIAN BUFFERS: Assess both bank's 100 foot riparian areas along the entire SAR. (rough measurements of length & width may be acceptable)

Conditional Category

	Optimal	Suboptimal		Marginal		Poor	
Riparian Buffers	Tree stratum (dbh > 3 inches) present, with > 60% tree canopy cover and a non-maintained understory. Wetlands located within the riparian areas.	**High Suboptimal:** Riparian areas with tree stratum (dbh > 3 inches) present, with 30% to 60% tree canopy cover and containing both herbaceous and shrub layers or a non-maintained understory.	**Low Suboptimal:** Riparian areas with tree stratum (dbh > 3 inches) present, with > 30% tree canopy cover and a maintained understory. Recent cutover (dense vegetation).	**High Marginal:** Non-maintained, dense herbaceous vegetation with either a shrub layer or a tree layer (dbh > 3 inches) present, with <30% tree canopy cover.	**Low Marginal:** Non-maintained, dense herbaceous vegetation, riparian areas lacking shrub and tree stratum, hay production, ponds, open water. If present, tree stratum (dbh >3 inches) present, with <30% tree canopy cover with maintained understory.	**High Poor:** Lawns, mowed, and maintained areas, nurseries; no-till cropland; actively grazed pasture, sparsely vegetated non-maintained area, recently seeded and stabilized, or other comparable condition.	**Low Poor:** Impervious surfaces, mine spoil lands, denuded surfaces, row crops, active feed lots, trails, or other comparable conditions.
		High	Low	High	Low	High	Low
Condition Scores	1.5	1.2	1.1	0.85	0.75	0.6	0.5

NOTES>> Maintained lawn - 0.6

1. Delineate riparian areas along each stream bank into Condition Categories and Condition Scores using the descriptors.
2. Determine square footage for each by measuring or estimating length and width. Calculators are provided for you below.
3. Enter the % Riparian Area and Score for each riparian category in the blocks below.

Ensure the sums of % Riparian Blocks equal 100

Right Bank	% Riparian Area>	100%						100%	
	Score >	0.6							
Left Bank	% Riparian Area>	100%						100%	Rt Bank CI > 0.60
	Score >	0.6							Lt Bank CI > 0.60

CI
0.60

3. INSTREAM HABITAT: Varied substrate sizes, water velocity and depths; woody and leafy debris; stable substrate; low embeddedness; shade; undercut banks; root mats; SAV; riffle pool complexes, stable features.

NOTES>> Mobile sand

Conditional Category

	Optimal	Suboptimal	Marginal	Poor	
Instream Habitat/ Available Cover	Habitat elements are typically present in greater than 50% of the reach.	Stable habitat elements are typically present in 30-50% of the reach and are adequate for maintenance of populations.	Stable habitat elements are typically present in 10-30% of the reach and are adequate for maintenance of populations.	Habitat elements listed above are lacking or are unstable. Habitat elements are typically present in less than 10% of the reach.	CI
Score	1.5	1.2	0.9	0.5	0.50

Stream Impact Assessment Form Page 2

Project #	Applicant	Locality	Cowardin Class.	HUC	Date	Data Point	SAR length	Impact Factor
4917	US Route 460							

4. CHANNEL ALTERATION: Stream crossings, riprap, concrete, gabions, or concrete blocks, straightening of channel, channelization, embankments, spoil piles, constrictions, livestock

Ditched with culverts at both ends

	Conditional Category						
	Negligible	Minor		Moderate		Severe	
Channel Alteration	Channelization, dredging, alteration, or hardening absent. Stream has an unaltered pattern or has naturalized.	Less than 20% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	20-40% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	40 - 60% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	60 - 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	Greater than 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines AND/OR 80% of banks shored with gabion, riprap, or cement.	
SCORE	1.5	1.3	1.1	0.9	0.7	0.5	0.50

REACH CONDITION INDEX and STREAM CONDITION UNITS FOR THIS REACH

NOTE: **The CIs and RCI should be rounded to 2 decimal places. The CR should be rounded to a whole number.**

THE REACH CONDITION INDEX (RCI) >>	0.72
RCI= (Sum of all CI's)/5	
COMPENSATION REQUIREMENT (CR) >>	0
CR = RCI X LF X IF	

INSERT PHOTOS:

Stream Assessment Form (Form 1)

Unified Stream Methodology for use in Virginia

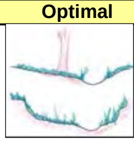
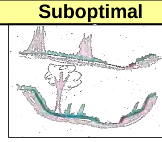
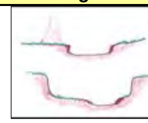
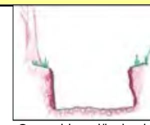
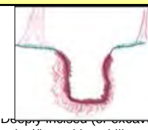
For use in wadeable channels classified as intermittent or perennial

Project #	Project Name	Locality	Cowardin Class.	HUC	Date	SAR #	Impact/SAR length	Impact Factor
00545	HRCS	Chesapeake	R3	02080208	02/10/16	R5	887	0

Name(s) of Evaluator(s)	Stream Name and Information
BWR	Unnamed Tributary to Goose Creek 1 - Map 28

1. Channel Condition:
Assess the cross-section of the stream and prevailing condition (erosion, aggradation)

Conditional Category

	Optimal	Suboptimal	Marginal	Poor	Severe	
						
Channel Condition	Very little incision or active erosion; 80-100% stable banks. Vegetative surface protection or natural rock, prominent (80-100%). AND/OR Stable point bars/bankfull benches are present. Access to their original floodplain or fully developed wide bankfull benches. Mid-channel bars, and transverse bars few. Transient sediment deposition covers less than 10% of bottom.	Slightly incised, few areas of active erosion or unprotected banks. Majority of banks are stable (60-80%). Vegetative protection or natural rock prominent (60-80%) AND/OR Depositional features contribute to stability. The bankfull and low flow channels are well defined. Stream likely has access to bankfull benches, or newly developed floodplains along portions of the reach. Transient sediment covers 10-40% of the stream bottom.	Often incised, but less than Severe or Poor. Banks more stable than Severe or Poor due to lower bank slopes. Erosion may be present on 40-60% of both banks. Vegetative protection on 40-60% of banks. Streambanks may be vertical or undercut. AND/OR 40-60% of stream is covered by sediment. Sediment may be temporary/transient, contribute instability. Deposition that contribute to stability, may be forming/present. AND/OR V-shaped channels have vegetative protection on > 40% of the banks and depositional features which	Over widened/incised. Vertically/laterally unstable. Likely to widen further. Majority of both banks are near vertical. Erosion present on 60-80% of banks. Vegetative protection present on 20-40% of banks, and is insufficient to prevent erosion. AND/OR 60-80% of the stream is covered by sediment. Sediment is temporary/transient in nature, and contributing to instability. AND/OR V-shaped channels have vegetative protection is present on > 40% of the banks and stable sediment deposition is absent.	vertical/lateral instability. Severe incision, flow contained within the banks. Streambed below average rooting depth, majority of banks vertical/undercut. Vegetative protection present on less than 20% of banks, is not preventing erosion. Obvious bank sloughing present. Erosion/raw banks on 80-100%. AND/OR Aggrading channel. Greater than 80% of stream bed is covered by deposition, contributing to instability. Multiple thread channels and/or subterranean flow.	CI
Score	3	2.4	2	1.6	1	3.0
NOTES>>	Stable E channel flowing through wetland					

2. RIPARIAN BUFFERS:
Assess both bank's 100 foot riparian areas along the entire SAR. (rough measurements of length & width may be acceptable)

Conditional Category

	Optimal	Suboptimal		Marginal		Poor	
Riparian Buffers	Tree stratum (dbh > 3 inches) present, with > 60% tree canopy cover and a non-maintained understory. Wetlands located within the riparian areas.	**High Suboptimal:** Riparian areas with tree stratum (dbh > 3 inches) present, with 30% to 60% tree canopy cover and containing both herbaceous and shrub layers or a non-maintained understory.	**Low Suboptimal:** Riparian areas with tree stratum (dbh > 3 inches) present, with > 30% tree canopy cover and a maintained understory. Recent cutover (dense vegetation).	**High Marginal:** Non-maintained, dense herbaceous vegetation with either a shrub layer or a tree layer (dbh > 3 inches) present, with <30% tree canopy cover.	**Low Marginal:** Non-maintained, dense herbaceous vegetation, riparian areas lacking shrub and tree stratum, hay production, ponds, open water. If present, tree stratum (dbh >3 inches) present, with <30% tree canopy cover with maintained understory.	**High Poor:** Lawns, mowed, and maintained areas, nurseries; no-till cropland; actively grazed pasture, sparsely vegetated non-maintained area, recently seeded and stabilized, or other comparable condition.	**Low Poor:** Impervious surfaces, mine spoil lands, denuded surfaces, row crops, active feed lots, trails, or other comparable conditions.
		High	Low	High	Low	High	Low
Condition Scores	1.5	1.2	1.1	0.85	0.75	0.6	0.5

NOTES>>
mature forest - 1.5

1. Delineate riparian areas along each stream bank into Condition Categories and Condition Scores using the descriptors.
2. Determine square footage for each by measuring or estimating length and width. Calculators are provided for you below.
3. Enter the % Riparian Area and Score for each riparian category in the blocks below.

Ensure the sums of % Riparian Blocks equal 100

Right Bank	% Riparian Area>	100%							100%
	Score >	1.5							
Left Bank	% Riparian Area>	100%							100%
	Score >	1.5							

		CI
Rt Bank CI >	1.50	
Lt Bank CI >	1.50	1.50

3. INSTREAM HABITAT:
Varied substrate sizes, water velocity and depths; woody and leafy debris; stable substrate; low embeddedness; shade; undercut banks; root mats; SAV; riffle pool complexes, stable features.

NOTES>> Mobile sand, overhanging vegetation, large woody debris, undercut banks

Conditional Category

	Optimal	Suboptimal	Marginal	Poor	CI
Instream Habitat/ Available Cover	Habitat elements are typically present in greater than 50% of the reach.	Stable habitat elements are typically present in 30-50% of the reach and are adequate for maintenance of populations.	Stable habitat elements are typically present in 10-30% of the reach and are adequate for maintenance of populations.	Habitat elements listed above are lacking or are unstable. Habitat elements are typically present in less than 10% of the reach.	
Score	1.5	1.2	0.9	0.5	1.20

Stream Impact Assessment Form Page 2

Project #	Applicant	Locality	Cowardin Class.	HUC	Date	Data Point	SAR length	Impact Factor
4917	US Route 460							

4. CHANNEL ALTERATION: Stream crossings, riprap, concrete, gabions, or concrete blocks, straightening of channel, channelization, embankments, spoil piles, constrictions, livestock

N/A

	Conditional Category					
	Negligible	Minor		Moderate		Severe
Channel Alteration	Channelization, dredging, alteration, or hardening absent. Stream has an unaltered pattern or has naturalized.	Less than 20% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	20-40% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	40 - 60% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	60 - 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	Greater than 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines AND/OR 80% of banks shored with gabion, riprap, or cement.
SCORE	1.5	1.3	1.1	0.9	0.7	0.5

1.50

REACH CONDITION INDEX and STREAM CONDITION UNITS FOR THIS REACH

NOTE: **The CIs and RCI should be rounded to 2 decimal places. The CR should be rounded to a whole number.**

THE REACH CONDITION INDEX (RCI) >> **1.44**

RCI= (Sum of all CI's)/5

COMPENSATION REQUIREMENT (CR) >> **0**

CR = RCI X LF X IF

INSERT PHOTOS:

Stream Assessment Form (Form 1)

Unified Stream Methodology for use in Virginia

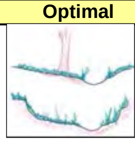
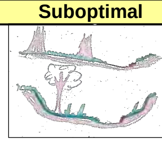
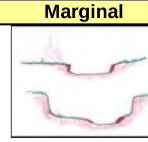
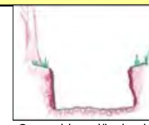
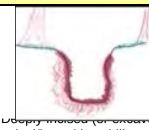
For use in wadeable channels classified as intermittent or perennial

Project #	Project Name	Locality	Cowardin Class.	HUC	Date	SAR #	Impact/SAR length	Impact Factor
00545	HRCS	Chesapeake	R3	02080208	02/10/16	R6	293	1

Name(s) of Evaluator(s)	Stream Name and Information
BWR	Unnamed Tributary to Goose Creek 2 - Map 28

1. Channel Condition: Assess the cross-section of the stream and prevailing condition (erosion, aggradation)

Conditional Category

	Optimal	Suboptimal	Marginal	Poor	Severe	
Channel Condition	 Very little incision or active erosion; 80-100% stable banks. Vegetative surface protection or natural rock, prominent (80-100%). AND/OR Stable point bars/bankfull benches are present. Access to their original floodplain or fully developed wide bankfull benches. Mid-channel bars, and transverse bars few. Transient sediment deposition covers less than 10% of bottom.	 Slightly incised, few areas of active erosion or unprotected banks. Majority of banks are stable (60-80%). Vegetative protection or natural rock prominent (60-80%) AND/OR Depositional features contribute to stability. The bankfull and low flow channels are well defined. Stream likely has access to bankfull benches, or newly developed floodplains along portions of the reach. Transient sediment covers 10-40% of the stream bottom.	 Often incised, but less than Severe or Poor. Banks more stable than Severe or Poor due to lower bank slopes. Erosion may be present on 40-60% of both banks. Vegetative protection on 40-60% of banks. Streambanks may be vertical or undercut. AND/OR 40-60% of stream is covered by sediment. Sediment may be temporary/transient, contribute instability. Deposition that contribute to stability, may be forming/present. AND/OR V-shaped channels have vegetative protection on > 40% of the banks and depositional features which	 Over widened/incised. Vertically/laterally unstable. Likely to widen further. Majority of both banks are near vertical. Erosion present on 60-80% of banks. Vegetative protection present on 20-40% of banks, and is insufficient to prevent erosion. AND/OR 60-80% of the stream is covered by sediment. Sediment is temporary/transient in nature, and contributing to instability. AND/OR V-shaped channels have vegetative protection is present on > 40% of the banks and stable sediment deposition is absent.	 vertical/lateral instability. Severe incision, flow contained within the banks. Streambed below average rooting depth, majority of banks vertical/undercut. Vegetative protection present on less than 20% of banks, is not preventing erosion. Obvious bank sloughing present. Erosion/raw banks on 80-100%. AND/OR Aggrading channel. Greater than 80% of stream bed is covered by deposition, contributing to instability. Multiple thread channels and/or subterranean flow.	CI
Score	3	2.4	2	1.6	1	2.4

NOTES>> Stable E channel flowing through wetland

2. RIPARIAN BUFFERS: Assess both bank's 100 foot riparian areas along the entire SAR. (rough measurements of length & width may be acceptable)

Conditional Category

	Optimal	Suboptimal		Marginal		Poor	
Riparian Buffers	Tree stratum (dbh > 3 inches) present, with > 60% tree canopy cover and a non-maintained understory. Wetlands located within the riparian areas.	**High Suboptimal:** Riparian areas with tree stratum (dbh > 3 inches) present, with 30% to 60% tree canopy cover and containing both herbaceous and shrub layers or a non-maintained understory.	**Low Suboptimal:** Riparian areas with tree stratum (dbh > 3 inches) present, with > 30% tree canopy cover and a maintained understory. Recent cutover (dense vegetation).	**High Marginal:** Non-maintained, dense herbaceous vegetation with either a shrub layer or a tree layer (dbh > 3 inches) present, with <30% tree canopy cover.	**Low Marginal:** Non-maintained, dense herbaceous vegetation, riparian areas lacking shrub and tree stratum, hay production, ponds, open water. If present, tree stratum (dbh >3 inches) present, with <30% tree canopy cover with maintained understory.	**High Poor:** Lawns, mowed, and maintained areas, nurseries; no-till cropland; actively grazed pasture, sparsely vegetated non-maintained area, recently seeded and stabilized, or other comparable condition.	**Low Poor:** Impervious surfaces, mine spoil lands, denuded surfaces, row crops, active feed lots, trails, or other comparable conditions.
		High	Low	High	Low	High	Low
Condition Scores	1.5	1.2	1.1	0.85	0.75	0.6	0.5

NOTES>>
mature forest - 1.5
Culvert outfall - 0.6

1. Delineate riparian areas along each stream bank into Condition Categories and Condition Scores using the descriptors.
2. Determine square footage for each by measuring or estimating length and width. Calculators are provided for you below.
3. Enter the % Riparian Area and Score for each riparian category in the blocks below.

Ensure the sums of % Riparian Blocks equal 100

Right Bank	% Riparian Area>	90%	10%						100%
	Score >	1.5	0.6						
Left Bank	% Riparian Area>	90%	10%						100%
	Score >	1.5	0.6						

		CI
Rt Bank CI >	1.41	
Lt Bank CI >	1.41	1.41

3. INSTREAM HABITAT: Varied substrate sizes, water velocity and depths; woody and leafy debris; stable substrate; low embeddedness; shade; undercut banks; root mats; SAV; riffle pool complexes, stable features.

NOTES>> Mobile sand, overhanging vegitation, large woody debri, undercut banks

Conditional Category

	Optimal	Suboptimal	Marginal	Poor	CI
Instream Habitat/ Available Cover	Habitat elements are typically present in greater than 50% of the reach.	Stable habitat elements are typically present in 30-50% of the reach and are adequate for maintenance of populations.	Stable habitat elements are typically present in 10-30% of the reach and are adequate for maintenance of populations.	Habitat elements listed above are lacking or are unstable. Habitat elements are typically present in less than 10% of the reach.	
Score	1.5	1.2	0.9	0.5	1.20

Stream Impact Assessment Form Page 2

Project #	Applicant	Locality	Cowardin Class.	HUC	Date	Data Point	SAR length	Impact Factor
4917	US Route 460							

4. CHANNEL ALTERATION: Stream crossings, riprap, concrete, gabions, or concrete blocks, straightening of channel, channelization, embankments, spoil piles, constrictions, livestock

Cultverts under road ways

	Conditional Category					
	Negligible	Minor		Moderate		Severe
Channel Alteration	Channelization, dredging, alteration, or hardening absent. Stream has an unaltered pattern or has naturalized.	Less than 20% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	20-40% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	40 - 60% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	60 - 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	Greater than 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines AND/OR 80% of banks shored with gabion, riprap, or cement.
SCORE	1.5	1.3	1.1	0.9	0.7	0.5

1.10

REACH CONDITION INDEX and STREAM CONDITION UNITS FOR THIS REACH

NOTE: **The CIs and RCI should be rounded to 2 decimal places. The CR should be rounded to a whole number.**

THE REACH CONDITION INDEX (RCI) >> **1.22**

RCI= (Sum of all CI's)/5

COMPENSATION REQUIREMENT (CR) >> **357**

CR = RCI X LF X IF

INSERT PHOTOS:

Stream Assessment Form (Form 1)

Unified Stream Methodology for use in Virginia

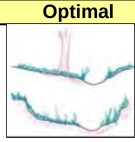
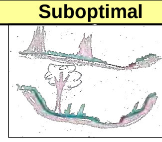
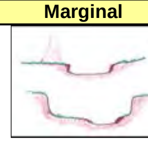
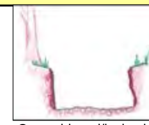
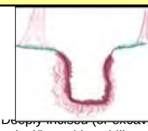
For use in wadeable channels classified as intermittent or perennial

Project #	Project Name	Locality	Cowardin Class.	HUC	Date	SAR #	Impact/SAR length	Impact Factor
00545	HRCS	Chesapeake	R3	02080208	02/10/16	R7	264	0

Name(s) of Evaluator(s)	Stream Name and Information
BWR	Unamed Tributary to Drum Point Creek - Map 32

1. Channel Condition: Assess the cross-section of the stream and prevailing condition (erosion, aggradation)

Conditional Category

	Optimal	Suboptimal	Marginal	Poor	Severe	
Channel Condition	 Very little incision or active erosion; 80-100% stable banks. Vegetative surface protection or natural rock, prominent (80-100%). AND/OR Stable point bars/bankfull benches are present. Access to their original floodplain or fully developed wide bankfull benches. Mid-channel bars, and transverse bars few. Transient sediment deposition covers less than 10% of bottom.	 Slightly incised, few areas of active erosion or unprotected banks. Majority of banks are stable (60-80%). Vegetative protection or natural rock prominent (60-80%) AND/OR Depositional features contribute to stability. The bankfull and low flow channels are well defined. Stream likely has access to bankfull benches, or newly developed floodplains along portions of the reach. Transient sediment covers 10-40% of the stream bottom.	 Often incised, but less than Severe or Poor. Banks more stable than Severe or Poor due to lower bank slopes. Erosion may be present on 40-60% of both banks. Vegetative protection on 40-60% of banks. Streambanks may be vertical or undercut. AND/OR 40-60% of stream is covered by sediment. Sediment may be temporary/transient, contribute instability. Deposition that contribute to stability, may be forming/present. AND/OR V-shaped channels have vegetative protection on > 40% of the banks and depositional features which	 Over widened/incised. Vertically/laterally unstable. Likely to widen further. Majority of both banks are near vertical. Erosion present on 60-80% of banks. Vegetative protection present on 20-40% of banks, and is insufficient to prevent erosion. AND/OR 60-80% of the stream is covered by sediment. Sediment is temporary/transient in nature, and contributing to instability. AND/OR V-shaped channels have vegetative protection is present on > 40% of the banks and stable sediment deposition is absent.	 vertical/lateral instability. Severe incision, flow contained within the banks. Streambed below average rooting depth, majority of banks vertical/undercut. Vegetative protection present on less than 20% of banks, is not preventing erosion. Obvious bank sloughing present. Erosion/raw banks on 80-100%. AND/OR Aggrading channel. Greater than 80% of stream bed is covered by deposition, contributing to instability. Multiple thread channels and/or subterranean flow.	CI
Score	3	2.4	2	1.6	1	3.0
NOTES>>	Stable channel flowing through wetland					

2. RIPARIAN BUFFERS: Assess both bank's 100 foot riparian areas along the entire SAR. (rough measurements of length & width may be acceptable)

Conditional Category

	Optimal	Suboptimal		Marginal		Poor	
Riparian Buffers	Tree stratum (dbh > 3 inches) present, with > 60% tree canopy cover and a non-maintained understory. Wetlands located within the riparian areas.	**High Suboptimal:** Riparian areas with tree stratum (dbh > 3 inches) present, with 30% to 60% tree canopy cover and containing both herbaceous and shrub layers or a non-maintained understory.	**Low Suboptimal:** Riparian areas with tree stratum (dbh > 3 inches) present, with > 30% tree canopy cover and a maintained understory. Recent cutover (dense vegetation).	**High Marginal:** Non-maintained, dense herbaceous vegetation with either a shrub layer or a tree layer (dbh > 3 inches) present, with <30% tree canopy cover.	**Low Marginal:** Non-maintained, dense herbaceous vegetation, riparian areas lacking shrub and tree stratum, hay production, ponds, open water. If present, tree stratum (dbh >3 inches) present, with <30% tree canopy cover with maintained understory.	**High Poor:** Lawns, mowed, and maintained areas, nurseries; no-till cropland; actively grazed pasture, sparsely vegetated non-maintained area, recently seeded and stabilized, or other comparable condition.	**Low Poor:** Impervious surfaces, mine spoil lands, denuded surfaces, row crops, active feed lots, trails, or other comparable conditions.
		High	Low	High	Low	High	Low
Condition Scores	1.5	1.2	1.1	0.85	0.75	0.6	0.5

NOTES>>
mature forest - 1.5
Culvert outfall - 0.6

1. Delineate riparian areas along each stream bank into Condition Categories and Condition Scores using the descriptors.
2. Determine square footage for each by measuring or estimating length and width. Calculators are provided for you below.
3. Enter the % Riparian Area and Score for each riparian category in the blocks below.

Ensure the sums of % Riparian Blocks equal 100

Right Bank	% Riparian Area>	95%	5%						100%
	Score >	1.5	0.6						
Left Bank	% Riparian Area>	95%	5%						100%
	Score >	1.5	0.6						

		CI
Rt Bank CI >	1.46	
Lt Bank CI >	1.46	1.46

3. INSTREAM HABITAT: Varied substrate sizes, water velocity and depths; woody and leafy debris; stable substrate; low embeddedness; shade; undercut banks; root mats; SAV; riffle pool complexes, stable features.

NOTES>> Mobile sand, overhanging vegetation, large woody debris, undercut banks, fast riffle

Conditional Category

	Optimal	Suboptimal	Marginal	Poor	CI
Instream Habitat/ Available Cover	Habitat elements are typically present in greater than 50% of the reach.	Stable habitat elements are typically present in 30-50% of the reach and are adequate for maintenance of populations.	Stable habitat elements are typically present in 10-30% of the reach and are adequate for maintenance of populations.	Habitat elements listed above are lacking or are unstable. Habitat elements are typically present in less than 10% of the reach.	
Score	1.5	1.2	0.9	0.5	1.50

Stream Impact Assessment Form Page 2

Project #	Applicant	Locality	Cowardin Class.	HUC	Date	Data Point	SAR length	Impact Factor
4917	US Route 460							

4. CHANNEL ALTERATION: Stream crossings, riprap, concrete, gabions, or concrete blocks, straightening of channel, channelization, embankments, spoil piles, constrictions, livestock

Cultvert at road

	Conditional Category						
	Negligible	Minor		Moderate		Severe	
Channel Alteration	Channelization, dredging, alteration, or hardening absent. Stream has an unaltered pattern or has naturalized.	Less than 20% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	20-40% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	40 - 60% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	60 - 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	Greater than 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines AND/OR 80% of banks shored with gabion, riprap, or cement.	
SCORE	1.5	1.3	1.1	0.9	0.7	0.5	1.30

REACH CONDITION INDEX and STREAM CONDITION UNITS FOR THIS REACH

NOTE: **The CIs and RCI should be rounded to 2 decimal places. The CR should be rounded to a whole number.**

THE REACH CONDITION INDEX (RCI) >>	**1.45**
RCI= (Sum of all CI's)/5	
COMPENSATION REQUIREMENT (CR) >>	**0**
CR = RCI X LF X IF	

INSERT PHOTOS:

Stream Assessment Form (Form 1)

Unified Stream Methodology for use in Virginia

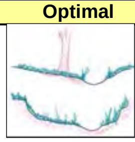
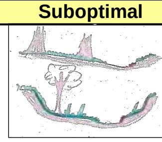
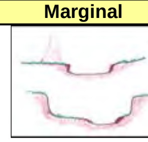
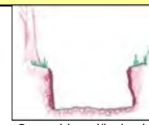
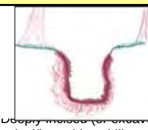
For use in wadeable channels classified as intermittent or perennial

Project #	Project Name	Locality	Cowardin Class.	HUC	Date	SAR #	Impact/SAR length	Impact Factor
00545	HRCS	Suffolk	R3	02080208	02/10/16	R8	183	0

Name(s) of Evaluator(s)	Stream Name and Information
BWR	Unnamed Tributary to Knotts Creek - Map 34

1. Channel Condition: Assess the cross-section of the stream and prevailing condition (erosion, aggradation)

Conditional Category

	Optimal	Suboptimal	Marginal	Poor	Severe	
						
Channel Condition	Very little incision or active erosion; 80-100% stable banks. Vegetative surface protection or natural rock, prominent (80-100%). AND/OR Stable point bars/bankfull benches are present. Access to their original floodplain or fully developed wide bankfull benches. Mid-channel bars, and transverse bars few. Transient sediment deposition covers less than 10% of bottom.	Slightly incised, few areas of active erosion or unprotected banks. Majority of banks are stable (60-80%). Vegetative protection or natural rock prominent (60-80%) AND/OR Depositional features contribute to stability. The bankfull and low flow channels are well defined. Stream likely has access to bankfull benches, or newly developed floodplains along portions of the reach. Transient sediment covers 10-40% of the stream bottom.	Often incised, but less than Severe or Poor. Banks more stable than Severe or Poor due to lower bank slopes. Erosion may be present on 40-60% of both banks. Vegetative protection on 40-60% of banks. Streambanks may be vertical or undercut. AND/OR 40-60% of stream is covered by sediment. Sediment may be temporary/transient, contribute instability. Deposition that contribute to stability, may be forming/present. AND/OR V-shaped channels have vegetative protection on > 40% of the banks and depositional features which	Over widened/incised. Vertically/laterally unstable. Likely to widen further. Majority of both banks are near vertical. Erosion present on 60-80% of banks. Vegetative protection present on 20-40% of banks, and is insufficient to prevent erosion. AND/OR 60-80% of the stream is covered by sediment. Sediment is temporary/transient in nature, and contributing to instability. AND/OR V-shaped channels have vegetative protection is present on > 40% of the banks and stable sediment deposition is absent.	vertical/lateral instability. Severe incision, flow contained within the banks. Streambed below average rooting depth, majority of banks vertical/undercut. Vegetative protection present on less than 20% of banks, is not preventing erosion. Obvious bank sloughing present. Erosion/raw banks on 80-100%. AND/OR Aggrading channel. Greater than 80% of stream bed is covered by deposition, contributing to instability. Multiple thread channels and/or subterranean flow.	**CI**
Score	3	2.4	2	1.6	1	2.4

NOTES>>	High sediment load creating mid channel bars and covering habitat

2. RIPARIAN BUFFERS: Assess both bank's 100 foot riparian areas along the entire SAR. (rough measurements of length & width may be acceptable)

Conditional Category

	Optimal	Suboptimal		Marginal		Poor	
Riparian Buffers	Tree stratum (dbh > 3 inches) present, with > 60% tree canopy cover and a non-maintained understory. Wetlands located within the riparian areas.	**High Suboptimal:** Riparian areas with tree stratum (dbh > 3 inches) present, with 30% to 60% tree canopy cover and containing both herbaceous and shrub layers or a non-maintained understory.	**Low Suboptimal:** Riparian areas with tree stratum (dbh > 3 inches) present, with > 30% tree canopy cover and a maintained understory. Recent cutover (dense vegetation).	**High Marginal:** Non-maintained, dense herbaceous vegetation with either a shrub layer or a tree layer (dbh > 3 inches) present, with <30% tree canopy cover.	**Low Marginal:** Non-maintained, dense herbaceous vegetation, riparian areas lacking shrub and tree stratum, hay production, ponds, open water. If present, tree stratum (dbh >3 inches) present, with <30% tree canopy cover with maintained understory.	**High Poor:** Lawns, mowed, and maintained areas, nurseries; no-till cropland; actively grazed pasture, sparsely vegetated non-maintained area, recently seeded and stabilized, or other comparable condition.	**Low Poor:** Impervious surfaces, mine spoil lands, denuded surfaces, row crops, active feed lots, trails, or other comparable conditions.
		High	Low	High	Low	High	Low
Condition Scores	1.5	1.2	1.1	0.85	0.75	0.6	0.5

NOTES>> mature forest - 1.5
maintained - 0.6

1. Delineate riparian areas along each stream bank into Condition Categories and Condition Scores using the descriptors.
2. Determine square footage for each by measuring or estimating length and width. Calculators are provided for you below.
3. Enter the % Riparian Area and Score for each riparian category in the blocks below.

Ensure the sums of % Riparian Blocks equal 100

Right Bank	% Riparian Area>	80%	20%						100%
	Score >	1.5	0.6						
Left Bank	% Riparian Area>	90%	10%						100%
	Score >	1.5	0.6						

Rt Bank CI >	1.32	**CI**
Lt Bank CI >	1.41	1.37

3. INSTREAM HABITAT: Varied substrate sizes, water velocity and depths; woody and leafy debris; stable substrate; low embeddedness; shade; undercut banks; root mats; SAV; riffle pool complexes, stable features.

NOTES>> overhanging vegetation, sand, fast riffle, leaf pack, large woody debris

Conditional Category

	Optimal	Suboptimal	Marginal	Poor	
Instream Habitat/ Available Cover	Habitat elements are typically present in greater than 50% of the reach.	Stable habitat elements are typically present in 30-50% of the reach and are adequate for maintenance of populations.	Stable habitat elements are typically present in 10-30% of the reach and are adequate for maintenance of populations.	Habitat elements listed above are lacking or are unstable. Habitat elements are typically present in less than 10% of the reach.	**CI**
Score	1.5	1.2	0.9	0.5	0.90

Stream Impact Assessment Form Page 2

Project #	Applicant	Locality	Cowardin Class.	HUC	Date	Data Point	SAR length	Impact Factor
4917	US Route 460							

4. CHANNEL ALTERATION: Stream crossings, riprap, concrete, gabions, or concrete blocks, straightening of channel, channelization, embankments, spoil piles, constrictions, livestock

Cultvert at road

	Conditional Category					
	Negligible	Minor		Moderate		Severe
Channel Alteration	Channelization, dredging, alteration, or hardening absent. Stream has an unaltered pattern or has naturalized.	Less than 20% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	20-40% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	40 - 60% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	60 - 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	Greater than 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines AND/OR 80% of banks shored with gabion, riprap, or cement.
SCORE	1.5	1.3	1.1	0.9	0.7	0.5

1.30

REACH CONDITION INDEX and STREAM CONDITION UNITS FOR THIS REACH

NOTE: **The CIs and RCI should be rounded to 2 decimal places. The CR should be rounded to a whole number.**

THE REACH CONDITION INDEX (RCI) >>	1.19
COMPENSATION REQUIREMENT (CR) >>	0

RCI= (Sum of all CI's)/5

CR = RCI X LF X IF

INSERT PHOTOS:

Stream Assessment Form (Form 1)

Unified Stream Methodology for use in Virginia

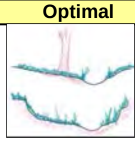
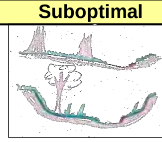
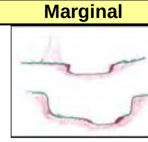
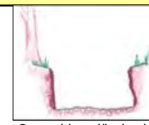
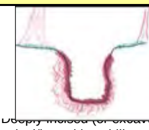
For use in wadeable channels classified as intermittent or perennial

Project #	Project Name	Locality	Cowardin Class.	HUC	Date	SAR #	Impact/SAR length	Impact Factor
00545	HRCS	Suffolk	R3	02080208	02/10/16	R9	112	1

Name(s) of Evaluator(s)	Stream Name and Information
BWR	Unnamed Tributary to Streeter Creek 1 - Map 35

1. Channel Condition: Assess the cross-section of the stream and prevailing condition (erosion, aggradation)

Conditional Category

	Optimal	Suboptimal	Marginal	Poor	Severe	
						
Channel Condition	Very little incision or active erosion; 80-100% stable banks. Vegetative surface protection or natural rock, prominent (80-100%). AND/OR Stable point bars/bankfull benches are present. Access to their original floodplain or fully developed wide bankfull benches. Mid-channel bars, and transverse bars few. Transient sediment deposition covers less than 10% of bottom.	Slightly incised, few areas of active erosion or unprotected banks. Majority of banks are stable (60-80%). Vegetative protection or natural rock prominent (60-80%) AND/OR Depositional features contribute to stability. The bankfull and low flow channels are well defined. Stream likely has access to bankfull benches, or newly developed floodplains along portions of the reach. Transient sediment covers 10-40% of the stream bottom.	Often incised, but less than Severe or Poor. Banks more stable than Severe or Poor due to lower bank slopes. Erosion may be present on 40-60% of both banks. Vegetative protection on 40-60% of banks. Streambanks may be vertical or undercut. AND/OR 40-60% of stream is covered by sediment. Sediment may be temporary/transient, contribute instability. Deposition that contribute to stability, may be forming/present. AND/OR V-shaped channels have vegetative protection on > 40% of the banks and depositional features which	Over widened/incised. Vertically/laterally unstable. Likely to widen further. Majority of both banks are near vertical. Erosion present on 60-80% of banks. Vegetative protection present on 20-40% of banks, and is insufficient to prevent erosion. AND/OR 60-80% of the stream is covered by sediment. Sediment is temporary/transient in nature, and contributing to instability. AND/OR V-shaped channels have vegetative protection is present on > 40% of the banks and stable sediment deposition is absent.	vertical/lateral instability. Severe incision, flow contained within the banks. Streambed below average rooting depth, majority of banks vertical/undercut. Vegetative protection present on less than 20% of banks, is not preventing erosion. Obvious bank sloughing present. Erosion/raw banks on 80-100%. AND/OR Aggrading channel. Greater than 80% of stream bed is covered by deposition, contributing to instability. Multiple thread channels and/or subterranean flow.	CI
Score	3	2.4	2	1.6	1	3.0

NOTES>>	No channel found, flooded under culvert

2. RIPARIAN BUFFERS: Assess both bank's 100 foot riparian areas along the entire SAR. (rough measurements of length & width may be acceptable)

Conditional Category

	Optimal	Suboptimal		Marginal		Poor	
Riparian Buffers	Tree stratum (dbh > 3 inches) present, with > 60% tree canopy cover and a non-maintained understory. Wetlands located within the riparian areas.	**High Suboptimal:** Riparian areas with tree stratum (dbh > 3 inches) present, with 30% to 60% tree canopy cover and containing both herbaceous and shrub layers or a non-maintained understory.	**Low Suboptimal:** Riparian areas with tree stratum (dbh > 3 inches) present, with > 30% tree canopy cover and a maintained understory. Recent cutover (dense vegetation).	**High Marginal:** Non-maintained, dense herbaceous vegetation with either a shrub layer or a tree layer (dbh > 3 inches) present, with <30% tree canopy cover.	**Low Marginal:** Non-maintained, dense herbaceous vegetation, riparian areas lacking shrub and tree stratum, hay production, ponds, open water. If present, tree stratum (dbh >3 inches) present, with <30% tree canopy cover with maintained understory.	**High Poor:** Lawns, mowed, and maintained areas, nurseries; no-till cropland; actively grazed pasture, sparsely vegetated non-maintained area, recently seeded and stabilized, or other comparable condition.	**Low Poor:** Impervious surfaces, mine spoil lands, denuded surfaces, row crops, active feed lots, trails, or other comparable conditions.
		High	Low	High	Low	High	Low
Condition Scores	1.5	1.2	1.1	0.85	0.75	0.6	0.5

NOTES>>
mature forest - 1.5
maintained - 0.6

1. Delineate riparian areas along each stream bank into Condition Categories and Condition Scores using the descriptors.
2. Determine square footage for each by measuring or estimating length and width. Calculators are provided for you below.
3. Enter the % Riparian Area and Score for each riparian category in the blocks below.

Ensure the sums of % Riparian Blocks equal 100

Right Bank	% Riparian Area>	95%	5%					100%
	Score >	1.5	0.6					
Left Bank	% Riparian Area>	95%	5%					100%
	Score >	1.5	0.6					

		CI
Rt Bank CI >	1.46	
Lt Bank CI >	1.46	1.46

3. INSTREAM HABITAT: Varied substrate sizes, water velocity and depths; woody and leafy debris; stable substrate; low embeddedness; shade; undercut banks; root mats; SAV; riffle pool complexes, stable features.

NOTES>> overhanging vegetation, pool/back water with leaf pack

Conditional Category

	Optimal	Suboptimal	Marginal	Poor	CI
Instream Habitat/ Available Cover	Habitat elements are typically present in greater than 50% of the reach.	Stable habitat elements are typically present in 30-50% of the reach and are adequate for maintenance of populations.	Stable habitat elements are typically present in 10-30% of the reach and are adequate for maintenance of populations.	Habitat elements listed above are lacking or are unstable. Habitat elements are typically present in less than 10% of the reach.	
Score	1.5	1.2	0.9	0.5	0.90

Stream Impact Assessment Form Page 2

Project #	Applicant	Locality	Cowardin Class.	HUC	Date	Data Point	SAR length	Impact Factor
4917	US Route 460							

4. CHANNEL ALTERATION: Stream crossings, riprap, concrete, gabions, or concrete blocks, straightening of channel, channelization, embankments, spoil piles, constrictions, livestock

Cultvert at road

	Conditional Category						
	Negligible	Minor		Moderate		Severe	
Channel Alteration	Channelization, dredging, alteration, or hardening absent. Stream has an unaltered pattern or has naturalized.	Less than 20% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	20-40% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	40 - 60% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	60 - 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	Greater than 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines AND/OR 80% of banks shored with gabion, riprap, or cement.	
SCORE	1.5	1.3	1.1	0.9	0.7	0.5	1.30

REACH CONDITION INDEX and STREAM CONDITION UNITS FOR THIS REACH

NOTE: **The CIs and RCI should be rounded to 2 decimal places. The CR should be rounded to a whole number.**

THE REACH CONDITION INDEX (RCI) >>	1.33
RCI= (Sum of all CI's)/5	
COMPENSATION REQUIREMENT (CR) >>	149
CR = RCI X LF X IF	

INSERT PHOTOS:

Stream Assessment Form (Form 1)

Unified Stream Methodology for use in Virginia

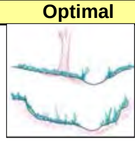
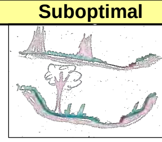
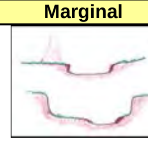
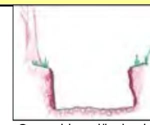
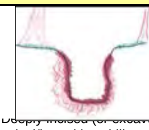
For use in wadeable channels classified as intermittent or perennial

Project #	Project Name	Locality	Cowardin Class.	HUC	Date	SAR #	Impact/SAR length	Impact Factor
00545	HRCS	Suffolk	R4	02080208	02/10/16	R10	169	0

Name(s) of Evaluator(s)	Stream Name and Information
BWR	Unnamed Tributary to Streeter Creek 2 - Map 35

1. Channel Condition:
Assess the cross-section of the stream and prevailing condition (erosion, aggradation)

Conditional Category

	Optimal	Suboptimal	Marginal	Poor	Severe	
						
Channel Condition	Very little incision or active erosion; 80-100% stable banks. Vegetative surface protection or natural rock, prominent (80-100%). AND/OR Stable point bars/bankfull benches are present. Access to their original floodplain or fully developed wide bankfull benches. Mid-channel bars, and transverse bars few. Transient sediment deposition covers less than 10% of bottom.	Slightly incised, few areas of active erosion or unprotected banks. Majority of banks are stable (60-80%). Vegetative protection or natural rock prominent (60-80%) AND/OR Depositional features contribute to stability. The bankfull and low flow channels are well defined. Stream likely has access to bankfull benches, or newly developed floodplains along portions of the reach. Transient sediment covers 10-40% of the stream bottom.	Often incised, but less than Severe or Poor. Banks more stable than Severe or Poor due to lower bank slopes. Erosion may be present on 40-60% of both banks. Vegetative protection on 40-60% of banks. Streambanks may be vertical or undercut. AND/OR 40-60% of stream is covered by sediment. Sediment may be temporary/transient, contribute instability. Deposition that contribute to stability, may be forming/present. AND/OR V-shaped channels have vegetative protection on > 40% of the banks and depositional features which	Over widened/incised. Vertically/laterally unstable. Likely to widen further. Majority of both banks are near vertical. Erosion present on 60-80% of banks. Vegetative protection present on 20-40% of banks, and is insufficient to prevent erosion. AND/OR 60-80% of the stream is covered by sediment. Sediment is temporary/transient in nature, and contributing to instability. AND/OR V-shaped channels have vegetative protection is present on > 40% of the banks and stable sediment deposition is absent.	Deeply incised (or excavated), vertical/lateral instability. Severe incision, flow contained within the banks. Streambed below average rooting depth, majority of banks vertical/undercut. Vegetative protection present on less than 20% of banks, is not preventing erosion. Obvious bank sloughing present. Erosion/raw banks on 80-100%. AND/OR Aggrading channel. Greater than 80% of stream bed is covered by deposition, contributing to instability. Multiple thread channels and/or subterranean flow.	**CI**
Score	3	2.4	2	1.6	1	3.0

NOTES>> Stable channel with vegetated bottom and thick algae and flock

2. RIPARIAN BUFFERS:
Assess both bank's 100 foot riparian areas along the entire SAR. (rough measurements of length & width may be acceptable)

Conditional Category

	Optimal	Suboptimal		Marginal		Poor	
Riparian Buffers	Tree stratum (dbh > 3 inches) present, with > 60% tree canopy cover and a non-maintained understory. Wetlands located within the riparian areas.	**High Suboptimal:** Riparian areas with tree stratum (dbh > 3 inches) present, with 30% to 60% tree canopy cover and containing both herbaceous and shrub layers or a non-maintained understory.	**Low Suboptimal:** Riparian areas with tree stratum (dbh > 3 inches) present, with > 30% tree canopy cover and a maintained understory. Recent cutover (dense vegetation).	**High Marginal:** Non-maintained, dense herbaceous vegetation with either a shrub layer or a tree layer (dbh > 3 inches) present, with <30% tree canopy cover.	**Low Marginal:** Non-maintained, dense herbaceous vegetation, riparian areas lacking shrub and tree stratum, hay production, ponds, open water. If present, tree stratum (dbh >3 inches) present, with <30% tree canopy cover with maintained understory.	**High Poor:** Lawns, mowed, and maintained areas, nurseries; no-till cropland; actively grazed pasture, sparsely vegetated non-maintained area, recently seeded and stabilized, or other comparable condition.	**Low Poor:** Impervious surfaces, mine spoil lands, denuded surfaces, row crops, active feed lots, trails, or other comparable conditions.
		High	Low	High	Low	High	Low
Condition Scores	1.5	1.2	1.1	0.85	0.75	0.6	0.5

NOTES>> Revegetated growth - 1.2
Non-maintained - 0.85

1. Delineate riparian areas along each stream bank into Condition Categories and Condition Scores using the descriptors.
2. Determine square footage for each by measuring or estimating length and width. Calculators are provided for you below.
3. Enter the % Riparian Area and Score for each riparian category in the blocks below.

Ensure the sums of % Riparian Blocks equal 100

Right Bank	% Riparian Area>	20%	80%						100%
	Score >	1.2	0.85						
Left Bank	% Riparian Area>	70%	30%						100%
	Score >	1.2	0.85						

Rt Bank CI >	0.92	**CI**
Lt Bank CI >	1.10	1.01

3. INSTREAM HABITAT:
Varied substrate sizes, water velocity and depths; woody and leafy debris; stable substrate; low embeddedness; shade; undercut banks; root mats; SAV; riffle pool complexes, stable features.

NOTES>> overhanging vegetation, pool/back water with leaf pack

Conditional Category

	Optimal	Suboptimal	Marginal	Poor	
Instream Habitat/ Available Cover	Habitat elements are typically present in greater than 50% of the reach.	Stable habitat elements are typically present in 30-50% of the reach and are adequate for maintenance of populations.	Stable habitat elements are typically present in 10-30% of the reach and are adequate for maintenance of populations.	Habitat elements listed above are lacking or are unstable. Habitat elements are typically present in less than 10% of the reach.	**CI**
Score	1.5	1.2	0.9	0.5	0.90

Stream Impact Assessment Form Page 2

Project #	Applicant	Locality	Cowardin Class.	HUC	Date	Data Point	SAR length	Impact Factor
4917	US Route 460							

4. CHANNEL ALTERATION: Stream crossings, riprap, concrete, gabions, or concrete blocks, straightening of channel, channelization, embankments, spoil piles, constrictions, livestock

ditched but naturalized

	Conditional Category					
	Negligible	Minor		Moderate		Severe
Channel Alteration	Channelization, dredging, alteration, or hardening absent. Stream has an unaltered pattern or has naturalized.	Less than 20% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	20-40% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	40 - 60% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	60 - 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	Greater than 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines AND/OR 80% of banks shored with gabion, riprap, or cement.
SCORE	1.5	1.3	1.1	0.9	0.7	0.5

1.50

REACH CONDITION INDEX and STREAM CONDITION UNITS FOR THIS REACH

NOTE: **The CIs and RCI should be rounded to 2 decimal places. The CR should be rounded to a whole number.**

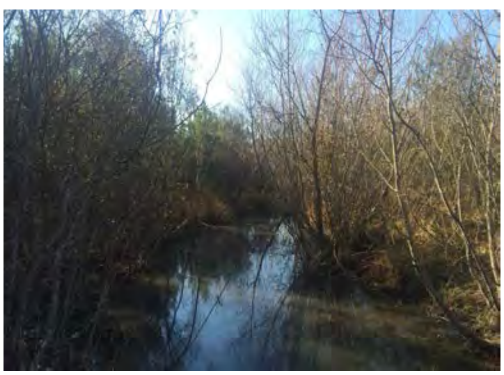
THE REACH CONDITION INDEX (RCI) >> **1.28**

RCI= (Sum of all CI's)/5

COMPENSATION REQUIREMENT (CR) >> **0**

CR = RCI X LF X IF

INSERT PHOTOS:



Stream Assessment Form (Form 1)

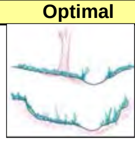
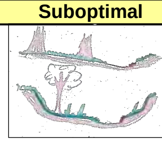
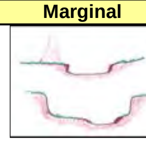
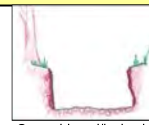
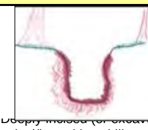
Unified Stream Methodology for use in Virginia

For use in wadeable channels classified as intermittent or perennial

Project #	Project Name	Locality	Cowardin Class.	HUC	Date	SAR #	Impact/SAR length	Impact Factor
00545	HRCS	Chesapeake	R3	02080208	03/14/16	R12	143	1

Name(s) of Evaluator(s)	Stream Name and Information
BWR	Drum Point Creek - Map 32

1. Channel Condition: Assess the cross-section of the stream and prevailing condition (erosion, aggradation)

	Conditional Category					
	Optimal	**Suboptimal**	**Marginal**	**Poor**	**Severe**	
Channel Condition	 Very little incision or active erosion; 80-100% stable banks. Vegetative surface protection or natural rock, prominent (80-100%). AND/OR Stable point bars/bankfull benches are present. Access to their original floodplain or fully developed wide bankfull benches. Mid-channel bars, and transverse bars few. Transient sediment deposition covers less than 10% of bottom.	 Slightly incised, few areas of active erosion or unprotected banks. Majority of banks are stable (60-80%). Vegetative protection or natural rock prominent (60-80%) AND/OR Depositional features contribute to stability. The bankfull and low flow channels are well defined. Stream likely has access to bankfull benches, or newly developed floodplains along portions of the reach. Transient sediment covers 10-40% of the stream bottom.	 Often incised, but less than Severe or Poor. Banks more stable than Severe or Poor due to lower bank slopes. Erosion may be present on 40-60% of both banks. Vegetative protection on 40-60% of banks. Streambanks may be vertical or undercut. AND/OR 40-60% of stream is covered by sediment. Sediment may be temporary/transient, contribute instability. Deposition that contribute to stability, may be forming/present. AND/OR V-shaped channels have vegetative protection on > 40% of the banks and depositional features which	 Over widened/incised. Vertically/laterally unstable. Likely to widen further. Majority of both banks are near vertical. Erosion present on 60-80% of banks. Vegetative protection present on 20-40% of banks, and is insufficient to prevent erosion. AND/OR 60-80% of the stream is covered by sediment. Sediment is temporary/transient in nature, and contributing to instability. AND/OR V-shaped channels have vegetative protection is present on > 40% of the banks and stable sediment deposition is absent.	 Deeply incised (or excavated), vertical/lateral instability. Severe incision, flow contained within the banks. Streambed below average rooting depth, majority of banks vertical/undercut. Vegetative protection present on less than 20% of banks, is not preventing erosion. Obvious bank sloughing present. Erosion/raw banks on 80-100%. AND/OR Aggrading channel. Greater than 80% of stream bed is covered by deposition, contributing to instability. Multiple thread channels and/or subterranean flow.	**CI**
Score	3	2.4	2	1.6	1	3.0

NOTES>> Very stable reach with minimal slope. No erosion found along vegtated banks. Some deposition at upstream culvert.

2. RIPARIAN BUFFERS: Assess both bank's 100 foot riparian areas along the entire SAR. (rough measurements of length & width may be acceptable)

	Conditional Category						
	Optimal	**Suboptimal**		**Marginal**		**Poor**	
Riparian Buffers	Tree stratum (dbh > 3 inches) present, with > 60% tree canopy cover and a non-maintained understory. Wetlands located within the riparian areas.	**High Suboptimal:** Riparian areas with tree stratum (dbh > 3 inches) present, with 30% to 60% tree canopy cover and containing both herbaceous and shrub layers or a non-maintained understory.	**Low Suboptimal:** Riparian areas with tree stratum (dbh > 3 inches) present, with > 30% tree canopy cover and a maintained understory. Recent cutover (dense vegetation).	**High Marginal:** Non-maintained, dense herbaceous vegetation with either a shrub layer or a tree layer (dbh > 3 inches) present, with <30% tree canopy cover.	**Low Marginal:** Non-maintained, dense herbaceous vegetation, riparian areas lacking shrub and tree stratum, hay production, ponds, open water. If present, tree stratum (dbh >3 inches) present, with <30% tree canopy cover with maintained understory.	**High Poor:** Lawns, mowed, and maintained areas, nurseries; no-till cropland; actively grazed pasture, sparsely vegetated non-maintained area, recently seeded and stabilized, or other comparable condition.	**Low Poor:** Impervious surfaces, mine spoil lands, denuded surfaces, row crops, active feed lots, trails, or other comparable conditions.
		High	Low	High	Low	High	Low
Condition Scores	1.5	1.2	1.1	0.85	0.75	0.6	0.5

NOTES>> Mature buffer along edge of upstream portion of the reach, continued below culvert but narrowing. Wetted width very wide with mature trees and large woody debris throughout reach.

1. Delineate riparian areas along each stream bank into Condition Categories and Condition Scores using the descriptors.
2. Determine square footage for each by measuring or estimating length and width. Calculators are provided for you below.
3. Enter the % Riparian Area and Score for each riparian category in the blocks below.

Ensure the sums of % Riparian Blocks equal 100

Right Bank	% Riparian Area>	90%	10%						100%
	Score >	1.5	0.6						
Left Bank	% Riparian Area>	80%	20%						100%
	Score >	1.5	0.6						

		CI
Rt Bank CI >	1.41	
Lt Bank CI >	1.32	1.37

3. INSTREAM HABITAT: Varied substrate sizes, water velocity and depths; woody and leafy debris; stable substrate; low embeddedness; shade; undercut banks; root mats; SAV; riffle pool complexes, stable features.

	Conditional Category				
	Optimal	**Suboptimal**	**Marginal**	**Poor**	
Instream Habitat/ Available Cover	Habitat elements are typically present in greater than 50% of the reach.	Stable habitat elements are typically present in 30-50% of the reach and are adequate for maintenance of populations.	Stable habitat elements are typically present in 10-30% of the reach and are adequate for maintenance of populations.	Habitat elements listed above are lacking or are unstable. Habitat elements are typically present in less than 10% of the reach.	**CI**
Score	1.5	1.2	0.9	0.5	1.50

NOTES>> Large woody debri, leaf pack, with low flow habitat.

Stream Impact Assessment Form Page 2

Project #	Applicant	Locality	Cowardin Class.	HUC	Date	Data Point	SAR length	Impact Factor
4917	US Route 460							

4. CHANNEL ALTERATION: Stream crossings, riprap, concrete, gabions, or concrete blocks, straightening of channel, channelization, embankments, spoil piles, constrictions, livestock

Culvert breaking up reach

	Conditional Category					
	Negligible	Minor		Moderate		Severe
Channel Alteration	Channelization, dredging, alteration, or hardening absent. Stream has an unaltered pattern or has naturalized.	Less than 20% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	20-40% of the stream reach is disrupted by any of the channel alterations listed in the parameter guidelines.	40 - 60% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	60 - 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines. If stream has been channelized, normal stable stream meander pattern has not recovered.	Greater than 80% of reach is disrupted by any of the channel alterations listed in the parameter guidelines AND/OR 80% of banks shored with gabion, riprap, or cement.
SCORE	1.5	1.3	1.1	0.9	0.7	0.5

1.10

REACH CONDITION INDEX and STREAM CONDITION UNITS FOR THIS REACH

NOTE: **The CIs and RCI should be rounded to 2 decimal places. The CR should be rounded to a whole number.**

THE REACH CONDITION INDEX (RCI) >>	**1.39**
RCI= (Sum of all CI's)/5	
COMPENSATION REQUIREMENT (CR) >>	**199**
CR = RCI X LF X IF	

INSERT PHOTOS:

Stream Assessment Summary Form (Form 2) - Alternative A

Unified Stream Methodology
for use in Virginia

Project	Applicant	Date
Hampton Roads Crossing Study	VDOT	3/14/2016
Evaluators	HUC	Locality
BWR	2080208	multiple

Stream Name	**Reach ID**	**Length of Impact (L_I)** (feet)	**Reach Condition Index (RCI)**	**Impact Factor (IF)**	**Compensation Requirement (CR) (L_I × RCI × IF)**
No R3 or R4 streams in Alternative A					0
	Total L_I	**0**		**Total CR**	**0**

Stream Assessment Summary Form (Form 2) - Alternative B

Unified Stream Methodology
for use in Virginia

Project	Applicant	Date
Hampton Roads Crossing Study	VDOT	3/14/2016
Evaluators	HUC	Locality
BWR	2080208	multiple

Stream Name	Reach ID	Length of Impact (L_I) (feet)	Reach Condition Index (RCI)	Impact Factor (IF)	Compensation Requirement (CR) (L_I × RCI × IF)
Unnamed Tributary to Knotts Creek - Map 34	R8	0	1.19	0.00	0
	Total L_I	**0**		**Total CR**	**0**

Stream Assessment Summary Form (Form 2) - Alternative C

Unified Stream Methodology
for use in Virginia

Project	Applicant	Date
Hampton Roads Crossing Study	VDOT	3/14/2016
Evaluators	**HUC**	**Locality**
BWR	2080208	multiple

Stream Name	Reach ID	Length of Impact (L_I) (feet)	Reach Condition Index (RCI)	Impact Factor (IF)	Compensation Requirement (CR) ($L_I \times RCI \times IF$)
Unnamed Tributary to Goose Creek 1 - Maps 26 & 28	R3	0	1.20	0.00	0
Unnamed Tributary to Goose Creek 1 - Map 28	R4	0	0.72	0.00	0
Unnamed Tributary to Goose Creek 1 - Map 28	R5	0	1.44	0.00	0
Unnamed Tributary to Goose Creek 2 - Map 28	R6	293	1.22	1.00	357
Unamed Tributary to Drum Point Creek - Map 32	R7	0	1.45	0.00	0
Unnamed Tributary to Knotts Creek - Map 34	R8	0	1.19	0.00	0
Unnamed Tributary to Streeter Creek 1 - Map 35	R9	112	1.33	1.00	149
Unnamed Tributary to Streeter Creek 2 - Map 35	R10	0	1.28	0.00	0
Drum Point Creek - Map 32	R12	143	1.39	1.00	199
	Total L_I	**548**		**Total CR**	**705**

Stream Assessment Summary Form (Form 2) - Alternative D

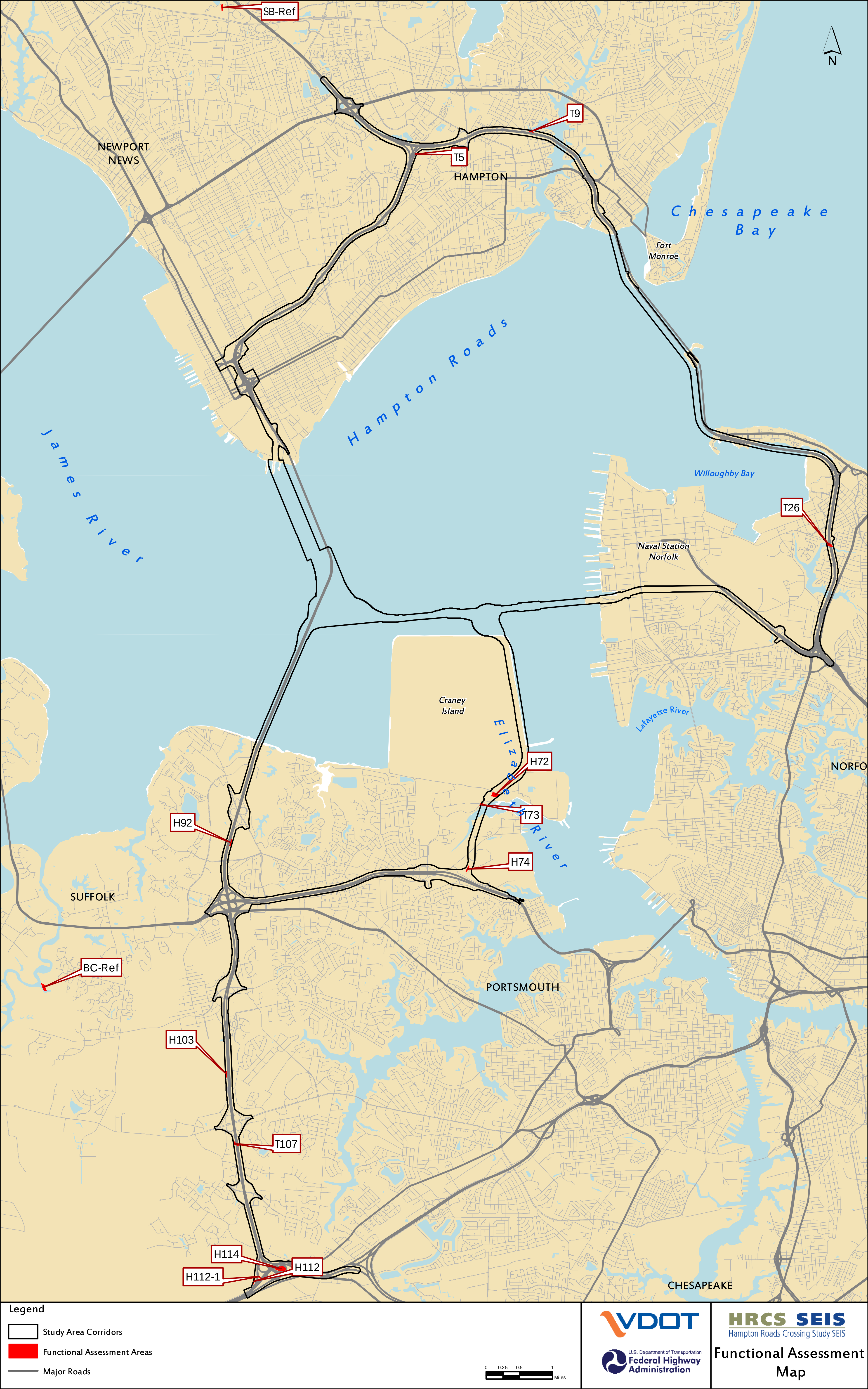
Unified Stream Methodology
for use in Virginia

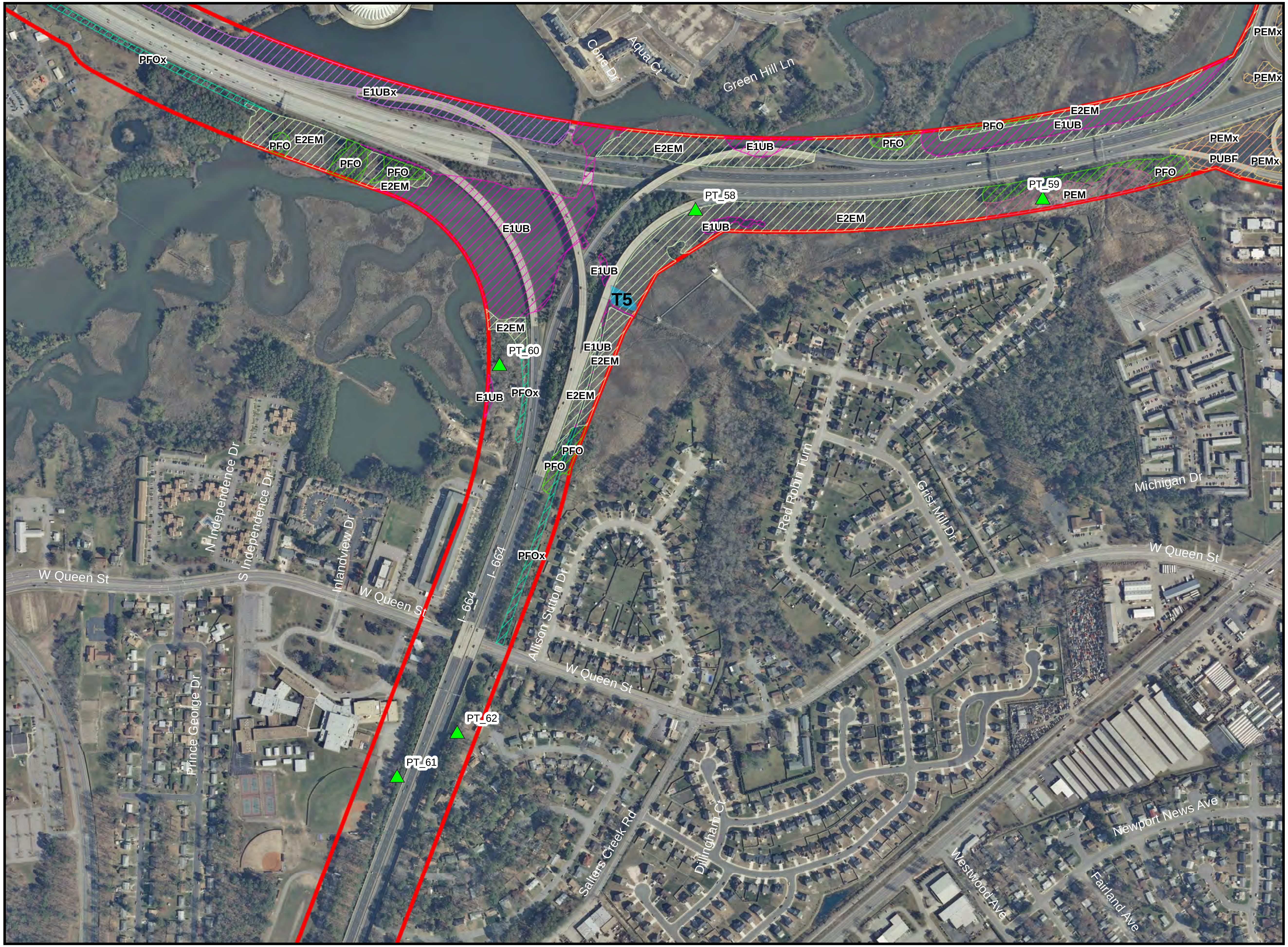
Project	Applicant	Date
Hampton Roads Crossing Study	VDOT	3/14/2016
Evaluators	HUC	Locality
BWR	2080208	multiple

Stream Name	Reach ID	Length of Impact (L_I) (feet)	Reach Condition Index (RCI)	Impact Factor (IF)	Compensation Requirement (CR) ($L_I \times RCI \times IF$)
Unnamed Tributary to Goose Creek 1 - Maps 26 & 28	R3	0	1.20	0.00	0
Unnamed Tributary to Goose Creek 1 - Map 28	R4	0	0.72	0.00	0
Unnamed Tributary to Goose Creek 1 - Map 28	R5	0	1.44	0.00	0
Unnamed Tributary to Goose Creek 2 - Map 28	R6	293	1.22	1.00	357
Unamed Tributary to Drum Point Creek - Map 32	R7	0	1.45	0.00	0
Unnamed Tributary to Knotts Creek - Map 34	R8	0	1.19	0.00	0
Unnamed Tributary to Streeter Creek 1 - Map 35	R9	112	1.33	1.00	149
Unnamed Tributary to Streeter Creek 2 - Map 35	R10	0	1.28	0.00	0
Drum Point Creek - Map 32	R12	143	1.39	1.00	199
	Total L_I	**548**		**Total CR**	**705**

APPENDIX D:

WETLAND FUNCTIONAL ASSESSMENT INFORMATION


SB-Ref
N
T9
T5
NEWPORT NEWS
HAMPTON
Chesapeake Bay
Fort Monroe
Hampton Roads
James River
Willoughby Bay
T26
Naval Station Norfolk
Craney Island
Elizabeth River
Lafayette River
H72
T73
H74
H92
NORFO
SUFFOLK
BC-Ref
PORTSMOUTH
H103
T107
H114
H112
H112-1
CHESAPEAKE
Legend
Study Area Corridors
Functional Assessment Areas
Major Roads
0 0.25 0.5 1 Miles
VDOT
U.S. Department of Transportation Federal Highway Administration
HRCS SEIS
Hampton Roads Crossing Study SEIS
Functional Assessment Map



VDOT

0 125 250 500 Feet

1 in = 500 ft

DATA SOURCES: USGS, VDOT, VGIN (2013 RGB AERIAL)

Hampton Roads Crossing Study
Virginia DOT
Hampton, Virginia

Legend

- Groundtruthing- 1/11/16-1/15/16
- Study Area Corridors
- Functional Assessment Areas

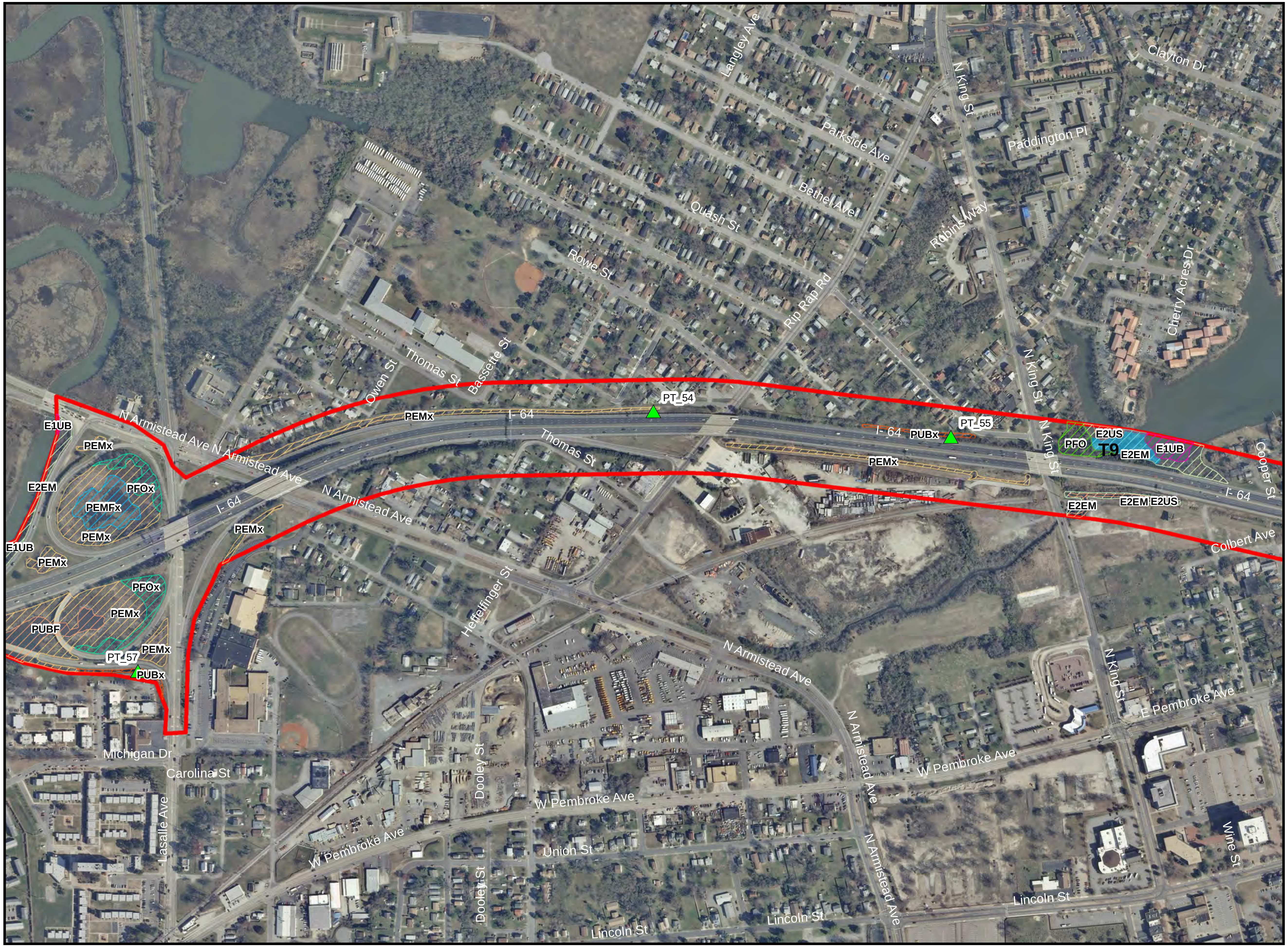
Photointerpreted Wetlands Cowardin Classification

- E1UB- Estuarine, Subtidal, Unconsolidated Bottom (open water)
- E1UBx- Excavated
- E2EM- Estuarine, Intertidal, Emergent
- E2EMx- Excavated
- E2US- Estuarine, Intertidal, Unconsolidated Shore
- E2USx- Excavated
- PEM- Palustrine, Emergent
- PEMF- Palustrine, Emergent, Semi-permanently or Permanently Flooded
- PEMFx- Excavated
- PEMx- Excavated
- PFO- Palustrine, Forested
- PFOF- Palustrine, Forested, Semi-permanently or Permanently Flooded
- PFOFx- Excavated
- PFOx- Excavated
- PSS- Palustrine, Scrub-shrub
- PSSx- Excavated
- PUB- Palustrine, Unconsolidated Bottom (open water)
- PUBF- Palustrine, Unconsolidated Bottom (open water), Semi or Permanently Flooded
- PUBFx- Excavated
- PUBx- Excavated
- R3- Riverine, Perennial
- R4- Riverine, Intermittent

Date: 7/25/2016

TITLE
MAP-2

SHEET NO. 2 OF 46



VDOT

0 125 250 500 Feet

1 in = 500 ft

DATA SOURCES: USGS, VDOT, VGIN (2013 RGB AERIAL)

Hampton Roads Crossing Study
Virginia DOT
Hampton, Virginia

Legend

- Groundtruthing- 1/11/16-1/15/16
- Study Area Corridors
- Functional Assessment Areas

Photointerpreted Wetlands Cowardin Classification

- E1UB- Estuarine, Subtidal, Unconsolidated Bottom (open water)
- E1UBx- Excavated
- E2EM- Estuarine, Intertidal, Emergent
- E2EMx- Excavated
- E2US- Estuarine, Intertidal, Unconsolidated Shore
- E2USx- Excavated
- PEM- Palustrine, Emergent
- PEMF- Palustrine, Emergent, Semi-permanently or Permanently Flooded
- PEMFx- Excavated
- PEMx- Excavated
- PFO- Palustrine, Forested
- PFOF- Palustrine, Forested, Semi-permanently or Permanently Flooded
- PFOFx- Excavated
- PFOx- Excavated
- PSS- Palustrine, Scrub-shrub
- PSSx- Excavated
- PUB- Palustrine, Unconsolidated Bottom (open water)
- PUBF- Palustrine, Unconsolidated Bottom (open water), Semi or Permanently Flooded
- PUBFx- Excavated
- PUBx- Excavated
- R3- Riverine, Perennial
- R4- Riverine, Intermittent

Date: 7/25/2016

TITLE
MAP-3

SHEET NO. 3 OF 46

VDOT

0 125 250 500 Feet

1 in = 500 ft

DATA SOURCES: USGS, VDOT, VGIN (2013 RGB AERIAL)

Hampton Roads Crossing Study
Virginia DOT
Norfolk, Virginia

Legend

- Groundtruthing- 1/11/16-1/15/16
- Study Area Corridors
- Functional Assessment Areas

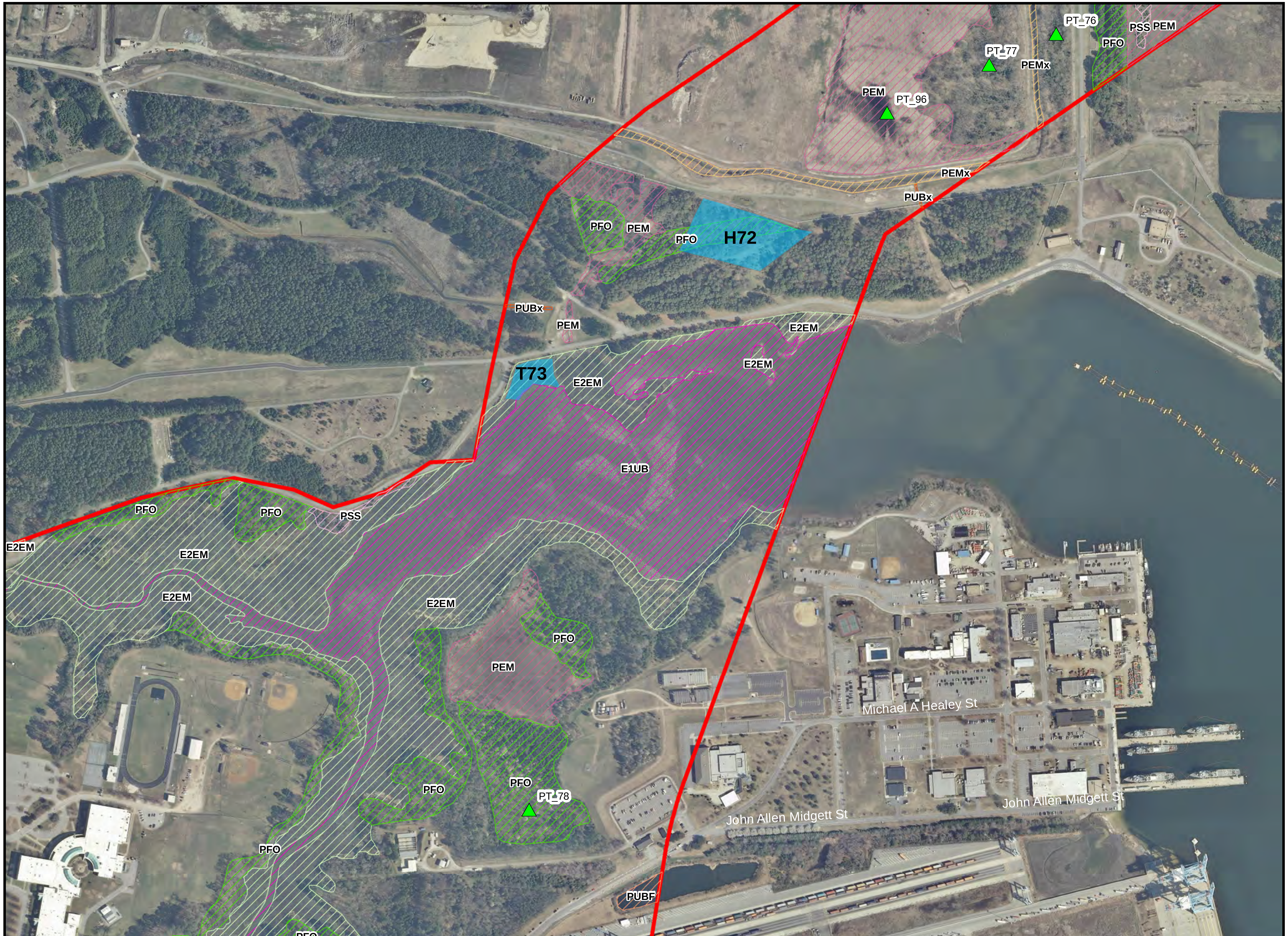
Photointerpreted Wetlands Cowardin Classification

- E1UB- Estuarine, Subtidal, Unconsolidated Bottom (open water)
- E1UBx- Excavated
- E2EM- Estuarine, Intertidal, Emergent
- E2EMx- Excavated
- E2US- Estuarine, Intertidal, Unconsolidated Shore
- E2USx- Excavated
- PEM- Palustrine, Emergent
- PEMF- Palustrine, Emergent, Semi-permanently or Permanently Flooded
- PEMFx- Excavated
- PEMx- Excavated
- PFO- Palustrine, Forested
- PFOF- Palustrine, Forested, Semi-permanently or Permanently Flooded
- PFOFx- Excavated
- PFOx- Excavated
- PSS- Palustrine, Scrub-shrub
- PSSx- Excavated
- PUB- Palustrine, Unconsolidated Bottom (open water)
- PUBF- Palustrine, Unconsolidated Bottom (open water), Semi or Permanently Flooded
- PUBFx- Excavated
- PUBx- Excavated
- R3- Riverine, Perennial
- R4- Riverine, Intermittent

Date: 7/25/2016

TITLE
MAP-11

SHEET NO. 11 OF 46



VDOT

0 125 250 500 Feet

1 in = 500 ft

DATA SOURCES: USGS, VDOT, VGIN (2013 RGB AERIAL)

Hampton Roads Crossing Study
Virginia DOT
Portsmouth, Virginia

Legend

- Groundtruthing- 1/11/16-1/15/16
- Study Area Corridors
- Functional Assessment Areas

Photointerpreted Wetlands Cowardin Classification

- E1UB- Estuarine, Subtidal, Unconsolidated Bottom (open water)
- E1UBx- Excavated
- E2EM- Estuarine, Intertidal, Emergent
- E2EMx- Excavated
- E2US- Estuarine, Intertidal, Unconsolidated Shore
- E2USx- Excavated
- PEM- Palustrine, Emergent
- PEMF- Palustrine, Emergent, Semi-permanently or Permanently Flooded
- PEMFx- Excavated
- PEMx- Excavated
- PFO- Palustrine, Forested
- PFOF- Palustrine, Forested, Semi-permanently or Permanently Flooded
- PFOFx- Excavated
- PFOx- Excavated
- PSS- Palustrine, Scrub-shrub
- PSSx- Excavated
- PUB- Palustrine, Unconsolidated Bottom (open water)
- PUBF- Palustrine, Unconsolidated Bottom (open water), Semi or Permanently Flooded
- PUBFx- Excavated
- PUBx- Excavated
- R3- Riverine, Perennial
- R4- Riverine, Intermittent

Date: 7/25/2016

TITLE
MAP-20

SHEET NO. 20 OF 46

VDOT

0 125 250 500 Feet

1 in = 500 ft

DATA SOURCES: USGS, VDOT, VGIN (2013 RGB AERIAL)

Hampton Roads Crossing Study
Virginia DOT
Portsmouth, Virginia

Legend

- Groundtruthing- 1/11/16-1/15/16
- Study Area Corridors
- Functional Assessment Areas

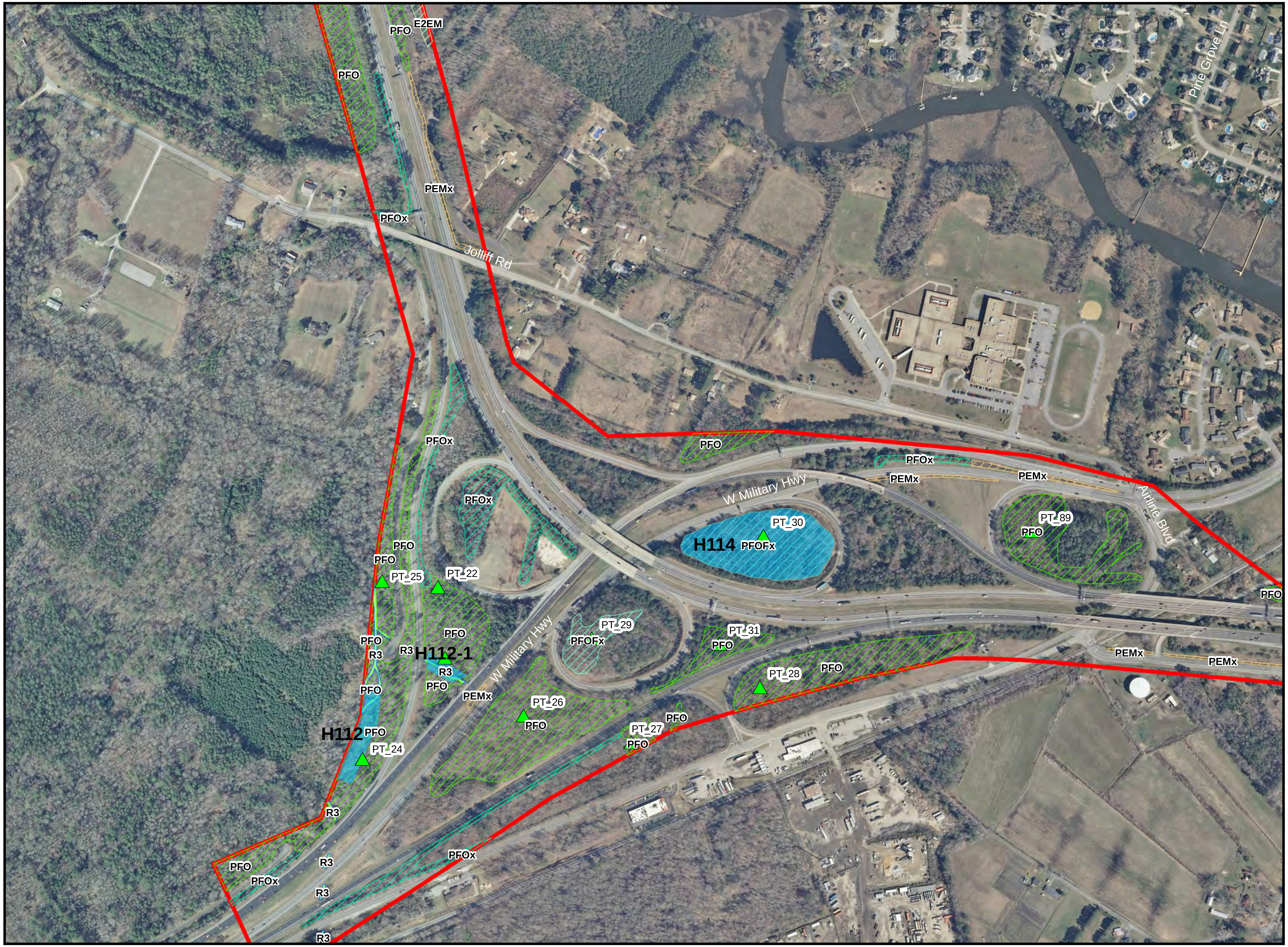
Photointerpreted Wetlands Cowardin Classification

- E1UB- Estuarine, Subtidal, Unconsolidated Bottom (open water)
- E1UBx- Excavated
- E2EM- Estuarine, Intertidal, Emergent
- E2EMx- Excavated
- E2US- Estuarine, Intertidal, Unconsolidated Shore
- E2USx- Excavated
- PEM- Palustrine, Emergent
- PEMF- Palustrine, Emergent, Semi-permanently or Permanently Flooded
- PEMFx- Excavated
- PEMx- Excavated
- PFO- Palustrine, Forested
- PFOF- Palustrine, Forested, Semi-permanently or Permanently Flooded
- PFOFx- Excavated
- PFOx- Excavated
- PSS- Palustrine, Scrub-shrub
- PSSx- Excavated
- PUB- Palustrine, Unconsolidated Bottom (open water)
- PUBF- Palustrine, Unconsolidated Bottom (open water), Semi or Permanently Flooded
- PUBFx- Excavated
- PUBx- Excavated
- R3- Riverine, Perennial
- R4- Riverine, Intermittent

Date: 7/25/2016

TITLE
MAP-21

SHEET NO. 21 OF 46



VDOT

0 125 250 500 Feet

1 in = 500 ft

DATA SOURCES: USGS, VDOT, VGIN (2013 RGB AERIAL)

Hampton Roads Crossing Study
Virginia DOT
Chesapeake, Virginia

Legend

- Groundtruthing- 1/11/16-1/15/16
- Study Area Corridors
- Functional Assessment Areas

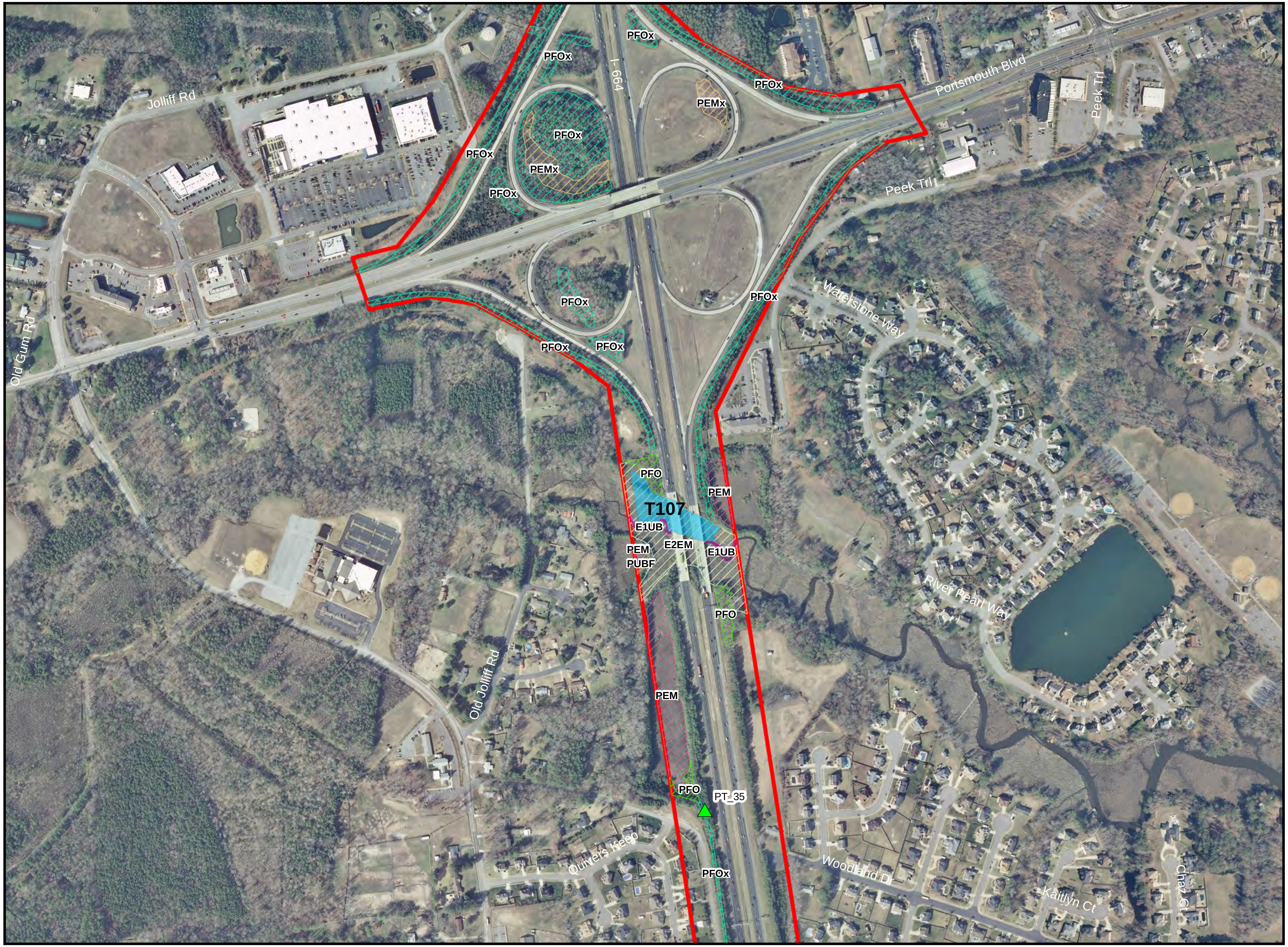
Photointerpreted Wetlands Cowardin Classification

- E1UB- Estuarine, Subtidal, Unconsolidated Bottom (open water)
- E1UBx- Excavated
- E2EM- Estuarine, Intertidal, Emergent
- E2EMx- Excavated
- E2US- Estuarine, Intertidal, Unconsolidated Shore
- E2USx- Excavated
- PEM- Palustrine, Emergent
- PEMF- Palustrine, Emergent, Semi-permanently or Permanently Flooded
- PEMFx- Excavated
- PEMx- Excavated
- PFO- Palustrine, Forested
- PFOF- Palustrine, Forested, Semi-permanently or Permanently Flooded
- PFOFx- Excavated
- PFOx- Excavated
- PSS- Palustrine, Scrub-shrub
- PSSx- Excavated
- PUB- Palustrine, Unconsolidated Bottom (open water)
- PUBF- Palustrine, Unconsolidated Bottom (open water), Semi or Permanently Flooded
- PUBFx- Excavated
- PUBx- Excavated
- R3- Riverine, Perennial
- R4- Riverine, Intermittent

Date: 7/25/2016

TITLE
MAP-28

SHEET NO. 28 OF 46



VDOT

0 125 250 500 Feet

1 in = 500 ft

DATA SOURCES: USGS, VDOT, VGIN (2013 RGB AERIAL)

Hampton Roads Crossing Study
Virginia DOT
Chesapeake, Virginia

Legend

- Groundtruthing- 1/11/16-1/15/16
- Study Area Corridors
- Functional Assessment Areas

Photointerpreted Wetlands Cowardin Classification

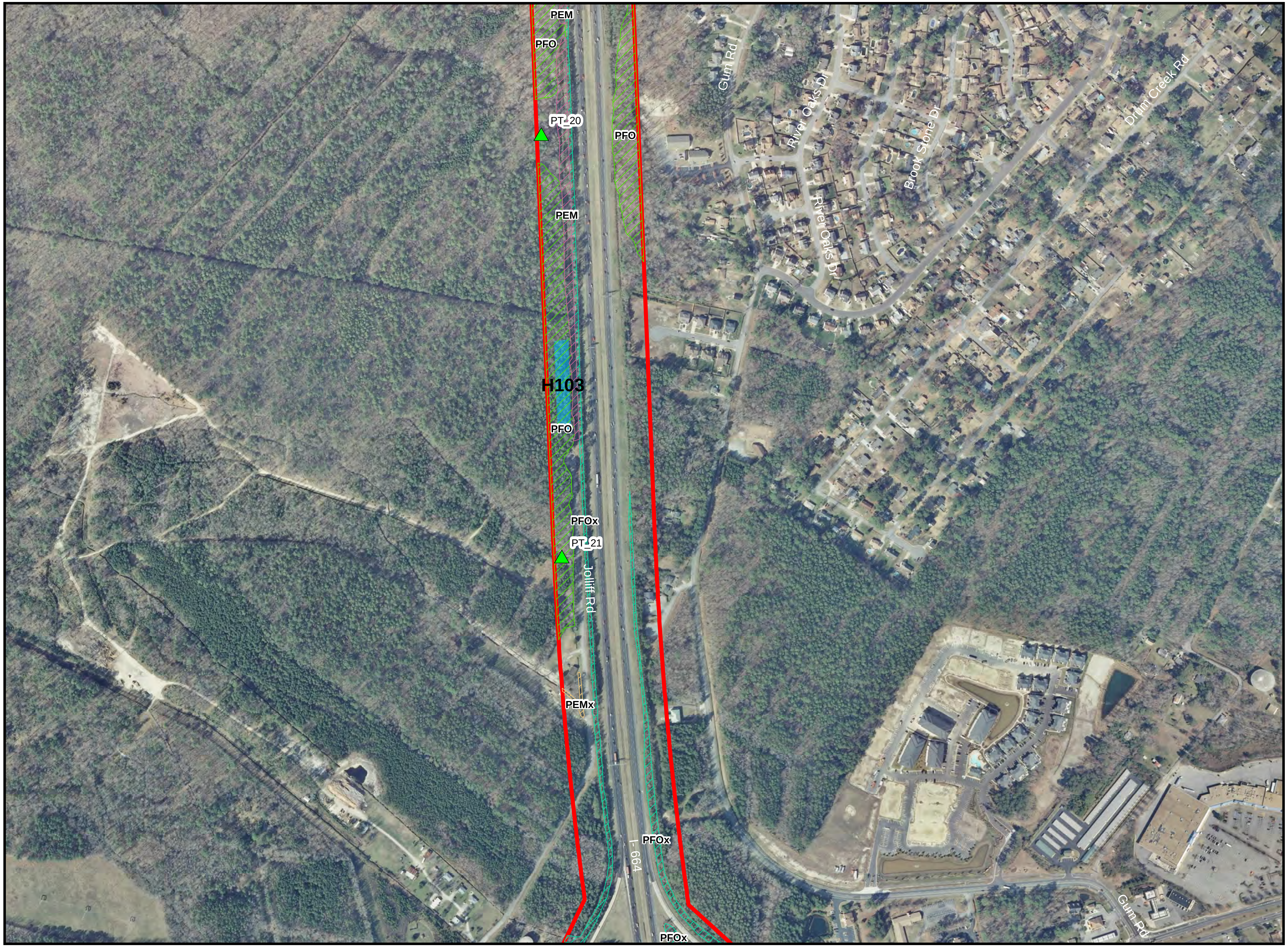
- E1UB- Estuarine, Subtidal, Unconsolidated Bottom (open water)
- E1UBx- Excavated
- E2EM- Estuarine, Intertidal, Emergent
- E2EMx- Excavated
- E2US- Estuarine, Intertidal, Unconsolidated Shore
- E2USx- Excavated
- PEM- Palustrine, Emergent
- PEMF- Palustrine, Emergent, Semi-permanently or Permanently Flooded
- PEMFx- Excavated
- PEMx- Excavated
- PFO- Palustrine, Forested
- PFOF- Palustrine, Forested, Semi-permanently or Permanently Flooded
- PFOFx- Excavated
- PFOx- Excavated
- PSS- Palustrine, Scrub-shrub
- PSSx- Excavated
- PUB- Palustrine, Unconsolidated Bottom (open water)
- PUBF- Palustrine, Unconsolidated Bottom (open water), Semi or Permanently Flooded
- PUBFx- Excavated
- PUBx- Excavated
- R3- Riverine, Perennial
- R4- Riverine, Intermittent

Date: 7/25/2016

TITLE

MAP-30

SHEET NO. 30 OF 46



VDOT

0 125 250 500 Feet

1 in = 500 ft

DATA SOURCES: USGS, VDOT, VGIN (2013 RGB AERIAL)

Hampton Roads Crossing Study
Virginia DOT
Chesapeake, Virginia

Legend

- Groundtruthing- 1/11/16-1/15/16
- Study Area Corridors
- Functional Assessment Areas

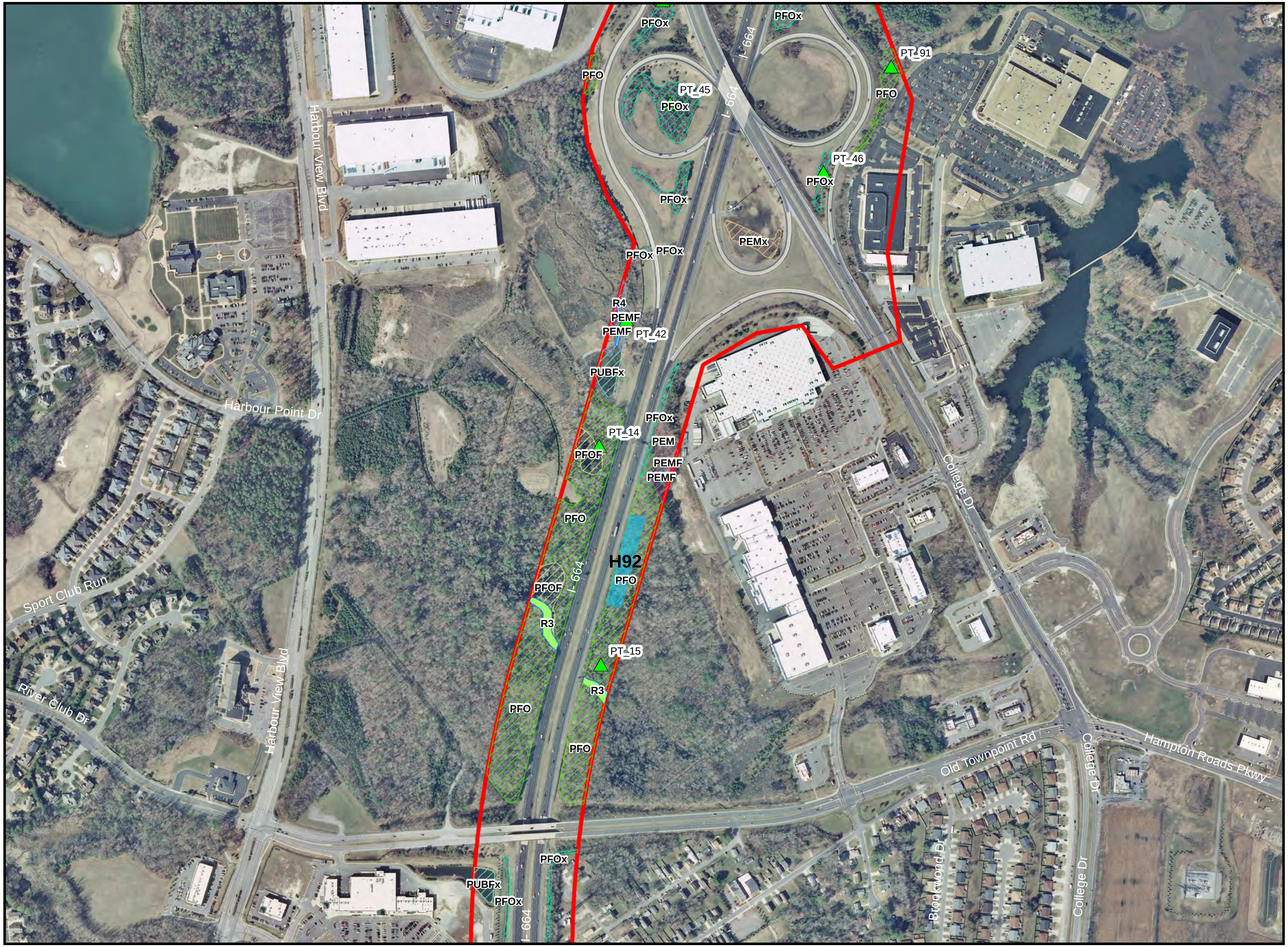
Photointerpreted Wetlands Cowardin Classification

- E1UB- Estuarine, Subtidal, Unconsolidated Bottom (open water)
- E1UBx- Excavated
- E2EM- Estuarine, Intertidal, Emergent
- E2EMx- Excavated
- E2US- Estuarine, Intertidal, Unconsolidated Shore
- E2USx- Excavated
- PEM- Palustrine, Emergent
- PEMF- Palustrine, Emergent, Semi-permanently or Permanently Flooded
- PEMFx- Excavated
- PEMx- Excavated
- PFO- Palustrine, Forested
- PFOF- Palustrine, Forested, Semi-permanently or Permanently Flooded
- PFOFx- Excavated
- PFOx- Excavated
- PSS- Palustrine, Scrub-shrub
- PSSx- Excavated
- PUB- Palustrine, Unconsolidated Bottom (open water)
- PUBF- Palustrine, Unconsolidated Bottom (open water), Semi or Permanently Flooded
- PUBFx- Excavated
- PUBx- Excavated
- R3- Riverine, Perennial
- R4- Riverine, Intermittent

Date: 7/25/2016

TITLE
MAP-31

SHEET NO. 31 OF 46



0 125 250 500 Feet

1 in = 500 ft

DATA SOURCES: USGS, VDOT, VGIN (2013 RGB AERIAL)

Hampton Roads Crossing Study
Virginia DOT
Suffolk, Virginia

Legend

- Groundtruthing- 1/11/16-1/15/16
- Study Area Corridors
- Functional Assessment Areas

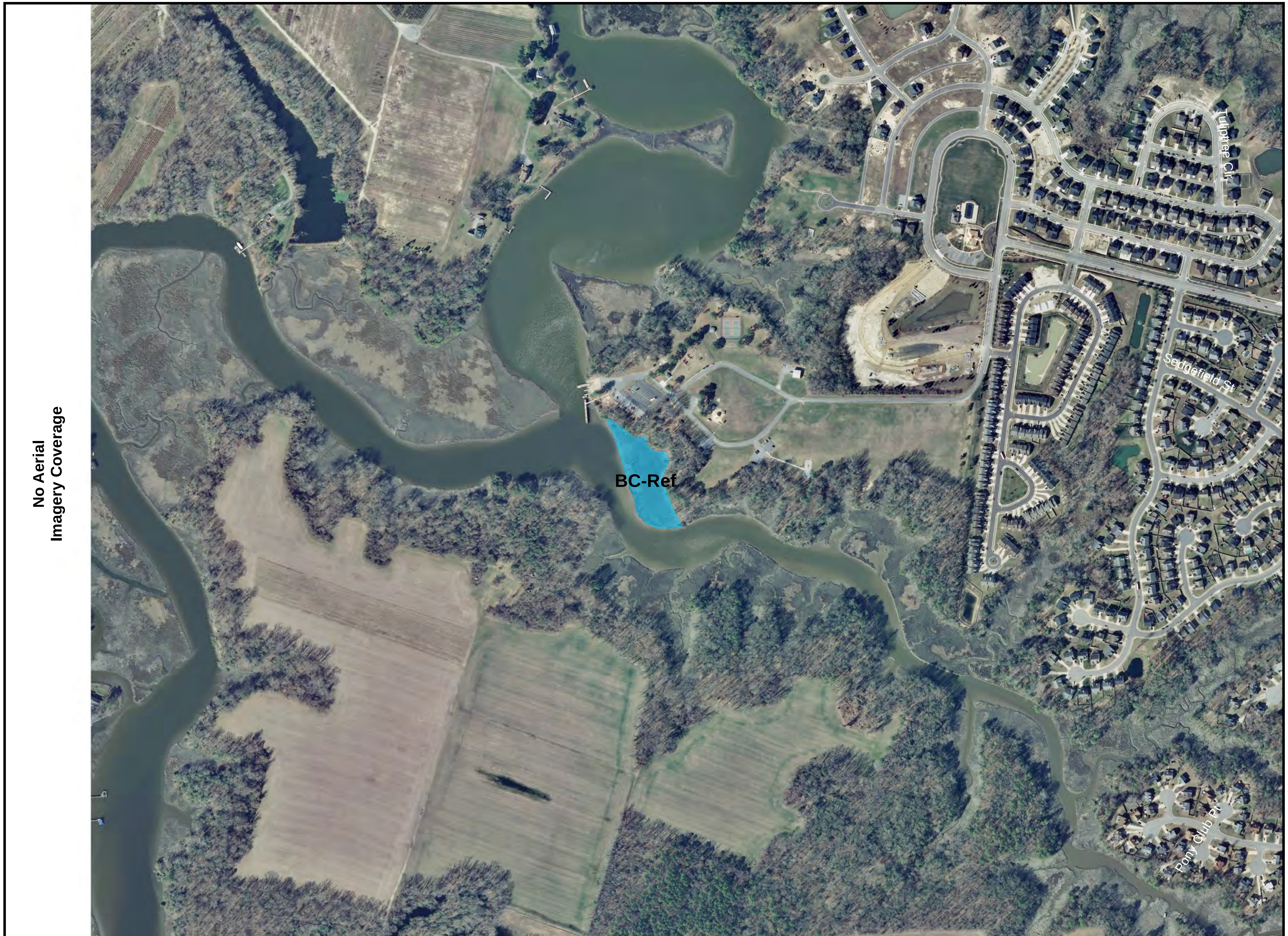
Photointerpreted Wetlands Cowardin Classification

- E1UB- Estuarine, Subtidal, Unconsolidated Bottom (open water)
- E1UBx- Excavated
- E2EM- Estuarine, Intertidal, Emergent
- E2EMx- Excavated
- E2US- Estuarine, Intertidal, Unconsolidated Shore
- E2USx- Excavated
- PEM- Palustrine, Emergent
- PEMF- Palustrine, Emergent, Semi-permanently or Permanently Flooded
- PEMFx- Excavated
- PEMx- Excavated
- PFO- Palustrine, Forested
- PFOF- Palustrine, Forested, Semi-permanently or Permanently Flooded
- PFOFx- Excavated
- PFOx- Excavated
- PSS- Palustrine, Scrub-shrub
- PSSx- Excavated
- PUB- Palustrine, Unconsolidated Bottom (open water)
- PUBF- Palustrine, Unconsolidated Bottom (open water), Semi or Permanently Flooded
- PUBFx- Excavated
- PUBx- Excavated
- R3- Riverine, Perennial
- R4- Riverine, Intermittent

Date: 7/25/2016

TITLE
MAP-35

SHEET NO. 35 OF 46



VDOT

0 125 250 500 Feet

1 in = 500 ft

DATA SOURCES: USGS, VDOT, VGIN (2013 RGB AERIAL)

Hampton Roads Crossing Study
Virginia DOT
Suffolk, Virginia

Legend

- Groundtruthing- 1/11/16-1/15/16
- Study Area Corridors
- Functional Assessment Areas

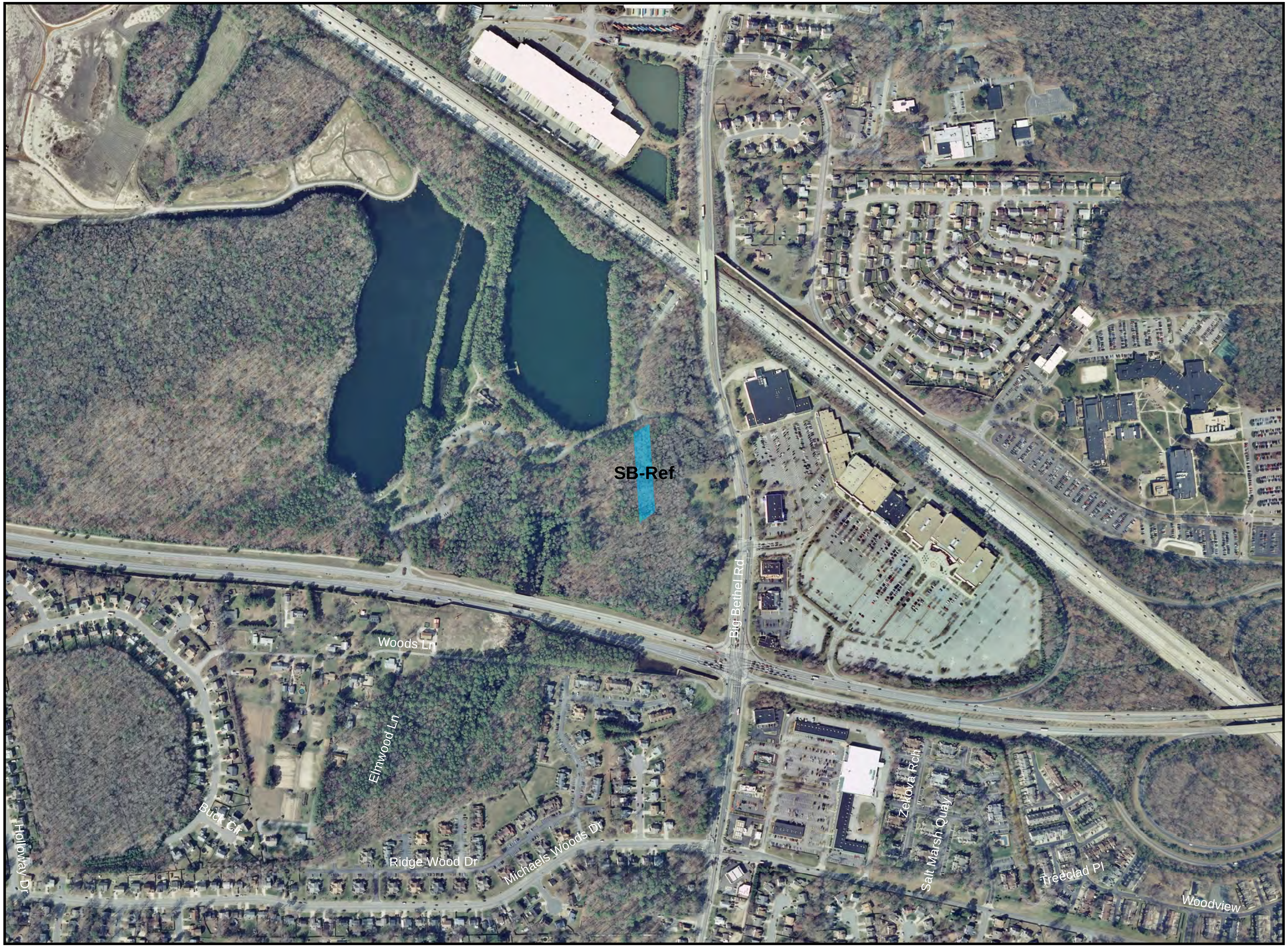
Photointerpreted Wetlands Cowardin Classification

- E1UB- Estuarine, Subtidal, Unconsolidated Bottom (open water)
- E1UBx- Excavated
- E2EM- Estuarine, Intertidal, Emergent
- E2EMx- Excavated
- E2US- Estuarine, Intertidal, Unconsolidated Shore
- E2USx- Excavated
- PEM- Palustrine, Emergent
- PEMF- Palustrine, Emergent, Semi-permanently or Permanently Flooded
- PEMFx- Excavated
- PEMx- Excavated
- PFO- Palustrine, Forested
- PFOF- Palustrine, Forested, Semi-permanently or Permanently Flooded
- PFOFx- Excavated
- PFOx- Excavated
- PSS- Palustrine, Scrub-shrub
- PSSx- Excavated
- PUB- Palustrine, Unconsolidated Bottom (open water)
- PUBF- Palustrine, Unconsolidated Bottom (open water), Semi or Permanently Flooded
- PUBFx- Excavated
- PUBx- Excavated
- R3- Riverine, Perennial
- R4- Riverine, Intermittent

Date: 7/25/2016

TITLE
Bennett Creek FA

SHEET NO. 2 OF 46



VDOT

0 125 250 500 Feet

1 in = 500 ft

DATA SOURCES: USGS, VDOT, VGIN (2013 RGB AERIAL)

Hampton Roads Crossing Study
Virginia DOT
Newport News, Virginia

Legend

- Groundtruthing- 1/11/16-1/15/16
- Study Area Corridors
- Functional Assessment Areas

Photointerpreted Wetlands Cowardin Classification

- E1UB- Estuarine, Subtidal, Unconsolidated Bottom (open water)
- E1UBx- Excavated
- E2EM- Estuarine, Intertidal, Emergent
- E2EMx- Excavated
- E2US- Estuarine, Intertidal, Unconsolidated Shore
- E2USx- Excavated
- PEM- Palustrine, Emergent
- PEMF- Palustrine, Emergent, Semi-permanently or Permanently Flooded
- PEMFx- Excavated
- PEMx- Excavated
- PFO- Palustrine, Forested
- PFOF- Palustrine, Forested, Semi-permanently or Permanently Flooded
- PFOFx- Excavated
- PFOx- Excavated
- PSS- Palustrine, Scrub-shrub
- PSSx- Excavated
- PUB- Palustrine, Unconsolidated Bottom (open water)
- PUBF- Palustrine, Unconsolidated Bottom (open water), Semi or Permanently Flooded
- PUBFx- Excavated
- PUBx- Excavated
- R3- Riverine, Perennial
- R4- Riverine, Intermittent

Date: 7/25/2016

TITLE
HGM Assessment FA

SHEET NO. 2 OF 46

Hydrogeomorphic Assessment of Wet Hardwood Flats on Mineral Soils

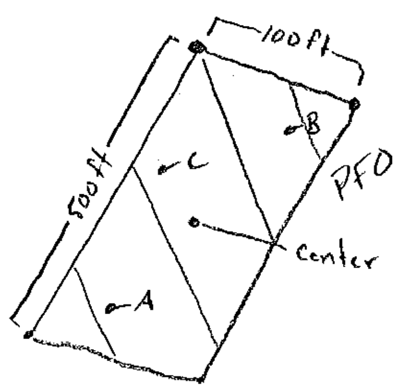
Site # SB-Ref Site Name HRCS Functional Assessment Date 3/10/2016

Time(Start & Finish) 10:30am-11:30am Crew Sean Wender, Branson Mauck

Lat/Long: 37.06304, -76.4291 AA shape: circle or rectangle or entire wetland polygon (circle)

AA moved from original location? Yes or No (circle one) If Yes, reason

Assessment Area Sketch



Stability of AA (check one)	
X	Healthy & Stable
	Deteriorating/Fragmenting
	Severe deterioration/fragmentation

Soils
Depth of organic layer (cm): 10
Comments on soil sample:

Function 1: Habitat Characteristic

Variable: Woody Debris (V_{WD}) DBH in CM			
Sub-plot A	64.3	58.2	54.3
Sub-plot B	66.4	75.4	40.9
Sub-plot C	55.5	55.7	49
Mean:	57.7		

Subindex Score: 1.00

Variable: Food Plants (V_{FOOD})
Number of species*: 17
* Number produced from species in V_{FQAI}
* Food list species provided in HGM Manual

Subindex Score: 1.00

Variable: Natural landcover with 200m ($V_{NATURAL}$)	
% Natural:	78.8

Subindex Score: 0.985

Variable: Tree Density ($V_{DENSITY}$)	
Sub-plot A	9
Sub-plot B	5
Sub-plot C	9
Mean:	8

Subindex Score: 1.00

Habitat Functional Capacity Formula	
$(V_{WD} + V_{FOOD} + V_{NATURAL} + V_{DENSITY})/4 =$	**0.996**

Function 2: Plant Community Characteristic

Species:	A	B	C	V_{CANOPY}
Acer rubrum	✓	✓	✓	••
Agrostis stolonifera		✓		
Aralia spinosa		✓		
Chasmanthium laxum			✓	
Clethra alnifolia			✓	
Fraxinus pennsylvanica			✓	
Ilex opaca			✓	
Juncus effusus		✓		
Liquidambar styraciflua	✓	✓	✓	••
Magnolia virginiana	✓			
Pinus taeda	✓			••
Pyrola americana		✓		
Quercus alba				•
Quercus michauxii	✓			•
Quercus pagoda				
Quercus phellos				
Quercus prinus				
Sambucus canadensis		✓		
Smilax rotundifolia		✓	✓	
Symplocos tinctoria	✓			
Tipularia discolor		✓		
Vaccinium corymbosum	✓		✓	
Viburnum nudum				

Variable: Floristic Quality Assessment Index (V_{FQAI})

Adjusted FQI Value*= **43.9**

* Adjusted FQI value determined by entering species list into FQAI Calculator at the Mid-Atlantic Wetlands Workgroup website: http://mawwg.psu.edu/tools/fqai.asp

Subindex Score: 1.00

Variable: Canopy Tree Composition (V_{CANOPY})

Relative Dominance	Subindex
No canopy trees	0.0
>50% pine	0.0
>50% hardwoods, >25% pine, <1% oak	0.2
>50% hardwoods, <25% pine, <1% oak	0.3
>50% hardwoods, >25% pine, 1-10% oak	0.5
>50% hardwoods, <25% pine, 1-10% oak	0.7
>50% hardwoods, >25% pine, >10% oak	0.8
>50% hardwoods, <25% pine, >10% oak	1.0

Variable: Hardwood Regeneration (V_{REGEN}) %

Sub-plot **A** = 0
Sub-plot B = 0
Sub-plot C = 0
Mean = 0.00

Subindex Score: 0.00

Variable:Non-native Invasive PlantS ($V_{INVASIVE}$) %

Sub-plot A = 0
Sub-plot B = 0
Sub-plot C = 0
Mean = 0.0

Subindex Score: 1.00

Plant Community Functional Capacity Formula

$FCI = (V_{FQAI} + V_{CANOPY} + V_{REGEN} + V_{INVASIVE})/4$

FCI = **0.70**

Function 3: Water Level Regime Characteristic

Variable: Anthropogenic Drainage (V_{DRAIN})

% Impacted: 0

V_{DRAIN} = 1.0

Variable: Percent Fill in WAA (V_{FILL})

% Fill: 10

V_{FILL} = 0.75

Variable: Natural Landcover with 200m ($V_{NATURAL}$)*

*$V_{NATURAL}$ value given in Function 1.

Subindex Score: 0.985

Water Regime Functional Capacity Formula

FCI = ($V_{NATURAL}$ + V_{DRAIN} + V_{FILL})/3

FCI = 0.91

Function 4: Carbon Cycling Processes Characteristic

Variable: Woody Debris (V_{WD})*

*V_{WD} value given in Function 1.

Subindex Score: 1.00

Variable: Herbaceous Cover (V_{HERB}) %

Sub-plot A = 10

Sub-plot B = 25

Sub-plot C = 30

Mean = 21.67

Subindex Score: 1.00

Variable: Floristic Quality Assessment Index (V_{FQAI})

Adjusted FQI Value*= **43.9**

Subindex Score: 1.00

Carbon Cycling Processes Functional Capacity Formula

(V_{WD} + V_{FQAI} + V_{HERB} + Water Level Regime Functional Capacity Score)/4

FCI = 0.98

Photograph 1: H SB-Ref North

Photograph 2: H SB-Ref East

Photograph 3: H SB-Ref South

Photograph 4: H SB-Ref West

Photograph 5: H SB-Ref A

Photograph 6: H SB-Ref B

Photograph 7: H SB-Ref C

Hydrogeomorphic Assessment of Wet Hardwood Flats on Mineral Soils

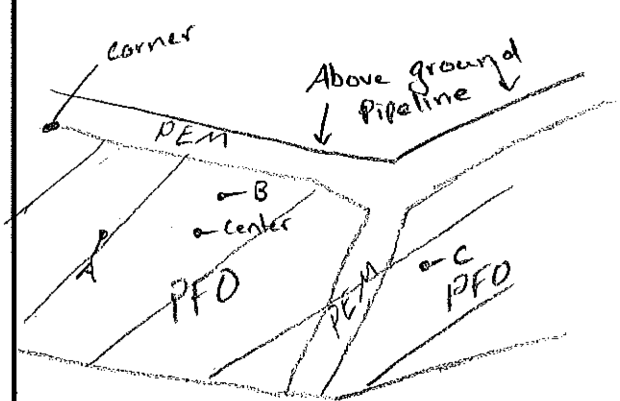
Site # H72 Site Name HRCS Functional Assessment Date 2/10/2016

Time(Start & Finish) 11:00 am ; 12:00 pm Crew S. Wender, S. Kupiec, B. Mauck

Lat/Long: 36°53'22.90"N; 76°21'32.80"W AA shape: circle or rectangle or entire wetland polygon (circle)

AA moved from original location? Yes or No (circle one) If Yes, reason

Assessment Area Sketch



Stability of AA (check one)	
	Healthy & Stable
X	Deteriorating/Fragmenting
	Severe deterioration/fragmentation

Soils

Depth of organic layer (cm): 5

Comments on soil sample:

Function 1: Habitat Characteristic

Variable: Woody Debris (V_{WD}) DBH in CM			
Sub-plot A	57	23	14.9
Sub-plot B	32.2	7.7	7.5
Sub-plot C	46.8	49.3	51
	Mean:	32.2	

Subindex Score: 0.804

Variable: Food Plants (V_{FOOD})
Number of species*: 13
* Number produced from species in V_{FQAI}
* Food list species provided in HGM Manual

Subindex Score: 1.00

Variable: Natural landcover with 200m ($V_{NATURAL}$)	
% Natural:	95

Subindex Score: 1.00

Variable: Tree Density ($V_{DENSITY}$)	
Sub-plot A	2
Sub-plot B	1
Sub-plot C	19
Mean:	7

Subindex Score: 1.00

Habitat Functional Capacity Formula	
$(V_{WD} + V_{FOOD} + V_{NATURAL} + V_{DENSITY})/4 =$	**0.951**

Function 2: Plant Community Characteristic

Species:	A	B	C	V_{CANOPY}
Acer rubrum			✓	••
Celtis occidentalis	✓			
Hedera helix		✓		
Juniperus virginiana				•
Ligustrum sinense	✓	✓		•
Liquidambar styraciflua			✓	
Lonicera japonica	✓		✓	
Morella cerifera			✓	
Phytolacca americana		✓		
Pinus taeda			✓	••
Prunus serotina	✓			•
Quercus nigra			✓	
Quercus palustris		✓		•
Rubus argutus		✓		
Smilax bona-nox	✓	✓	✓	
Smilax rotundifolia			✓	
Vitis rotundifolia			✓	
Smilax bona-nox			✓	

Variable: Floristic Quality Assessment Index (V_{FQAI})

Adjusted FQI Value*= **27.9**

* Adjusted FQI value determined by entering species list into FQAI Calculator at the Mid-Atlantic Wetlands Workgroup website: http://mawwg.psu.edu/tools/fqai.asp

Subindex Score: 0.00

Variable: Canopy Tree Composition (V_{CANOPY})

Relative Dominance	Subindex
No canopy trees	0.0
>50% pine	0.0
>50% hardwoods, >25% pine, <1% oak	0.2
>50% hardwoods, <25% pine, <1% oak	0.3
>50% hardwoods, >25% pine, 1-10% oak	0.5
>50% hardwoods, <25% pine, 1-10% oak	0.7
>50% hardwoods, >25% pine, >10% oak	0.8
>50% hardwoods, <25% pine, >10% oak	1.0

Variable: Hardwood Regeneration (V_{REGEN}) %

Sub-plot A = 0
Sub-plot B = 0
Sub-plot C = 1
Mean = 0.33

Subindex Score: 0.111

Variable:Non-native Invasive PlantS ($V_{INVASIVE}$) %

Sub-plot A = 20
Sub-plot B = 25
Sub-plot C = 10
Mean = 18.3

Subindex Score: 0.00

Plant Community Functional Capacity Formula

$FCI = (V_{FQAI} + V_{CANOPY} + V_{REGEN} + V_{INVASIVE})/4$

FCI = **0.23**

Function 3: Water Level Regime Characteristic

Variable: Anthropogenic Drainage (V_{DRAIN})	
% Impacted:	15
V_{DRAIN} =	0.85

Variable: Percent Fill in WAA (V_{FILL})	
% Fill:	15
V_{FILL} =	0.50

Variable: Natural Landcover with 200m ($V_{NATURAL}$)*

*$V_{NATURAL}$ value given in Function 1.

Subindex Score: 1.00

Water Regime Functional Capacity Formula

$FCI = (V_{NATURAL} + V_{DRAIN} + V_{FILL})/3$

FCI = 0.78

Function 4: Carbon Cycling Processes Characteristic

Variable: Woody Debris (V_{WD})*

*V_{WD} value given in Function 1.

Subindex Score: 0.804

Variable: Herbaceous Cover (V_{HERB}) %	
Sub-plot A =	20
Sub-plot B =	33
Sub-plot C =	50
Mean =	34.33

Subindex Score: 1.0

Variable: Floristic Quality Assessment Index (V_{FQAI})	
Adjusted FQI Value*=	**27.9**

Subindex Score: 0.00

Carbon Cycling Processes Functional Capacity Formula

$(V_{WD} + V_{FQAI} + V_{HERB} +$ Water Level Regime Functional Capacity Score$)/4$

FCI = 0.647

Photograph 1: H72 North

Photograph 2: H72 East

Photograph 3: H72 South

Photograph 4: H72 West

Photograph 5: H72A

Photograph 6: H72B

Photograph 7: H72C

Hydrogeomorphic Assessment of Wet Hardwood Flats on Mineral Soils

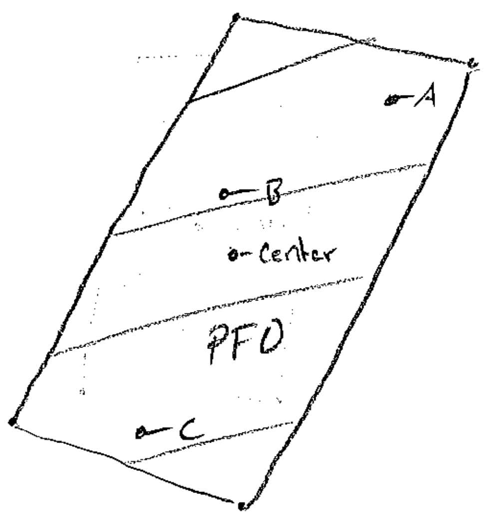
Site # H74 Site Name HRCS Functional Assessment Date 1/27/2016

Time(Start & Finish) 2:00 pm, 3:30 pm Crew S. Wender, B. Mauck, J. Mann, B. Connors,

Lat/Long: 36°52'26.67"N; 76°21'59.23"W AA shape: circle or rectangle or entire wetland polygon (circle)

AA moved from original location? Yes or No (circle one) If Yes, reason

Assessment Area Sketch



Stability of AA (check one)	
X	Healthy & Stable
	Deteriorating/Fragmenting
	Severe deterioration/fragmentation

Soils

Depth of organic layer (cm): 3.75

Comments on soil sample:

Function 1: Habitat Characteristic

Variable: Woody Debris (V_{WD}) DBH in CM			
Sub-plot A	33.02	27.94	30.48
Sub-plot B	58.42	45.72	40.64
Sub-plot C	38.1	27.94	22.86
Mean:	36.1		

Subindex Score: 0.903

Variable: Food Plants (V_{FOOD})
Number of species*: 10
* Number produced from species in V_{FQAI}
* Food list species provided in HGM Manual

Subindex Score: 1.00

Variable: Natural landcover with 200m ($V_{NATURAL}$)	
% Natural:	78

Subindex Score: 0.98

Variable: Tree Density ($V_{DENSITY}$)	
Sub-plot A	10
Sub-plot B	8
Sub-plot C	6
Mean:	8

Subindex Score: 1.00

Habitat Functional Capacity Formula	
$(V_{WD} + V_{FOOD} + V_{NATURAL} + V_{DENSITY})/4 =$	**0.970**

Function 2: Plant Community Characteristic

Species:	A	B	C	V_{CANOPY}
Acer rubrum	✓	✓	✓	
Arundinaria tecta	✓			
Liquidambar styraciflua	✓	✓		
Morella cerifera			✓	
Nyssa sylvatica			✓	
Oxydendrum arboreum			✓	
Pinus taeda	✓	✓	✓	
Quercus falcata		✓		
Quercus nigra		✓	✓	
Smilax rotundifolia	✓	✓		
Tipularia discolor				
Vaccinium corymbosum	✓	✓	✓	

Variable: Floristic Quality Assessment Index (V_{FQAI})

Adjusted FQI Value*= **39.0**

* Adjusted FQI value determined by entering species list into FQAI Calculator at the Mid-Atlantic Wetlands Workgroup website: http://mawwg.psu.edu/tools/fqai.asp

Subindex Score: 1.00

Variable: Canopy Tree Composition (V_{CANOPY})

Relative Dominance	Subindex
No canopy trees	0.0
>50% pine	0.0
>50% hardwoods, >25% pine, <1% oak	0.2
>50% hardwoods, <25% pine, <1% oak	0.3
>50% hardwoods, >25% pine, 1-10% oak	0.5
>50% hardwoods, <25% pine, 1-10% oak	0.7
>50% hardwoods, >25% pine, >10% oak	0.8
>50% hardwoods, <25% pine, >10% oak	1.0

Variable: Hardwood Regeneration (V_{REGEN}) %

Sub-plot A = 0
Sub-plot B = 5
Sub-plot C = 1
Mean = 2

Subindex Score: 0.666

Variable:Non-native Invasive PlantS ($V_{INVASIVE}$) %

Sub-plot A = 0
Sub-plot B = 0
Sub-plot C = 0
Mean = 0.0

Subindex Score: 1.00

Plant Community Functional Capacity Formula

$FCI = (V_{FQAI} + V_{CANOPY} + V_{REGEN} + V_{INVASIVE})/4$

FCI = 0.67

Function 3: Water Level Regime Characteristic

Variable: Anthropogenic Drainage (V_{DRAIN})

% Impacted: 3

V_{DRAIN} = 0.97

Variable: Percent Fill in WAA (V_{FILL})

% Fill: 15

V_{FILL} = 0.5

Variable: Natural Landcover with 200m ($V_{NATURAL}$)*

*$V_{NATURAL}$ value given in Function 1.

Subindex Score: 1.0

Water Regime Functional Capacity Formula

FCI = ($V_{NATURAL}$ + V_{DRAIN} + V_{FILL})/3

FCI = 0.815

Function 4: Carbon Cycling Processes Characteristic

Variable: Woody Debris (V_{WD})*

*V_{WD} value given in Function 1.

Subindex Score: 0.903

Variable: Herbaceous Cover (V_{HERB}) %

Sub-plot A = 30

Sub-plot B = 15

Sub-plot C = 2

Mean = 15.67

Subindex Score: 1.0

Variable: Floristic Quality Assessment Index (V_{FQAI})

Adjusted FQI Value*= **39.0**

Subindex Score: 1.00

Carbon Cycling Processes Functional Capacity Formula

(V_{WD} + V_{FQAI} + V_{HERB} + Water Level Regime Functional Capacity Score)/4

FCI = **0.930**

Photograph 1: H74 North

Photograph 2: H74 East

Photograph 3: H74 South

Photograph 4: H74 West

Photograph 5: H74A

Photograph 6: H74B

Photograph 7: H74C

Hydrogeomorphic Assessment of Wet Hardwood Flats on Mineral Soils

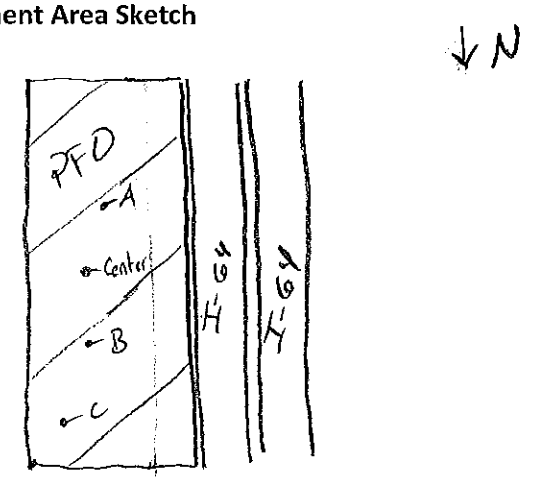
Site # H92 Site Name HRCS Functional Assessment Date 1/27/2016

Time(Start & Finish) 10:00am, 11:30pm Crew S. Wender, B. Mauck, J. Mann, B. Connors

Lat/Long: 36°52'49.52"N, 76°25'53.06"W AA shape: circle or rectangle or entire wetland polygon (circle)

AA moved from original location? Yes or No (circle one) If Yes, reason

Assessment Area Sketch



Stability of AA (check one)	
X	Healthy & Stable
	Deteriorating/Fragmenting
	Severe deterioration/fragmentation

Soils
Depth of organic layer (cm): 6
Comments on soil sample:

Function 1: Habitat Characteristic

Variable: Woody Debris (V_{WD}) DBH in CM			
Sub-plot A	45.72	45.72	40.64
Sub-plot B	55.88	53.34	53.34
Sub-plot C	45.72	30.48	27.94
Mean:	44.3		

Subindex Score: 1.00

Variable: Food Plants (V_{FOOD})
Number of species*: 16
* Number produced from species in V_{FQAI}
* Food list species provided in HGM Manual

Subindex Score: 1.0

Variable: Natural landcover with 200m ($V_{NATURAL}$)	
% Natural:	67.3

Subindex Score: 0.841

Variable: Tree Density ($V_{DENSITY}$)	
Sub-plot A	10
Sub-plot B	9
Sub-plot C	5
Mean:	8

Subindex Score: 1.0

Habitat Functional Capacity Formula	
$(V_{WD} + V_{FOOD} + V_{NATURAL} + V_{DENSITY})/4 =$	**0.96**

Function 2: Plant Community Characteristic

Species:	A	B	C	V_{CANOPY}
Acer rubrum	✓	✓	✓	•••
Arundinaria tecta	✓	✓	✓	
Clethra alnifolia		✓	✓	
Fagus grandifolia	✓			
Kalmia latifolia		✓	✓	
Liquidambar styraciflua	✓	✓	✓	
Magnolia virginiana	✓			•
Morella cerifera	✓			
Nyssa sylvatica		✓	✓	
Oxydendrum arboreum			✓	
Pinus taeda	✓			
Quercus alba	✓	✓	✓	••••
Quercus falcata			✓	••••
Quercus nigra	✓	✓		
Quercus phellos	✓	✓		•
Quercus rubra	✓			
Smilax rotundifolia		✓	✓	
Symplocos tinctoria	✓	✓	✓	
Vaccinium corymbosum	✓	✓		

Variable: Floristic Quality Assessment Index (V_{FQAI})

Adjusted FQI Value*= **46.5**

* Adjusted FQI value determined by entering species list into FQAI Calculator at the Mid-Atlantic Wetlands Workgroup website: http://mawwg.psu.edu/tools/fqai.asp

Subindex Score: 1.00

Variable: Canopy Tree Composition (V_{CANOPY})

Relative Dominance	Subindex
No canopy trees	0.0
>50% pine	0.0
>50% hardwoods, >25% pine, <1% oak	0.2
>50% hardwoods, <25% pine, <1% oak	0.3
>50% hardwoods, >25% pine, 1-10% oak	0.5
>50% hardwoods, <25% pine, 1-10% oak	0.7
>50% hardwoods, >25% pine, >10% oak	0.8
>50% hardwoods, <25% pine, >10% oak	1.0

Variable: Hardwood Regeneration (V_{REGEN}) %

Sub-plot A = 5

Sub-plot B = 0

Sub-plot C = 0

Mean = 1.67

Subindex Score: 0.555

Variable:Non-native Invasive PlantS ($V_{INVASIVE}$) %

Sub-plot A = 0

Sub-plot B = 0

Sub-plot C = 0

Mean = 0.0

Subindex Score: 1.00

Plant Community Functional Capacity Formula

$FCI = (V_{FQAI} + V_{CANOPY} + V_{REGEN} + V_{INVASIVE})/4$

FCI = **0.89**

Function 3: Water Level Regime Characteristic

Variable: Anthropogenic Drainage (V_{DRAIN})

% Impacted: 5

V_{DRAIN} = 0.95

Variable: Percent Fill in WAA (V_{FILL})

% Fill: 5

V_{FILL} = 1.0

Variable: Natural Landcover with 200m ($V_{NATURAL}$)*

*$V_{NATURAL}$ value given in Function 1.

Subindex Score: 0.841

Water Regime Functional Capacity Formula

FCI = ($V_{NATURAL}$ + V_{DRAIN} + V_{FILL})/3

FCI = 0.93

Function 4: Carbon Cycling Processes Characteristic

Variable: Woody Debris (V_{WD})*

*V_{WD} value given in Function 1.

Subindex Score: 1.00

Variable: Herbaceous Cover (V_{HERB}) %

Sub-plot **A** = 40

Sub-plot B = 65

Sub-plot C = 55

Mean = 53.33

Subindex Score: 0.89

Variable: Floristic Quality Assessment Index (V_{FQAI})

Adjusted FQI Value*= **46.5**

Subindex Score: 1.00

Carbon Cycling Processes Functional Capacity Formula

(V_{WD} + V_{FQAI} + V_{HERB} + Water Level Regime Functional Capacity Score)/4

FCI = 0.96

Photograph 1: H92 North

Photograph 2: H92 East

Photograph 3: H92 South

Photograph 4: H92 West

Photograph 5: H92A

Photograph 6: H92B

Photograph 7: H92C

Hydrogeomorphic Assessment of Wet Hardwood Flats on Mineral Soils

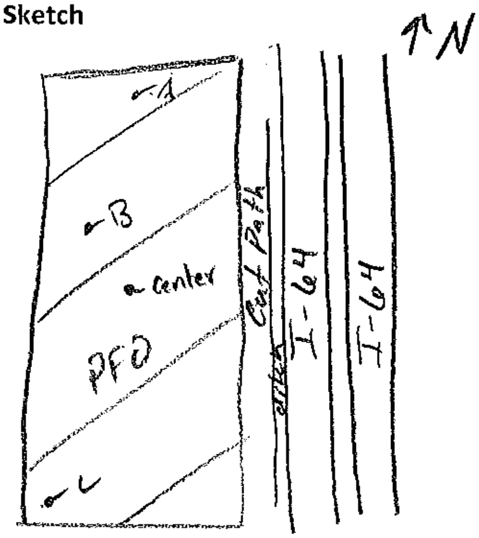
Site # H103 Site Name HRCS Functional Assessment Date 1/27/2016

Time(Start & Finish) 12:30 pm, 1:30 pm Crew S. Wender, B. Mauck, J. Mann, S. Kupiec

Lat/Long: 36°49'47.45"N, 76°26'2.96"W AA shape: circle or rectangle or entire wetland polygon (circle)

AA moved from original location? Yes or No (circle one) If Yes, reason

Assessment Area Sketch



Stability of AA (check one)	
	Healthy & Stable
X	Deteriorating/Fragmenting
	Severe deterioration/fragmentation

Soils

Depth of organic layer (cm): 7

Comments on soil sample:

Function 1: Habitat Characteristic

Variable: Woody Debris (V_{WD}) DBH in CM			
Sub-plot A	48.26	40.64	35.56
Sub-plot B	60.96	30.48	30.48
Sub-plot C	43.18	55.88	43.12
Mean:	43.2		

Subindex Score: 1.00

Variable: Food Plants (V_{FOOD})
Number of species*: 18
* Number produced from species in V_{FQAI}
* Food list species provided in HGM Manual

Subindex Score: 1.00

Variable: Natural landcover with 200m ($V_{NATURAL}$)	
% Natural:	58

Subindex Score: 0.73

Variable: Tree Density ($V_{DENSITY}$)	
Sub-plot A	9
Sub-plot B	10
Sub-plot C	12
Mean:	10

Subindex Score: 1.00

Habitat Functional Capacity Formula	
$(V_{WD} + V_{FOOD} + V_{NATURAL} + V_{DENSITY})/4 =$	**0.93**

Function 2: Plant Community Characteristic

Species:	A	B	C	V_{CANOPY}
Acer rubrum	✓	✓	✓	
Arundinaria tecta	✓	✓	✓	
Clethra alnifolia				
Fagus grandifolia				
Ilex opaca	✓			
Kalmia latifolia				
Liquidambar styraciflua	✓	✓	✓	
Liriodendron tulipifera				
Magnolia virginiana	✓	✓		
Nyssa sylvatica		✓	✓	
Oxydendrum arboreum				
Pinus taeda	✓	✓	✓	
Quercus alba			✓	
Quercus falcata				
Quercus nigra		✓		
Quercus palustris		✓		
Quercus phellos				
Smilax rotundifolia	✓	✓		
Symplocos tinctoria	✓		✓	
Vaccinium corymbosum	✓			

Variable: Floristic Quality Assessment Index (V_{FQAI})
Adjusted FQI Value*= **45.3**
* Adjusted FQI value determined by entering species list into FQAI Calculator at the Mid-Atlantic Wetlands Workgroup website: http://mawwg.psu.edu/tools/fqai.asp

Subindex Score: 1.00

Variable: Canopy Tree Composition (V_{CANOPY})	
Relative Dominance	Subindex
No canopy trees	0.0
>50% pine	0.0
>50% hardwoods, >25% pine, <1% oak	0.2
>50% hardwoods, <25% pine, <1% oak	0.3
>50% hardwoods, >25% pine, 1-10% oak	0.5
>50% hardwoods, <25% pine, 1-10% oak	0.7
>50% hardwoods, >25% pine, >10% oak	0.8
>50% hardwoods, <25% pine, >10% oak	1.0

Variable: Hardwood Regeneration (V_{REGEN}) %

Sub-plot A =	0
Sub-plot B =	0
Sub-plot C =	0
Mean =	0

Subindex Score: 0.00

Variable:Non-native Invasive PlantS ($V_{INVASIVE}$) %

Sub-plot A =	0
Sub-plot B =	0
Sub-plot C =	0
Mean =	0.0

Subindex Score: 1.00

Plant Community Functional Capacity Formula

FCI = $(V_{FQAI} + V_{CANOPY} + V_{REGEN} + V_{INVASIVE})/4$

FCI = 0.50

Function 3: Water Level Regime Characteristic

Variable: Anthropogenic Drainage (V_{DRAIN})

% Impacted: 0.0

V_{DRAIN} = 1.0

Variable: Percent Fill in WAA (V_{FILL})

% Fill: 5

V_{FILL} = 1.0

Variable: Natural Landcover with 200m ($V_{NATURAL}$)*

*$V_{NATURAL}$ value given in Function 1.

Subindex Score: 0.73

Water Regime Functional Capacity Formula

FCI = ($V_{NATURAL}$ + V_{DRAIN} + V_{FILL})/3

FCI = 0.91

Function 4: Carbon Cycling Processes Characteristic

Variable: Woody Debris (V_{WD})*

*V_{WD} value given in Function 1.

Subindex Score: 1.00

Variable: Herbaceous Cover (V_{HERB}) %

Sub-plot A =	50
Sub-plot B =	40
Sub-plot C =	50
Mean =	46.67

Subindex Score: 0.779

Variable: Floristic Quality Assessment Index (V_{FQAI})

Adjusted FQI Value*= **45.3**

Subindex Score: 1.00

Carbon Cycling Processes Functional Capacity Formula

(V_{WD} + V_{FQAI} + V_{HERB} + Water Level Regime Functional Capacity Score)/4

FCI = 0.922

Photograph 1: H103 North

Photograph 2: H103 East

Photograph 3: H103 South

Photograph 4: H103 West

Photograph 5: H103A

Photograph 6: H103B

Photograph 7: H103C

Hydrogeomorphic Assessment of Wet Hardwood Flats on Mineral Soils

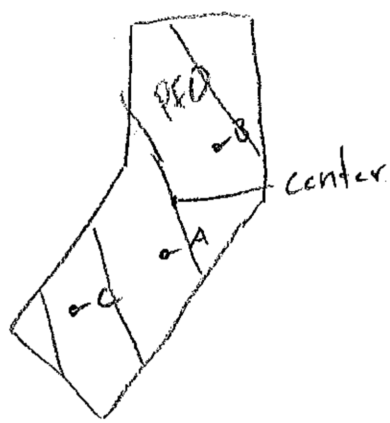
Site # H112 Site Name HRCS Functional Assessment Date 1/27/2016

Time(Start & Finish) 4:00 pm - 5:00 pm Crew SW, JM, BM, BC

Lat/Long: 36°47'4.82"N, 76°25'38.76"W AA shape: circle or rectangle or entire wetland polygon (circle)

AA moved from original location? Yes or No (circle one) If Yes, reason

Assessment Area Sketch



Stability of AA (check one)	
X	Healthy & Stable
	Deteriorating/Fragmenting
	Severe deterioration/fragmentation

Soils

Depth of organic layer (cm): 3.75

Comments on soil sample:

Function 1: Habitat Characteristic

Variable: Woody Debris (V_{WD}) DBH in CM			
Sub-plot A	35.56	17.78	17.78
Sub-plot B	48.26	25.4	30.48
Sub-plot C	96.52	55.88	48.26
Mean:	41.8		

Subindex Score: 1.00

Variable: Food Plants (V_{FOOD})
Number of species*: 12
* Number produced from species in V_{FQAI}
* Food list species provided in HGM Manual

Subindex Score: 1.00

Variable: Natural landcover with 200m ($V_{NATURAL}$)	
% Natural:	70

Subindex Score: 0.88

Variable: Tree Density ($V_{DENSITY}$)	
Sub-plot A	5
Sub-plot B	9
Sub-plot C	9
Mean:	8

Subindex Score: 1.00

Habitat Functional Capacity Formula	
$(V_{WD} + V_{FOOD} + V_{NATURAL} + V_{DENSITY})/4 =$	**0.97**

Function 2: Plant Community Characteristic

Species:	A	B	C	V_{CANOPY}
Acer rubrum	✓	✓	✓	:
Arundinaria tecta		✓	✓	
Asimina triloba	✓	✓	✓	
Carpinus caroliniana		✓	✓	
Fraxinus pennsylvanica	✓			
Ilex opaca		✓	✓	
Ligustrum sinense	✓	✓	✓	
Liquidambar styraciflua	✓	✓	✓	:
Lonicera japonica	✓		✓	
Magnolia virginiana		✓		
Nyssa sylvatica				•
Quercus nigra			✓	
Smilax rotundifolia	✓	✓	✓	
Toxicodendron radicans		✓		
Ulmus americana		✓	✓	•
Viburnum nudum			✓	

Variable: Floristic Quality Assessment Index (V_{FQAI})

Adjusted FQI Value*= **31.9**

* Adjusted FQI value determined by entering species list into FQAI Calculator at the Mid-Atlantic Wetlands Workgroup website: http://mawwg.psu.edu/tools/fqai.asp

Subindex Score: 0.38

Variable: Canopy Tree Composition (V_{CANOPY})

Relative Dominance	Subindex
No canopy trees	0.0
>50% pine	0.0
>50% hardwoods, >25% pine, <1% oak	0.2
>50% hardwoods, <25% pine, <1% oak	0.3
>50% hardwoods, >25% pine, 1-10% oak	0.5
>50% hardwoods, <25% pine, 1-10% oak	0.7
>50% hardwoods, >25% pine, >10% oak	0.8
>50% hardwoods, <25% pine, >10% oak	1.0

Variable: Hardwood Regeneration (V_{REGEN}) %

Sub-plot A = 0
Sub-plot B = 0
Sub-plot C = 0
Mean = 0

Subindex Score: 0.00

Variable:Non-native Invasive PlantS ($V_{INVASIVE}$) %

Sub-plot A = 10
Sub-plot B = 15
Sub-plot C = 5
Mean = 10.0

Subindex Score: 0.0

Plant Community Functional Capacity Formula

$FCI = (V_{FQAI} + V_{CANOPY} + V_{REGEN} + V_{INVASIVE})/4$

FCI = 0.17

Function 3: Water Level Regime Characteristic

Variable: Anthropogenic Drainage (V_{DRAIN})

% Impacted: 0.0

V_{DRAIN} = 1.0

Variable: Percent Fill in WAA (V_{FILL})

% Fill: 10

V_{FILL} = 0.75

Variable: Natural Landcover with 200m ($V_{NATURAL}$)*

*$V_{NATURAL}$ value given in Function 1.

Subindex Score: 0.88

Water Regime Functional Capacity Formula

FCI = ($V_{NATURAL}$ + V_{DRAIN} + V_{FILL})/3

FCI = 0.88

Function 4: Carbon Cycling Processes Characteristic

Variable: Woody Debris (V_{WD})*

*V_{WD} value given in Function 1.

Subindex Score: 1.00

Variable: Herbaceous Cover (V_{HERB}) %

Sub-plot A = 30

Sub-plot B = 35

Sub-plot C = 15

Mean = 26.67

Subindex Score: 1.00

Variable: Floristic Quality Assessment Index (V_{FQAI})

Adjusted FQI Value*= **31.9**

Subindex Score: 0.38

Carbon Cycling Processes Functional Capacity Formula

(V_{WD} + V_{FQAI} + V_{HERB} + Water Level Regime Functional Capacity Score)/4

FCI = 0.814

Photograph 1: H112 North

Photograph 2: H112 East

Photograph 3: H112 South

Photograph 4: H112 West

Photograph 5: H112A

Photograph 6: H112B

Photograph 7: H112C

Hydrogeomorphic Assessment of Wet Hardwood Flats on Mineral Soils

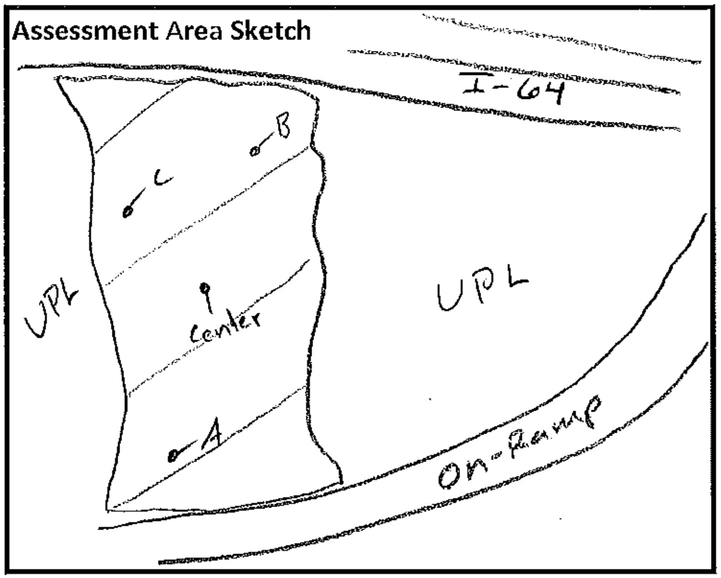
Site # H112-1 Site Name HRCS Functional Assessment Date 1/27/2016

Time(Start & Finish) 8:00 am - 9:30 am Crew SW, BM, JM, BC

Lat/Long: 36°47'7.94"N; 76°25'33.80"W AA shape: circle or rectangle or entire wetland polygon (circle)

AA moved from original location? Yes or No (circle one) If Yes, reason

Assessment Area Sketch



Stability of AA (check one)	
X	Healthy & Stable
	Deteriorating/Fragmenting
	Severe deterioration/fragmentation

Soils
Depth of organic layer (cm): 1
Comments on soil sample:

Function 1: Habitat Characteristic

Variable: Woody Debris (V_{WD}) DBH in CM			
Sub-plot A	35.56	45.72	50.8
Sub-plot B	58.42	35.56	40.64
Sub-plot C	63.5	60.96	43.18
	Mean:	48.3	

Subindex Score: 1.00

Variable: Food Plants (V_{FOOD})
Number of species*: 14
* Number produced from species in V_{FQAI}
* Food list species provided in HGM Manual

Subindex Score: 1.00

Variable: Natural landcover with 200m ($V_{NATURAL}$)	
% Natural:	77.7

Subindex Score: 0.97

Variable: Tree Density ($V_{DENSITY}$)	
Sub-plot A	7
Sub-plot B	10
Sub-plot C	11
Mean:	9

Subindex Score: 1.00

Habitat Functional Capacity Formula	
$(V_{WD} + V_{FOOD} + V_{NATURAL} + V_{DENSITY})/4 =$	**0.99**

Function 2: Plant Community Characteristic

Species:	A	B	C	V_{CANOPY}
Acer rubrum	✓	✓	✓	
Arundinaria tecta	✓	✓	✓	
Carpinus caroliniana		✓		
Cinna arundinacea			✓	
Fraxinus pennsylvanica				
Ligustrum sinense	✓	✓	✓	
Liquidambar styraciflua	✓	✓	✓	
Liriodendron tulipifera		✓		
Lonicera japonica	✓	✓	✓	
Magnolia virginiana	✓	✓	✓	
Nyssa aquatica	✓	✓	✓	☒
Quercus laurifolia	✓	✓		
Quercus nigra		✓		
Quercus phellos		✓		
Smilax rotundifolia			✓	
Toxicodendron radicans			✓	
Ulmus americana			✓	

Variable: Floristic Quality Assessment Index (V_{FQAI})

Adjusted FQI Value*= **35.9**

* Adjusted FQI value determined by entering species list into FQAI Calculator at the Mid-Atlantic Wetlands Workgroup website: http://mawwg.psu.edu/tools/fqai.asp

Subindex Score: 1.00

Variable: Canopy Tree Composition (V_{CANOPY})

Relative Dominance	Subindex
No canopy trees	0.0
>50% pine	0.0
>50% hardwoods, >25% pine, <1% oak	0.2
>50% hardwoods, <25% pine, <1% oak	0.3
>50% hardwoods, >25% pine, 1-10% oak	0.5
>50% hardwoods, <25% pine, 1-10% oak	0.7
>50% hardwoods, >25% pine, >10% oak	0.8
>50% hardwoods, <25% pine, >10% oak	1.0

Variable: Hardwood Regeneration (V_{REGEN}) %

Sub-plot A =	0
Sub-plot B =	2
Sub-plot C =	0
Mean =	0.67

Subindex Score: 0.22

Variable:Non-native Invasive PlantS ($V_{INVASIVE}$) %

Sub-plot A =	35
Sub-plot B =	10
Sub-plot C =	15
Mean =	20.0

Subindex Score: 0.0

Plant Community Functional Capacity Formula

$FCI = (V_{FQAI} + V_{CANOPY} + V_{REGEN} + V_{INVASIVE})/4$

FCI = 0.38

Function 3: Water Level Regime Characteristic

Variable: Anthropogenic Drainage (V_{DRAIN})	
% Impacted:	0
V_{DRAIN} =	1.0

Variable: Percent Fill in WAA (V_{FILL})	
% Fill:	10
V_{FILL} =	0.75

Variable: Natural Landcover with 200m ($V_{NATURAL}$)*

*$V_{NATURAL}$ value given in Function 1.

Subindex Score: 1.0

Water Regime Functional Capacity Formula

$FCI = (V_{NATURAL} + V_{DRAIN} + V_{FILL})/3$

FCI = 0.91

Function 4: Carbon Cycling Processes Characteristic

Variable: Woody Debris (V_{WD})*

*V_{WD} value given in Function 1.

Subindex Score: 1.00

Variable: Herbaceous Cover (V_{HERB}) %	
Sub-plot A =	45
Sub-plot B =	35
Sub-plot C =	35
Mean =	38.33

Subindex Score: 1.00

Variable: Floristic Quality Assessment Index (V_{FQAI})	
Adjusted FQI Value*=	**35.9**

Subindex Score: 1.00

Carbon Cycling Processes Functional Capacity Formula

$(V_{WD} + V_{FQAI} + V_{HERB}$ + Water Level Regime Functional Capacity Score)/4

FCI = 0.98

Photograph 1: H112-1 North

Photograph 2: H112-1 East

Photograph 3: H112-1 South

Photograph 4: H112-1 West

Photograph 5: H112-1A

Photograph 6: H112-1B

Photograph 7: H112-1C

Hydrogeomorphic Assessment of Wet Hardwood Flats on Mineral Soils

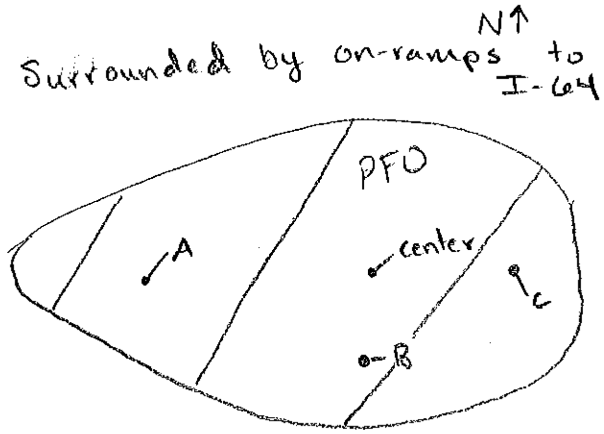
Site # H114 Site Name HRCS Functional Assessment Date 1/27/2016

Time(Start & Finish) 3:00 pm, 4:00 pm Crew Sean Wender, B. Mauck, J. Mann, B. Conners

Lat/Long: 36°47'12.43"N; 76°25'13.43"W AA shape: circle or rectangle or entire wetland polygon (circle)

AA moved from original location? Yes or No (circle one) If Yes, reason

Assessment Area Sketch



Stability of AA (check one)	
X	Healthy & Stable
	Deteriorating/Fragmenting
	Severe deterioration/fragmentation

Soils

Depth of organic layer (cm): 1

Comments on soil sample:

Function 1: Habitat Characteristic

Variable: Woody Debris (V_{WD}) DBH in CM			
Sub-plot A	35.56	35.56	30.48
Sub-plot B	45.72	43.18	30.48
Sub-plot C	55.88	35.56	35.56
Mean:	38.7		

Subindex Score: 0.967

Variable: Food Plants (V_{FOOD})	
Number of species*:	14

* Number produced from species in V_{FQAI}

* Food list species provided in HGM Manual

Subindex Score: 1.00

Variable: Natural landcover with 200m ($V_{NATURAL}$)	
% Natural:	51

Subindex Score: 0.638

Variable: Tree Density ($V_{DENSITY}$)	
Sub-plot A	8
Sub-plot B	14
Sub-plot C	12
Mean:	11

Subindex Score: 1.00

Habitat Functional Capacity Formula

$(V_{WD} + V_{FOOD} + V_{NATURAL} + V_{DENSITY})/4 =$ **0.90**

Function 2: Plant Community Characteristic

Species:	A	B	C	V_{CANOPY}
Acer rubrum	✓	✓	✓	
Juniperus virginiana	✓			
Liquidambar styraciflua	✓	✓	✓	
Lonicera japonica	✓	✓	✓	
Morella cerifera	✓	✓	✓	
Nyssa sylvatica	✓	✓	✓	
Pinus taeda	✓	✓	✓	
Platanus occidentalis		✓		
Quercus laurifolia				
Quercus nigra	✓	✓	✓	
Quercus phellos		✓		
Smilax glauca				
Toxicodendron radicans	✓	✓	✓	
Ulmus americana				
Vaccinium corymbosum	✓			

Variable: Floristic Quality Assessment Index (V_{FQAI})

Adjusted FQI Value*= **33.3**

* Adjusted FQI value determined by entering species list into FQAI Calculator at the Mid-Atlantic Wetlands Workgroup website: http://mawwg.psu.edu/tools/fqai.asp

Subindex Score: 0.66

Variable: Canopy Tree Composition (V_{CANOPY})

Relative Dominance	Subindex
No canopy trees	0.0
>50% pine	0.0
>50% hardwoods, >25% pine, <1% oak	0.2
>50% hardwoods, <25% pine, <1% oak	0.3
>50% hardwoods, >25% pine, 1-10% oak	0.5
>50% hardwoods, <25% pine, 1-10% oak	0.7
>50% hardwoods, >25% pine, >10% oak	0.8
>50% hardwoods, <25% pine, >10% oak	1.0

Variable: Hardwood Regeneration (V_{REGEN}) %

Sub-plot A = 2
Sub-plot B = 5
Sub-plot C = 5
Mean = 4

Subindex Score: 1.00

Variable:Non-native Invasive PlantS ($V_{INVASIVE}$) %

Sub-plot A = 5
Sub-plot B = 2
Sub-plot C = 1
Mean = 2.7

Subindex Score: 0.0

Plant Community Functional Capacity Formula

$FCI = (V_{FQAI} + V_{CANOPY} + V_{REGEN} + V_{INVASIVE})/4$

FCI = 0.47

Function 3: Water Level Regime Characteristic

Variable: Anthropogenic Drainage (V_{DRAIN})

% Impacted: 0.0

V_{DRAIN} = 1.0

Variable: Percent Fill in WAA (V_{FILL})

% Fill: 5

V_{FILL} = 0.75

Variable: Natural Landcover with 200m ($V_{NATURAL}$)*

*$V_{NATURAL}$ value given in Function 1.

Subindex Score: 0.64

Water Regime Functional Capacity Formula

FCI = $(V_{NATURAL} + V_{DRAIN} + V_{FILL})/3$

FCI = 0.80

Function 4: Carbon Cycling Processes Characteristic

Variable: Woody Debris (V_{WD})*

*V_{WD} value given in Function 1.

Subindex Score: 0.967

Variable: Herbaceous Cover (V_{HERB}) %

Sub-plot A = 10

Sub-plot B = 25

Sub-plot C = 25

Mean = 20

Subindex Score: 1.0

Variable: Floristic Quality Assessment Index (V_{FQAI})

Adjusted FQI Value*= **33.3**

Subindex Score: 0.66

Carbon Cycling Processes Functional Capacity Formula

$(V_{WD} + V_{FQAI} + V_{HERB}$ + Water Level Regime Functional Capacity Score)/4

FCI = 0.86

Photograph 1: H114 North

Photograph 2: H114 East

Photograph 3: H114 South

Photograph 4: H114 West

Photograph 5: H114 A

Photograph 6: H114 B

Photograph 7: H114 C

Mid-Atlantic Tidal Wetland Rapid Assessment Method V3.0

Site # BC-Ref Site Name HRCS Tidal Reference Date 3/09/16

Time of Start& Finish 2:00 3:30 Crew Sean Wender; Branson Mauck

Watershed Bennett's Creek Sub-Watershed ______

lat/long 36.51009, -76.29067 AA shape: circle or rectangle or entire wetland polygon (circle)

AA moved from original location? Yes or No (circle one) If yes, reason ______

Classification: (circle one)	Reference or Assessment (circle one)
Marine Tidal Fringe Fringing Estuarine Tidal Fringe Expansive Estuarine Tidal Fringe Back Barrier Estuarine Tidal Fringe	Natural, Re-establishment, establishment Enhancement, Impoundment (circle one)

What best describes the tidal stage over the course of the time spent in the field? (circle one)
Note: It is recommended that the assessment be conducted at low tide.

Tide Stage

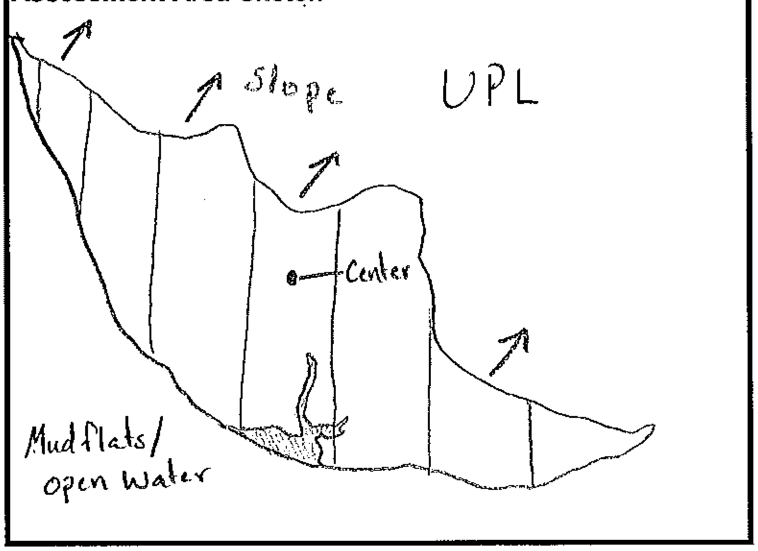
H <--------------------M--------------------> L

5 4 3 2 1

Range of Photo Identification Numbers:

Stressor Photo Description:

Assessment Area Sketch



low marsh or high marsh (circle one)

Distance to Upland 0 **meters**

Distance to Open Water 0 **meters**

Stability of AA (check one)
✓ Healthy & Stable
___ Beginning to deteriorate and/or some fragmentation
___ Severe deterioration and/or substantial fragmentation

Soils

Depth of organic layer (cm): > 18 cm

Comments on soil sample:

10YR 3/2 Muck

Salinity ______**ppt**

Vegetation Communities and Features

enter midpoint for each species/combination present using the cover class chart below

15.5 Spartina alterniflora	______ Phragmites australis	______ root mat
88.5 Spartina patens	______ pannes, pools, creeks	______ unvegetated, mud or sand
______ Spart. alterniflora/Spart. cynosuroides	______ open water	______ unhealthy marsh- SWD, deterioration
______ Spartina patens-Distichlis spicata	______ ditches	______ other 1 ______

Cover Classes	MidPt	Cover Classes	MidPt	Cover Classes	MidPt
0	0	6-25%	15.5	76-99%	88.5
<1%	0.5	26-50%	38	100%	100
1-5%	2.5	51-75%	63		

Comments:

Qualitative Disturbance Rating						
1	2	3	4	5	6	(circle one)
Low <----------------Disturbace----------------> High						

Assessment Complete: Yes No (circle one)

Mid-Atlantic Tidal Wetland Rapid Assessment Method V.3.0

Site # BC-Ref Date 3/09/16

Attribute 1: Buffer/Landscape (All W/in 250m)

B1. Percent of Assessment Area Perimeter with 5m-Buffer

Record Estimated Percent 97 %	
Alternative States(not including open-water areas)	**Rating (circle one)**
Buffer is 100% of AA perimeter.	12
Buffer is 75-99% of AA perimeter.	9
Buffer is 50-74% of AA perimeter.	6
Buffer is <50% of AA perimeter.	3

B2. Average Buffer Width (max 250m)

Line	Buffer Width (m)
A	30
B	20
C	7
D	4.30
E	46.8
F	53
G	40
H	25
Average Buffer Width 28.3	
Alternative States	**Rating (circle one)**
Average buffer width 190-250m	12
Average buffer width 130-189m	9
Average buffer width 65-129m	6
Average buffer width 0-64m	3

B3. Surrounding Development between AA edge and 250m

Estimate Development 21 %	
Alternative States	**Rating (circle one)**
0% development	12
>0-5% development	9
>5-15% development	6
>15% development	3

B4. 250m Landscape Condition

Alternative States	Rating (circle one)
AA's surrounding landscape is comprised of only native vegetation, has undisturbed soils, and there is no evidence of human disturbance.	12
AA's surrounding landscape is dominated by native vegetation, has undisturbed soils, and there is to little or no evidence of human visitation.	9
AA's surrounding landscape is characterized by an intermediate mix of native and non-native vegetation, and/or a moderate degree of soil disturbance/compaction, and/or there is evidence of moderate human visitation.	6
AA's surrounding landscape is characterized by barren ground and/or dominated by invasive species and/or highly compacted or otherwise disturbed soils, and/or there is evidence of very intensive human visitation.	3

B5. Barriers to Landward Migration

% Perimeter Obstructed 100 %

Dist. From Center of AA 78 m

Alternative States	Rating (circle one)
Absent: no barriers	12
Low: <10% of perimeter obstructed	9
Moderate: 10-25% of perimeter obstructed	6
High: 26-100% of perimeter obstructed	3

Shoreline Test Metrics (comlete at low tide along open water shoreline)

S1: Shoreline Erosion

	Erosion Rating (1, 0, -1)
Transect #1	
Transect #2	
Transect #3	
Transect #4	
Transect #5	
Average:	

S2: Shoreline Alteration

	Shoreline altered or
Transect #1	
Transect #2	
Transect #3	
Transect #4	
Transect #5	
Average:	

Coorindates of Transects		
#1		
#2		
#3		
#4		
#5		

Attribute 2: Hydrology

H1. Ditching/Draining (AA only)

Alternative States	Rating (circle one)
No Ditching	12
Low Ditching	9
Moderate Ditching	6
Severe Ditching	3

H2. Fill & Fragmentation (AA only)

Alternative States	Rating (circle one)
No fill or fragmentation	12
Low fill or fragmentation	9
Moderate fill or fragmentation	6
Severe fill or fragmentation	3
Estimate amount of fill 0 % of AA	
Dimensions of Fill Pile	

H3. Diking & Tidal Restriction (250m)

Description of restriction: ______

Alternative States	Rating (circle one)
Absent: no restriction, free flow, normal range	12
Low: restriction presumed (<10% of normal range)	9
Moderate restriction (10-25% normal range)	6
High (26-100 of normal range)	3

H4. Point Sources (250m)

Alternative States	Rating (circle one)
Absent: no discharge	12
Low: one small discharge from a natural area	9
Moderate: one discharge from a developed area or two discharges from a natural area	6
High: ≥ 2 discharges from a developed area or ≥ 3 from a natural area	3

Attribute 3: Habitat (All W/in AA)

used a 15.5 pound fence post driver instead of an 18 pound slide hammer

HAB1. Bearing Capacity (Hummocks)

	Mark Depth (cm)							
	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	Plot 8
Water Depth (cm)	1	1	—	0.5	1	1	1	1
Initial capacity	7	5	4	2	2	4	4	2
Blow 1	29	10	13	3	4	5.5	7	5
Blow 2	38	13	21	4	6	6	10	6
Blow 3	45.5	17	27	4	8	7	14	8
Blow 4	50+	20	32	5	10	8	19	10
Blow 5 (Final)	—	23	35	5	13	9	26	12
Final - Initial	>50	18	31	3	11	5	22	10

AVG= 18.9

* % of AA in hollows x hollows average (HAB1) = /
% of AA in hummocks x hummocks avg (HAB1b)= /
Sum of two weighted averages = /

Av. of Final - Initial for the 8 Sub-plots	Rating (circle one)
≤ 1.8	12
1.9-4.0	9
4.1-6.2	6
> 6.2	3

Average Final-Initial = 18.9 cm

HAB2. Horizontal Vegetative Obstruction

Sub-plot	1	3	5	7
0.25m	10	0	0	10
0.50m	10	1	10	10
0.75m	10	4	10	10
Sum	30	5	20	30
Veg. type	SPPA	SPPA	SPPA	SPPA

Average of 4 Sub-plots 21.25

Average of 4 Sub-plot totals	Rating
< 7	12
< 12 ≥7	9
<22 ≥ 12	6
≥22	3

AA = 8000m² 5% of AA = 400m² = 20mx20m 400m² = 11.3m radius circle
Buffer = 274,750m² 5% of Buffer = 13,737m² = 117m x 117m

HAB1b. Bearing Capacity (Unvegetated Hollows) if applicable*

	Mark Depth (cm)							
	Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8
Water depth (cm)								
Initial capacity								
Blow 1								
Blow 2								
Blow 3								
Blow 4								
Blow 5								
Final - Initial								

AVG= _

HAB3-5. Plant Community Worksheet

Floating or Aquatic Spp	Invasive? Y/N	Co-dom?	Short spp <0.3m	Invasive?	Co-dom?
Medium spp 0.3-0.75m	**Invasive?**	**Co-dom?**	**Tall spp 0.75-1.5m**	**Invasive?**	**Co-dom?**
Spartina patens	N	Y	Spartina alt.	N	Y
			Narrowleaf Cat.	N	Y
Very Tall spp >1.5m	**Invasive?**	**Co-dom?**	**(A) # of Plant Layers**		
			(B) Total # of Native co-dominant species for all layers combined	3	
			(C) Total # of Invasive co-dominant species for all layers combined	0	
			(D) % of Invasive co-dominant species for all layers combined C/(B+C)	0	
			(E) % Invasive cover in AA		

HAB3. # of Plant Layers (A)

Alternative States	Rating (circle one)
4-5 layers	**12**
2-3 layers	**9**
1 layer	**6**
0 layer	**3**

HAB4. % Co-Dominant Invasive Species (D)

Alternative States	Rating (circle one)
0-15%	**12**
16-30%	**9**
31-45%	**6**
46-100%	**3**

HAB5. % Invasive Cover in AA (E)

Alternative States	Rating (circle one)
0%	**12**
>0-25%	**9**
26-50%	**6**
>50%	**3**

COMMENTS:

Mid-Atlantic Tidal Wetland Rapid Assessment Method V.3.0

Site Number: BC-Ref **Site Name:** HRCS Tidal Reference **Date:** 3/09/16

Attributes and Metrics		Scores	Comments
Buffer/Landscape	**Raw #**		
B1. % of AA Perimeter with 5m Buffer	9		
B2. Average Buffer Width	3		
B3. Surrounded Developed	3		
B4. 250 Landscape Condition	6		
B5. Barriers to Landward Migration	3		
((((∑(B1,B2,B3,B4,B5))/60)*100)-25)/75)*100 = **Buffer Attribute Score**		Score: 20.0	
Hydrology	**Raw #**		
H1. Ditching & Draining	12		
H2. Fill & Fragmentation	12		
H3. Diking/Restriction	12		
H4. Point Sources	6		
((((∑(H1,H2,H3,H4))/48)*100)-25)/75)*100 = **Hydrology Attribute Score**		Score: 83.3	
Habitat	**Raw #**		
HAB1. Bearing Capacity	3		
HAB2. Horizontal Vegetative Obstruction	3		
HAB3. Number of Plant Layers	9		
HAB4. Percent Co-dominant Invasive Species	12		
HAB5. Percent Invasives	12		
((((∑(HAB1,HAB2,HAB3,HAB4,HAB5))/60)*100)-25)/75)*100 = **Habitat Attribute Score**		Score: 53.3	

((Buf/Land + Hydrology + Habitat Attribute Scores)/3)= Final Score **Final Score =** 52.2

Photograph 1: T BC-Ref North

Photograph 2: T BC-Ref East

Photograph 3: T BC-Ref South

Photograph 4: T BC-Ref West

Photograph 5: T BC-Ref Overview

Mid-Atlantic Tidal Wetland Rapid Assessment Method V3.0

Site # T5 Site Name HRCS Tidal 5 Date 1/28/16

Time of Start& Finish 10:50 12:40 Crew SW, KP, JM, BM, BC, BY

Watershed SW Branch Back River Sub-Watershed

lat/long 37.14843, -76.223648 AA shape: circle or rectangle or entire wetland polygon (circle)

AA moved from original location? Yes or No (circle one) If yes, reason

Classification: (circle one) Marine Tidal Fringe Fringing Estuarine Tidal Fringe Expansive Estuarine Tidal Fringe Back Barrier Estuarine Tidal Fringe	Reference or Assessment (circle one) Natural, Re-establishment, establishment Enhancement, Impoundment (circle one)

What best describes the tidal stage over the course of the time spent in the field? (circle one)
Note: It is recommended that the assessment be conducted at low tide.

Tide Stage

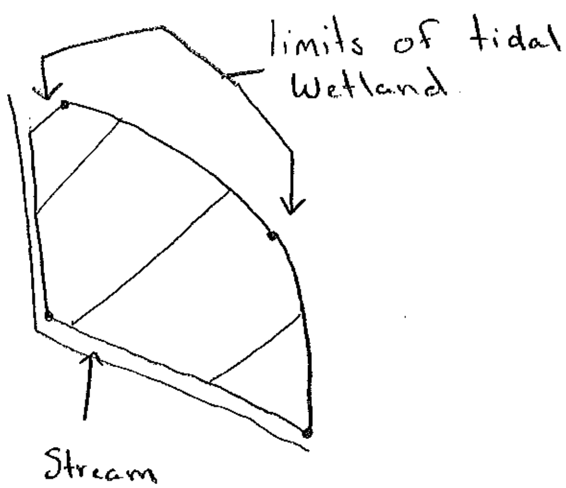
H <--------------------M--------------------> L

5 4 3 2 1

Range of Photo Identification Numbers:

Stressor Photo Description:

Assessment Area Sketch



low marsh or high marsh (circle one)
Distance to Upland 0 **meters**
Distance to Open Water 92 **meters**

Stability of AA (check one)

✓	Healthy & Stable
	Beginning to deteriorate and/or some fragmentation
	Severe deterioration and/or substantial fragmentation

Soils
Depth of organic layer (cm): > 18 cm
Comments on soil sample:
10YR 3/2 Muck

Salinity ____ **ppt**

Vegetation Communities and Features

enter midpoint for each species/combination present using the cover class chart below

0	Spartina alterniflora	63	Phragmites australis	88.5	root mat
0	Spartina patens	2.5	pannes, pools, creeks	2.5	unvegetated, mud or sand
63	Spart. alterniflora/Spart. cynosuroides	0	open water	15.5	unhealthy marsh- SWD, deterioration
0	Spartina patens-Distichlis spicata	0	ditches	15.5	other 1 IVFR

Cover Classes	MidPt	Cover Classes	MidPt	Cover Classes	MidPt
0	0	6-25%	15.5	76-99%	88.5
<1%	0.5	26-50%	38	100%	100
1-5%	2.5	51-75%	63		

Comments:

Sig. dead IVFR

Qualitative Disturbance Rating						
1	2	3	4	5	6	(circle one)

Low <--------------------------------Disturbace--------------------------------> High

Assessment Complete: Yes No (circle one)

Mid-Atlantic Tidal Wetland Rapid Assessment Method V.3.0

Site # T5 Date 1/28/16

Attribute 1: Buffer/Landscape (All W/in 250m)

B1. Percent of Assessment Area Perimeter with 5m-Buffer

Record Estimated Percent 100 %	
Alternative States(not including open-water areas)	Rating (circle one)
Buffer is 100% of AA perimeter.	12
Buffer is 75-99% of AA perimeter.	9
Buffer is 50-74% of AA perimeter.	6
Buffer is <50% of AA perimeter.	3

B2. Average Buffer Width (max 250m)

Line	Buffer Width (m)
A	107
B	140
C	121
D	0
E	22
F	244
G	250
H	58
Average Buffer Width 117	
Alternative States	Rating (circle one)
Average buffer width 190-250m	12
Average buffer width 130-189m	9
Average buffer width 65-129m	6
Average buffer width 0-64m	3

B3. Surrounding Development between AA edge and 250m

Estimate Development 27 %	
Alternative States	Rating (circle one)
0% development	12
>0-5% development	9
>5-15% development	6
>15% development	3

B4. 250m Landscape Condition

Alternative States	Rating (circle one)
AA's surrounding landscape is comprised of only native vegetation, has undisturbed soils, and there is no evidence of human disturbance.	12
AA's surrounding landscape is dominated by native vegetation, has undisturbed soils, and there is to little or no evidence of human visitation.	9
AA's surrounding landscape is characterized by an intermediate mix of native and non-native vegetation, and/or a moderate degree of soil disturbance/compaction, and/or there is evidence of moderate human visitation.	6
AA's surrounding landscape is characterized by barren ground and/or dominated by invasive species and/or highly compacted or otherwise disturbed soils, and/or there is evidence of very intensive human visitation.	3

B5. Barriers to Landward Migration

% Perimeter Obstructed 33 %

Dist. From Center of AA 75 m

Alternative States	Rating (circle one)
Absent: no barriers	12
Low: <10% of perimeter obstructed	9
Moderate: 10-25% of perimeter obstructed	6
High: 26-100% of perimeter obstructed	3

Shoreline Test Metrics (comlete at low tide along open water shoreline)

S1: Shoreline Erosion

	Erosion Rating (1, 0, -1)
Transect #1	
Transect #2	
Transect #3	
Transect #4	
Transect #5	
Average:	

S2: Shoreline Alteration

	Shoreline altered or
Transect #1	
Transect #2	
Transect #3	
Transect #4	
Transect #5	
Average:	

Coorindates of Transects		
#1		
#2		
#3		
#4		
#5		

Attribute 2: Hydrology

H1. Ditching/Draining (AA only)

Alternative States	Rating (circle one)
No Ditching	12
Low Ditching	9
Moderate Ditching	6
Severe Ditching	3

H2. Fill & Fragmentation (AA only)

Alternative States	Rating (circle one)
No fill or fragmentation	12
Low fill or fragmentation	9
Moderate fill or fragmentation	6
Severe fill or fragmentation	3

Estimate amount of fill 0 % of AA
Dimensions of Fill Pile /

H3. Diking & Tidal Restriction (250m)

Description of restriction: ______

Alternative States	Rating (circle one)
Absent: no restriction, free flow, normal range	12
Low: restriction presumed (<10% of normal range)	9
Moderate restriction (10-25% normal range)	6
High (26-100 of normal range)	3

H4. Point Sources (250m)

Alternative States	Rating (circle one)
Absent: no discharge	12
Low: one small discharge from a natural area	9
Moderate: one discharge from a developed area or two discharges from a natural area	6
High: ≥ 2 discharges from a developed area or ≥ 3 from a natural area	3

Attribute 3: Habitat (All W/in AA)

used a 15.5 pound fence post driver instead of an 18 pound slide hammer

HAB1. Bearing Capacity (Hummocks)

	Mark Depth (cm)							
	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	Plot 8
Water Depth (cm)	0	0	0	0	2.5	2.5	0	0
Initial capacity	0.5	2.5	1.0	0	1.0	2.5	2.0	2.0
Blow 1	3.0	6.75	4.0	5.5	5.5	6.25	5.75	7.0
Blow 2	4.0	8.5	6.0	7.0	8.0	10.5	7.0	9.5
Blow 3	5.0	10.0	7.5	8.0	12.5	11.5	8.75	11.25
Blow 4	5.5	11.5	9.0	9.0	18.0	13.5	9.5	12.0
Blow 5 (Final)	6.0	13.25	10.0	10.0	20.5	15.5	10.0	12.75
Final - Initial	5.5	10.75	9.0	10.0	19.5	13.0	8.0	10.78

AVG= 10.81

* % of AA in hollows x hollows average (HAB1) = /
% of AA in hummocks x hummocks avg (HAB1b)= /
Sum of two weighted averages = /

Av. of Final - Initial for the 8 Sub-plots	Rating (circle one)
≤ 1.8	12
1.9-4.0	9
4.1-6.2	6
> 6.2	3

Average Final-Initial = 10.81 cm

HAB2. Horizontal Vegetative Obstruction

Sub-plot	1	3	5	7
0.25m	0	0	0	0
0.50m	6	0	0	0
0.75m	10	0	0	1
Sum	16	0	0	1
Veg. type	PHRAG	PHRAG	PHRAG	PHRAG

IVFR IVFR SPCY SPCY
SPCY SPCY

Average of 4 Sub-plots 4.25

Average of 4 Sub-plot totals	Rating
< 7	12
< 12 ≥7	9
<22 ≥ 12	6
≥22	3

AA = 8000m² 5% of AA = 400m² = 20mx20m 400m² = 11.3m radius circle
Buffer = 274,750m² 5% of Buffer = 13,737m² = 117m x 117m

HAB1b. Bearing Capacity (Unvegetated Hollows) if applicable*

	Mark Depth (cm)							
	Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8
Water depth (cm)								
Initial capacity								
Blow 1								
Blow 2								
Blow 3								
Blow 4								
Blow 5								
Final - Initial								

AVG=

HAB3-5. Plant Community Worksheet

Floating or Aquatic Spp	Invasive? Y/N	Co-dom?	Short spp <0.3m	Invasive?	Co-dom?

Medium spp 0.3-0.75m	Invasive?	Co-dom?	Tall spp 0.75-1.5m	Invasive?	Co-dom?
DISP	N	Y			
Aster Spp.	N	N			

Very Tall spp >1.5m	Invasive?	Co-dom?		
Phrag. Aus.	Y	Y	(A) # of Plant Layers	2
SPCY	N	Y	(B) Total # of Native co-dominant species for all layers combined	3
IVFR	N	Y	(C) Total # of Invasive co-dominant species for all layers combined	1
Schenoplectus Spp.	N	N	(D) % of Invasive co-dominant species for all layers combined C/(B+C)	25%
			(E) % Invasive cover in AA	85%

HAB3. # of Plant Layers (A)

Alternative States	Rating (circle one)
4-5 layers	12
2-3 layers	9
1 layer	6
0 layer	3

HAB4. % Co-Dominant Invasive Species (D)

Alternative States	Rating (circle one)
0-15%	12
16-30%	9
31-45%	6
46-100%	3

HAB5. % Invasive Cover in AA (E)

Alternative States	Rating (circle one)
0%	12
>0-25%	9
26-50%	6
>50%	3

COMMENTS:

Schenoplectus Spp.

Aster Spp.

Mid-Atlantic Tidal Wetland Rapid Assessment Method V.3.0

Site Number: T5	Site Name: HRCS Tidal 5		Date: 01/28/16
Attributes and Metrics		**Scores**	**Comments**
Buffer/Landscape	**Raw #**		
B1. % of AA Perimeter with 5m Buffer	12		
B2. Average Buffer Width	6		
B3. Surrounded Developed	3		
B4. 250 Landscape Condition	6		
B5. Barriers to Landward Migration	3		
((((∑(B1,B2,B3,B4,B5))/60)*100)-25)/75)*100 = **Buffer Attribute Score**		Score 33.3	
Hydrology	**Raw #**		
H1. Ditching & Draining	12		
H2. Fill & Fragmentation	12		
H3. Diking/Restriction	9		
H4. Point Sources	12		
((((∑(H1,H2,H3,H4))/48)*100)-25)/75)*100 = **Hydrology Attribute Score**		Score 91.7	
Habitat	**Raw #**		
HAB1. Bearing Capacity	3		
HAB2. Horizontal Vegetative Obstruction	12		
HAB3. Number of Plant Layers	9		
HAB4. Percent Co-dominant Invasive Species	9		
HAB5. Percent Invasives	3		
((((∑(HAB1,HAB2,HAB3,HAB4,HAB5))/60)*100)-25)/75)*100 = **Habitat Attribute Score**		Score 46.6	
((Buf/Land + Hydrology + Habitat Attribute Scores)/3)= Final Score		**Final Score =** 57.2	

Photograph 1: T5 North

Photograph 2: T5 East

Photograph 3: T5 South

Photograph 4: T5 West

Photograph 5: T5 Stressor

Mid-Atlantic Tidal Wetland Rapid Assessment Method V3.0

Site # T9 Site Name HRCS Tidal 9 Date 1/28/16

Time of Start& Finish 9:00 10:20 Crew DW, KP, JM, BM, BC, BY

Watershed Hampton River Sub-Watershed ____

lat/long 37.2394, -76.204273 AA shape: circle or rectangle or entire wetland polygon (circle)

AA moved from original location? Yes or No (circle one) If yes, reason ____

Classification: (circle one)	Reference or Assessment (circle one)
Marine Tidal Fringe Fringing Estuarine Tidal Fringe Expansive Estuarine Tidal Fringe Back Barrier Estuarine Tidal Fringe	Natural, Re-establishment, establishment Enhancement, Impoundment (circle one)

What best describes the tidal stage over the course of the time spent in the field? (circle one)
Note: It is recommended that the assessment be conducted at low tide.

Tide Stage

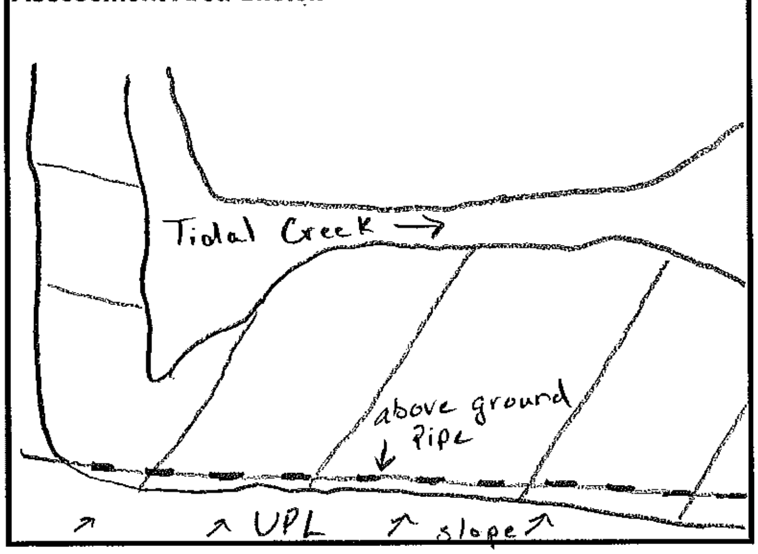
H <--------------------M--------------------> L

5 4 3 2 1

Range of Photo Identification Numbers:

Stressor Photo Description:

Assessment Area Sketch



low marsh or **high marsh** (circle one)

Distance to Upland 0 **meters**

Distance to Open Water 0 **meters**

Stability of AA (check one)
Healthy & Stable
✓ Beginning to deteriorate and/or some fragmentation
Severe deterioration and/or substantial fragmentation

Soils

Depth of organic layer (cm): > 18 cm

Comments on soil sample:

10YR 2/1 Muck

Salinity ____ **ppt**

Vegetation Communities and Features

enter midpoint for each species/combination present using the cover class chart below

63 Spartina alterniflora	15.5 Phragmites australis	88.5 root mat
____ Spartina patens	0 pannes, pools, creeks	15.5 unvegetated, mud or sand
____ Spart. alterniflora/Spart. cynosuroides	0 open water	2.5 unhealthy marsh- SWD, deterioration
15.5 Spartina patens-Distichlis spicata	0 ditches	15.5 other 1 IVFR, BABA, LEOC hackberry

Cover Classes	MidPt	Cover Classes	MidPt	Cover Classes	MidPt
0	0	6-25%	15.5	76-99%	88.5
<1%	0.5	26-50%	38	100%	100
1-5%	2.5	51-75%	63		

Comments:

Qualitative Disturbance Rating						
1	2	3	4	5	6	(circle one)
Low <----------Disturbace----------> High						

Assessment Complete: Yes No (circle one)

Mid-Atlantic Tidal Wetland Rapid Assessment Method V.3.0

Site # T9 Date 01/28/16

Attribute 1: Buffer/Landscape (All W/in 250m)

B1. Percent of Assessment Area Perimeter with 5m-Buffer

Record Estimated Percent 70 %	
Alternative States(not including open-water areas)	**Rating (circle one)**
Buffer is 100% of AA perimeter.	12
Buffer is 75-99% of AA perimeter.	9
Buffer is 50-74% of AA perimeter.	6
Buffer is <50% of AA perimeter.	3

B2. Average Buffer Width (max 250m)

Line	Buffer Width (m)
A	67
B	67
C	8
D	5
E	5
F	0
G	0
H	0
Average Buffer Width 19	
Alternative States	**Rating (circle one)**
Average buffer width 190-250m	12
Average buffer width 130-189m	9
Average buffer width 65-129m	6
Average buffer width 0-64m	3

B3. Surrounding Development between AA edge and 250m

Estimate Development 83 %	
Alternative States	**Rating (circle one)**
0% development	12
>0-5% development	9
>5-15% development	6
>15% development	3

B4. 250m Landscape Condition

Alternative States	Rating (circle one)
AA's surrounding landscape is comprised of only native vegetation, has undisturbed soils, and there is no evidence of human disturbance.	12
AA's surrounding landscape is dominated by native vegetation, has undisturbed soils, and there is to little or no evidence of human visitation.	9
AA's surrounding landscape is characterized by an intermediate mix of native and non-native vegetation, and/or a moderate degree of soil disturbance/compaction, and/or there is evidence of moderate human visitation.	6
AA's surrounding landscape is characterized by barren ground and/or dominated by invasive species and/or highly compacted or otherwise disturbed soils, and/or there is evidence of very intensive human visitation.	3

B5. Barriers to Landward Migration

% Perimeter Obstructed 50 %

Dist. From Center of AA 23 m

Alternative States	Rating (circle one)
Absent: no barriers	12
Low: <10% of perimeter obstructed	9
Moderate: 10-25% of perimeter obstructed	6
High: 26-100% of perimeter obstructed	3

Shoreline Test Metrics (comlete at low tide along open water shoreline)

S1: Shoreline Erosion

	Erosion Rating (1, 0, -1)
Transect #1	
Transect #2	
Transect #3	
Transect #4	
Transect #5	
Average:	

S2: Shoreline Alteration

	Shoreline altered or
Transect #1	
Transect #2	
Transect #3	
Transect #4	
Transect #5	
Average:	

Coorindates of Transects		
#1		
#2		
#3		
#4		
#5		

Attribute 2: Hydrology

H1. Ditching/Draining (AA only)

Alternative States	Rating (circle one)
No Ditching	12
Low Ditching	9
Moderate Ditching	6
Severe Ditching	3

H2. Fill & Fragmentation (AA only)

Alternative States	Rating (circle one)
No fill or fragmentation	12
Low fill or fragmentation	9
Moderate fill or fragmentation	6
Severe fill or fragmentation	3
Estimate amount of fill 5 % of AA	
Dimensions of Fill Pile /	

H3. Diking & Tidal Restriction (250m)

Description of restriction: Road

Alternative States	Rating (circle one)
Absent: no restriction, free flow, normal range	12
Low: restriction presumed (<10% of normal range)	9
Moderate restriction (10-25% normal range)	6
High (26-100 of normal range)	3

H4. Point Sources (250m)

Alternative States	Rating (circle one)
Absent: no discharge	12
Low: one small discharge from a natural area	9
Moderate: one discharge from a developed area or two discharges from a natural area	6
High: ≥ 2 discharges from a developed area or ≥ 3 from a natural area	3

Attribute 3: Habitat (All W/in AA)

used a 15.5 pound fence post driver instead of an 18 pound slide hammer

HAB1. Bearing Capacity (Hummocks)

	Mark Depth (cm)							
	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	Plot 8
Water Depth (cm)	0.5	0.5	0					
Initial capacity	1.5	11.25	1.0					
Blow 1	5.0	21.5	3.0					
Blow 2	6.0	29.75	4.25					
Blow 3	7.5	34.0	5.75					
Blow 4	9.0	37.0	6.0					
Blow 5 (Final)	10.25	39.5	8.0					
Final - Initial	8.75	28.25	7.0					

AVG= 14.67cm

* % of AA in hollows x hollows average (HAB1) = /
% of AA in hummocks x hummocks avg (HAB1b)= /
Sum of two weighted averages = /

Av. of Final - Initial for the 8 Sub-plots	Rating (circle one)
≤ 1.8	12
1.9-4.0	9
4.1-6.2	6
> 6.2	3

Average Final-Initial = 14.67 cm

HAB2. Horizontal Vegetative Obstruction

Sub-plot	1	3	5	7
0.25m	10	10	3	
0.50m	10	10	7	
0.75m	10	10	10	
Sum	30	30	20	
Veg. type	SPAL	SPAL	PHRAG DISP	

Average of 4 Sub-plots	
Average of 4 Sub-plot totals	Rating
< 7	12
< 12 ≥ 7	9
<22 ≥ 12	6
≥22	3

AA = 8000m² 5% of AA = 400m² = 20mx20m 400m² = 11.3m radius circle
Buffer = 274,750m² 5% of Buffer = 13,737m² = 117m x 117m

HAB1b. Bearing Capacity (Unvegetated Hollows) if applicable*

	Mark Depth (cm)							
	Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8
Water depth (cm)								
Initial capacity								
Blow 1								
Blow 2								
Blow 3								
Blow 4								
Blow 5								
Final - Initial								

AVG= _

HAB3-5. Plant Community Worksheet

Floating or Aquatic Spp	Invasive? Y/N	Co-dom?	Short spp <0.3m	Invasive?	Co-dom?

Medium spp 0.3-0.75m	Invasive?	Co-dom?	Tall spp 0.75-1.5m	Invasive?	Co-dom?
SPAL	N	Y			
SPDI	N	Y			

Very Tall spp >1.5m	Invasive?	Co-dom?	(A) # of Plant Layers	
PHRAG AUS.	Y	Y	(B) Total # of Native co-dominant species for all layers combined	3
BAHA	N	N	(C) Total # of Invasive co-dominant species for all layers combined	1
			(D) % of Invasive co-dominant species for all layers combined C/(B+C)	25%
			(E) % Invasive cover in AA	20%

HAB3. # of Plant Layers (A)

Alternative States	Rating (circle one)
4-5 layers	12
2-3 layers	9
1 layer	6
0 layer	3

HAB4. % Co-Dominant Invasive Species (D)

Alternative States	Rating (circle one)
0-15%	12
16-30%	9
31-45%	6
46-100%	3

HAB5. % Invasive Cover in AA (E)

Alternative States	Rating (circle one)
0%	12
>0-25%	9
26-50%	6
>50%	3

COMMENTS:

Mid-Atlantic Tidal Wetland Rapid Assessment Method V.3.0

Site Number: T9 Site Name: HRCS Tidal 9 Date: 01/28/16

Attributes and Metrics		Scores	Comments
Buffer/Landscape	**Raw #**		
B1. % of AA Perimeter with 5m Buffer	6		
B2. Average Buffer Width	3		
B3. Surrounded Developed	3		
B4. 250 Landscape Condition	3		
B5. Barriers to Landward Migration	3		
((((∑(B1,B2,B3,B4,B5))/60)*100)-25)/75)*100 = **Buffer Attribute Score**		Score: 6.7	
Hydrology	**Raw #**		
H1. Ditching & Draining	12		
H2. Fill & Fragmentation	9		
H3. Diking/Restriction	6		
H4. Point Sources	3		
((((∑(H1,H2,H3,H4))/48)*100)-25)/75)*100 = **Hydrology Attribute Score**		Score: 50.0	
Habitat	**Raw #**		
HAB1. Bearing Capacity	3		
HAB2. Horizontal Vegetative Obstruction	3		
HAB3. Number of Plant Layers	9		
HAB4. Percent Co-dominant Invasive Species	9		
HAB5. Percent Invasives	9		
((((∑(HAB1,HAB2,HAB3,HAB4,HAB5))/60)*100)-25)/75)*100 = **Habitat Attribute Score**		Score: 40.0	

((Buf/Land + Hydrology + Habitat Attribute Scores)/3)= Final Score

Final Score = 32.2

Photograph 1: T9 North

Photograph 2: T9 East

Photograph 3: T9 South

Photograph 4: T9 West

Photograph 5: T9 Stressor

Mid-Atlantic Tidal Wetland Rapid Assessment Method V3.0

Site # T26 Site Name HRCS Tidal 26 Date 1/28/16

Time of Start& Finish 2:20, 4:00 Crew SW, BM, JM, BC, KP, BY

Watershed Mason Creek Sub-Watershed

lat/long 36.563240; -76.16017 AA shape: circle or rectangle or entire wetland polygon (circle)

AA moved from original location? Yes or No (circle one) If yes, reason

Classification: (circle one)	Reference or Assessment (circle one)
Marine Tidal Fringe Fringing Estuarine Tidal Fringe Expansive Estuarine Tidal Fringe Back Barrier Estuarine Tidal Fringe	Natural Re-establishment, establishment Enhancement, Impoundment (circle one)

What best describes the tidal stage over the course of the time spent in the field? (circle one)
Note: It is recommended that the assessment be conducted at low tide.

Tide Stage

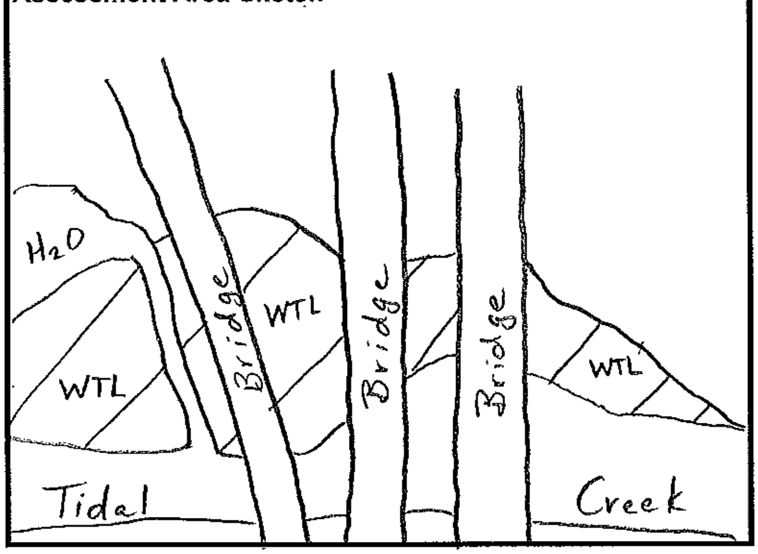
H <--------------------M--------------------> L

5 4 3 2 1

Range of Photo Identification Numbers:

Stressor Photo Description:

Assessment Area Sketch



low marsh or high marsh (circle one)
Distance to Upland 0 **meters**
Distance to Open Water 0 **meters**

Stability of AA (check one)
- ___ Healthy & Stable
- ✓ Beginning to deteriorate and/or some fragmentation
- ___ Severe deterioration and/or substantial fragmentation

Soils
Depth of organic layer (cm): >18 cm
Comments on soil sample: Muck

Salinity ____ **ppt**

Vegetation Communities and Features

enter midpoint for each species/combination present using the cover class chart below

0	Spartina alterniflora	63	Phragmites australis	88.5	root mat
38	Spartina patens	15.5	pannes, pools, creeks	15.5	unvegetated, mud or sand
0	Spart. alterniflora/Spart. cynosuroides	0	open water	2.5	unhealthy marsh- SWD, deterioration
0	Spartina patens-Distichlis spicata	0	ditches	2.5	other 1 Baccharis Ham.

Cover Classes	MidPt	Cover Classes	MidPt	Cover Classes	MidPt
0	0	6-25%	15.5	76-99%	88.5
<1%	0.5	26-50%	38	100%	100
1-5%	2.5	51-75%	63		

Comments:

Qualitative Disturbance Rating						
1	2	3	4	5	6	(circle one)
Low <-----------------Disturbace-----------------> High						

Assessment Complete: Yes No (circle one)

Mid-Atlantic Tidal Wetland Rapid Assessment Method V.3.0

Site # T26 Date 1 / 28 / 16

Attribute 1: Buffer/Landscape (All W/in 250m)

B1. Percent of Assessment Area Perimeter with 5m-Buffer

Record Estimated Percent 80 %	
Alternative States(not including open-water areas)	Rating (circle one)
Buffer is 100% of AA perimeter.	12
Buffer is 75-99% of AA perimeter.	9
Buffer is 50-74% of AA perimeter.	6
Buffer is <50% of AA perimeter.	3

B2. Average Buffer Width (max 250m)

Line	Buffer Width (m)
A	29
B	46
C	35
D	0
E	16
F	11
G	0
H	0
Average Buffer Width 17	
Alternative States	Rating (circle one)
Average buffer width 190-250m	12
Average buffer width 130-189m	9
Average buffer width 65-129m	6
Average buffer width 0-64m	3

B3. Surrounding Development between AA edge and 250m

Estimate Development 47 %	
Alternative States	Rating (circle one)
0% development	12
>0-5% development	9
>5-15% development	6
>15% development	3

B4. 250m Landscape Condition

Alternative States	Rating (circle one)
AA's surrounding landscape is comprised of only native vegetation, has undisturbed soils, and there is no evidence of human disturbance.	12
AA's surrounding landscape is dominated by native vegetation, has undisturbed soils, and there is to little or no evidence of human visitation.	9
AA's surrounding landscape is characterized by an intermediate mix of native and non-native vegetation, and/or a moderate degree of soil disturbance/compaction, and/or there is evidence of moderate human visitation.	6
AA's surrounding landscape is characterized by barren ground and/or dominated by invasive species and/or highly compacted or otherwise disturbed soils, and/or there is evidence of very intensive human visitation.	3

B5. Barriers to Landward Migration

% Perimeter Obstructed 50 %

Dist. From Center of AA 75 m

Alternative States	Rating (circle one)
Absent: no barriers	12
Low: <10% of perimeter obstructed	9
Moderate: 10-25% of perimeter obstructed	6
High: 26-100% of perimeter obstructed	3

Shoreline Test Metrics (comlete at low tide along open water shoreline)

S1: Shoreline Erosion

	Erosion Rating (1, 0, -1)
Transect #1	
Transect #2	
Transect #3	
Transect #4	
Transect #5	
Average:	

S2: Shoreline Alteration

	Shoreline altered or
Transect #1	
Transect #2	
Transect #3	
Transect #4	
Transect #5	
Average:	

Coorindates of Transects		
#1		
#2		
#3		
#4		
#5		

Attribute 2: Hydrology

H1. Ditching/Draining (AA only)

Alternative States	Rating (circle one)
No Ditching	12
Low Ditching	9
Moderate Ditching	6
Severe Ditching	3

H2. Fill & Fragmentation (AA only)

Alternative States	Rating (circle one)
No fill or fragmentation	12
Low fill or fragmentation	9
Moderate fill or fragmentation	6
Severe fill or fragmentation	3
Estimate amount of fill 10 % of AA	
Dimensions of Fill Pile /	

H3. Diking & Tidal Restriction (250m)

Description of restriction: Roads

Alternative States	Rating (circle one)
Absent: no restriction, free flow, normal range	12
Low: restriction presumed (<10% of normal range)	9
Moderate restriction (10-25% normal range)	6
High (26-100 of normal range)	3

H4. Point Sources (250m)

Alternative States	Rating (circle one)
Absent: no discharge	12
Low: one small discharge from a natural area	9
Moderate: one discharge from a developed area or two discharges from a natural area	6
High: ≥ 2 discharges from a developed area or ≥ 3 from a natural area	3

Attribute 3: Habitat (All W/in AA)

used a 15.5 pound fence post driver instead of an 18 pound slide hammer

HAB1. Bearing Capacity (Hummocks)

	Mark Depth (cm)							
	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	Plot 8
Water Depth (cm)	0	0	0	0	0	0	0	0
Initial capacity	0	0	0	0.5	2.5	1.5	3.0	1.0
Blow 1	3.0	1.0	2.0	3.0	7.5	7.0	5.0	3.5
Blow 2	3.0	1.5	3.0	5.5	10.5	9.0	10.0	5.0
Blow 3	3.5	2.5	4.0	6.0	13.0	11.0	17.0	7.0
Blow 4	3.5	3.0	4.5	7.5	16.0	12.0	23.0	9.0
Blow 5 (Final)	3.5	3.5	5.0	8.0	18.0	13.0	29.0	12.0
Final - Initial	3.5	3.5	5.0	7.5	15.5	11.5	26.0	11.0

AVG= 10.44

* % of AA in hollows x hollows average (HAB1) = /
% of AA in hummocks x hummocks avg (HAB1b)= /
Sum of two weighted averages = /

Av. of Final - Initial for the 8 Sub-plots	Rating (circle one)
≤ 1.8	12
1.9-4.0	9
4.1-6.2	6
> 6.2	3

Average Final-Initial = 10.44 cm

HAB2. Horizontal Vegetative Obstruction

Sub-plot	1	3	5	7
0.25m	3	3	10	7
0.50m	10	10	10	7
0.75m	10	10	10	9
Sum	23	23	30	23
Veg. type	SPPA	Phrag.	Phrag.	Phrag.

Average of 4 Sub-plots 24.75

Average of 4 Sub-plot totals	Rating
< 7	12
< 12 ≥7	9
<22 ≥ 12	6
≥22	3

AA = 8000m² 5% of AA = 400m² = 20mx20m 400m² = 11.3m radius circle
Buffer = 274,750m² 5% of Buffer = 13,737m² = 117m x 117m

HAB1b. Bearing Capacity (Unvegetated Hollows) if applicable*

	Mark Depth (cm)							
	Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8
Water depth (cm)								
Initial capacity								
Blow 1								
Blow 2								
Blow 3								
Blow 4								
Blow 5								
Final - Initial								

AVG= –

HAB3-5. Plant Community Worksheet

Floating or Aquatic Spp	Invasive? Y/N	Co-dom?	Short spp <0.3m	Invasive?	Co-dom?

Medium spp 0.3-0.75m	Invasive?	Co-dom?	Tall spp 0.75-1.5m	Invasive?	Co-dom?
Spartina patens	N	Y			
Schenoplectus Sp.	N	Y			
Lonicera japonica	Y	N			

Very Tall spp >1.5m	Invasive?	Co-dom?		
			(A) # of Plant Layers	2
Phrag. Aus.	Y	Y	(B) Total # of Native co-dominant species for all layers combined	2
Baccharis Ham.	N	N	(C) Total # of Invasive co-dominant species for all layers combined	1
live Oak	N	N	(D) % of Invasive co-dominant species for all layers combined C/(B+C)	33%
Ulmus ala.	N	N	(E) % Invasive cover in AA	75%

HAB3. # of Plant Layers (A)

Alternative States	Rating (circle one)
4-5 layers	12
2-3 layers	9
1 layer	6
0 layer	3

HAB4. % Co-Dominant Invasive Species (D)

Alternative States	Rating (circle one)
0-15%	12
16-30%	9
31-45%	6
46-100%	3

HAB5. % Invasive Cover in AA (E)

Alternative States	Rating (circle one)
0%	12
>0-25%	9
26-50%	6
>50%	3

COMMENTS:

Mid-Atlantic Tidal Wetland Rapid Assessment Method V.3.0

Site Number: T26 **Site Name:** HRCS Tidal 26 **Date:** 1/28/16

Attributes and Metrics	Raw #	Scores	Comments
Buffer/Landscape	**Raw #**		
B1. % of AA Perimeter with 5m Buffer	9		
B2. Average Buffer Width	3		
B3. Surrounded Developed	3		
B4. 250 Landscape Condition	3		
B5. Barriers to Landward Migration	3		
((((∑(B1,B2,B3,B4,B5))/60)*100)-25)/75)*100 = **Buffer Attribute Score**		Score: 13.3	
Hydrology	**Raw #**		
H1. Ditching & Draining	12		
H2. Fill & Fragmentation	9		
H3. Diking/Restriction	3		
H4. Point Sources	6		
((((∑(H1,H2,H3,H4))/48)*100)-25)/75)*100 = **Hydrology Attribute Score**		Score: 50	
Habitat	**Raw #**		
HAB1. Bearing Capacity	3		
HAB2. Horizontal Vegetative Obstruction	3		
HAB3. Number of Plant Layers	9		
HAB4. Percent Co-dominant Invasive Species	6		
HAB5. Percent Invasives	3		
((((∑(HAB1,HAB2,HAB3,HAB4,HAB5))/60)*100)-25)/75)*100 = **Habitat Attribute Score**		Score: 20	

((Buf/Land + Hydrology + Habitat Attribute Scores)/3)= Final Score

Final Score = 27.8

Photograph 1: T26 North

Photograph 2: T26 East

Photograph 3: T26 South

Photograph 4: T26 West

Photograph 5: T26 Stressor

Mid-Atlantic Tidal Wetland Rapid Assessment Method V3.0

Site # T73 Site Name HRCS Tidal 73 Date 2/10/16

Time of Start& Finish 2:00 3:30 Crew Sean Wender, Scott Kupiec, B. Mauck

Watershed Elizabeth River Sub-Watershed ____

lat/long 36.531496; -76.214661 AA shape: circle or rectangle or entire wetland polygon (circle)

AA moved from original location? Yes or No (circle one) If yes, reason ____

Classification: (circle one)	Reference or Assessment (circle one)
Marine Tidal Fringe Fringing Estuarine Tidal Fringe Expansive Estuarine Tidal Fringe Back Barrier Estuarine Tidal Fringe	Natural Re-establishment, establishment Enhancement, Impoundment (circle one)

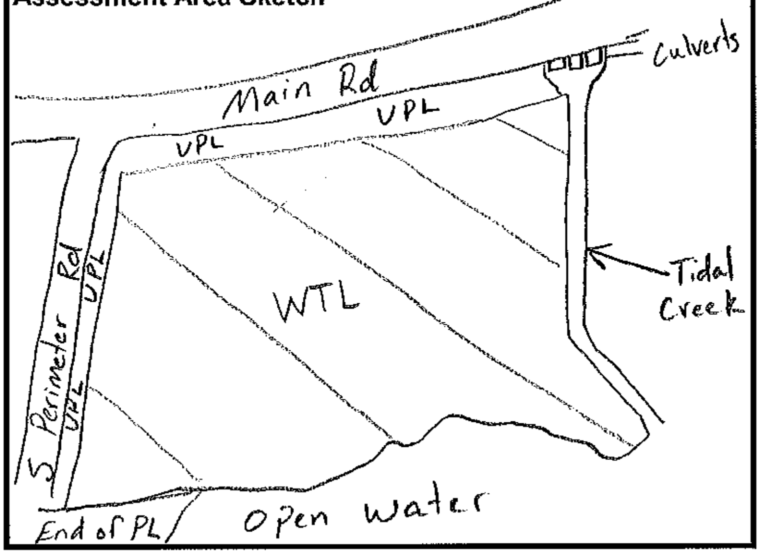
What best describes the tidal stage over the course of the time spent in the field? (circle one)
Note: It is recommended that the assessment be conducted at low tide.

Tide Stage
H <--------------------M--------------------> L
5 4 3 2 1

Range of Photo Identification Numbers:

Stressor Photo Description:

Assessment Area Sketch



low marsh or high marsh (circle one)
Distance to Upland 0 **meters**
Distance to Open Water 0 **meters**

Stability of AA (check one)
✓ Healthy & Stable
____ Beginning to deteriorate and/or some fragmentation
____ Severe deterioration and/or substantial fragmentation

Soils
Depth of organic layer (cm): >18cm
Comments on soil sample: Muck

Salinity ____ **ppt**

Vegetation Communities and Features

enter midpoint for each species/combination present using the cover class chart below

88.5 Spartina alterniflora	15.5 Phragmites australis	88.5 root mat
____ Spartina patens	____ pannes, pools, creeks	0.5 unvegetated, mud or sand
____ Spart. alterniflora/Spart. cynosuroides	____ open water	____ unhealthy marsh- SWD, deterioration
____ Spartina patens-Distichlis spicata	____ ditches	____ other 1 ____

Cover Classes	MidPt	Cover Classes	MidPt	Cover Classes	MidPt
0	0	6-25%	15.5	76-99%	88.5
<1%	0.5	26-50%	38	100%	100
1-5%	2.5	51-75%	63		

Comments:

Qualitative Disturbance Rating						
1	2	3	4	5	6	(circle one)
Low <------------------Disturbace------------------> High						

 Assessment Complete: Yes No (circle one)

Mid-Atlantic Tidal Wetland Rapid Assessment Method V.3.0

Site # T73 Date 2/10/16

Attribute 1: Buffer/Landscape (All W/in 250m)

B1. Percent of Assessment Area Perimeter with 5m-Buffer

Record Estimated Percent 100 %	
Alternative States(not including open-water areas)	Rating (circle one)
Buffer is 100% of AA perimeter.	12
Buffer is 75-99% of AA perimeter.	9
Buffer is 50-74% of AA perimeter.	6
Buffer is <50% of AA perimeter.	3

B2. Average Buffer Width (max 250m)

Line	Buffer Width (m)
A	135
B	126
C	7
D	6
E	6
F	0
G	0
H	0
Average Buffer Width 35	
Alternative States	Rating (circle one)
Average buffer width 190-250m	12
Average buffer width 130-189m	9
Average buffer width 65-129m	6
Average buffer width 0-64m	3

B3. Surrounding Development between AA edge and 250m

Estimate Development 3 %	
Alternative States	Rating (circle one)
0% development	12
>0-5% development	9
>5-15% development	6
>15% development	3

B4. 250m Landscape Condition

Alternative States	Rating (circle one)
AA's surrounding landscape is comprised of only native vegetation, has undisturbed soils, and there is no evidence of human disturbance.	12
AA's surrounding landscape is dominated by native vegetation, has undisturbed soils, and there is to little or no evidence of human visitation.	9
AA's surrounding landscape is characterized by an intermediate mix of native and non-native vegetation, and/or a moderate degree of soil disturbance/compaction, and/or there is evidence of moderate human visitation.	6
AA's surrounding landscape is characterized by barren ground and/or dominated by invasive species and/or highly compacted or otherwise disturbed soils, and/or there is evidence of very intensive human visitation.	3

B5. Barriers to Landward Migration

% Perimeter Obstructed 100 %

Dist. From Center of AA 70 m

Alternative States	Rating (circle one)
Absent: no barriers	12
Low: <10% of perimeter obstructed	9
Moderate: 10-25% of perimeter obstructed	6
High: 26-100% of perimeter obstructed	3

Shoreline Test Metrics (comlete at low tide along open water shoreline)

S1: Shoreline Erosion

	Erosion Rating (1, 0, -1)
Transect #1	
Transect #2	
Transect #3	
Transect #4	
Transect #5	
Average:	

S2: Shoreline Alteration

	Shoreline altered or
Transect #1	
Transect #2	
Transect #3	
Transect #4	
Transect #5	
Average:	

Coorindates of Transects		
#1		
#2		
#3		
#4		
#5		

Attribute 2: Hydrology

H1. Ditching/Draining (AA only)

Alternative States	Rating (circle one)
No Ditching	12
Low Ditching	9
Moderate Ditching	6
Severe Ditching	3

H2. Fill & Fragmentation (AA only)

Alternative States	Rating (circle one)
No fill or fragmentation	12
Low fill or fragmentation	9
Moderate fill or fragmentation	6
Severe fill or fragmentation	3
Estimate amount of fill 5 % of AA	
Dimensions of Fill Pile /	

H3. Diking & Tidal Restriction (250m)

Description of restriction: Roads

Alternative States	Rating (circle one)
Absent: no restriction, free flow, normal range	12
Low: restriction presumed (<10% of normal range)	9
Moderate restriction (10-25% normal range)	6
High (26-100 of normal range)	3

H4. Point Sources (250m)

Alternative States	Rating (circle one)
Absent: no discharge	12
Low: one small discharge from a natural area	9
Moderate: one discharge from a developed area or two discharges from a natural area	6
High: ≥ 2 discharges from a developed area or ≥ 3 from a natural area	3

Attribute 3: Habitat (All W/in AA)

used a 15.5 pound fence post driver instead of an 18 pound slide hammer

HAB1. Bearing Capacity (Hummocks)

	Mark Depth (cm)							
	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	Plot 8
Water Depth (cm)	1.0	0.5	0.5	0	2.0	1.0	0	2.0
Initial capacity	1.0	2.0	1.0	7.5	3.5	6.0	0.5	50.0
Blow 1	8.0	6.0	3.5	12.5	7.0	14.0	3.75	60.0
Blow 2	13.0	9.5	4.0	15.5	11.0	19.5	6.0	>60.0
Blow 3	16.5	13.0	5.0	18.0	13.5	25.0	8.0	–
Blow 4	20.0	17.0	6.5	19.5	15.0	32.0	9.0	–
Blow 5 (Final)	24.0	24.0	8.5	20.0	18.5	42.25	9.5	–
Final - Initial	23.0	22.0	7.5	12.5	15.0	36.25	9.0	>10.0

AVG= 18.0 cm

* % of AA in hollows x hollows average (HAB1) = /
% of AA in hummocks x hummocks avg (HAB1b)= /
Sum of two weighted averages = /

Av. of Final - Initial for the 8 Sub-plots	Rating (circle one)
≤ 1.8	12
1.9-4.0	9
4.1-6.2	6
> 6.2	3

Average Final-Initial = 18.0 cm

HAB2. Horizontal Vegetative Obstruction

Sub-plot	1	3	5	7
0.25m	0	0	0	0
0.50m	0	0	9	0
0.75m	10	10	10	0
Sum	10	10	19	0
Veg. type	SPAL	SPAL	SPAL	Phrag.

Average of 4 Sub-plots 9.75	
Average of 4 Sub-plot totals	Rating
< 7	12
< 12 ≥ 7	9
<22 ≥ 12	6
≥22	3

AA = 8000m² 5% of AA = 400m² = 20mx20m 400m² = 11.3m radius circle

Buffer = 274,750m² 5% of Buffer = 13,737m² = 117m x 117m

HAB1b. Bearing Capacity (Unvegetated Hollows) if applicable*

	Mark Depth (cm)							
	Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8
Water depth (cm)								
Initial capacity								
Blow 1								
Blow 2								
Blow 3								
Blow 4								
Blow 5								
Final - Initial								

AVG= _

HAB3-5. Plant Community Worksheet

Floating or Aquatic Spp	Invasive? Y/N	Co-dom?	Short spp <0.3m	Invasive?	Co-dom?
Medium spp 0.3-0.75m	**Invasive?**	**Co-dom?**	**Tall spp 0.75-1.5m**	**Invasive?**	**Co-dom?**
			SPAT	N	Y
Very Tall spp >1.5m	**Invasive?**	**Co-dom?**	**(A) # of Plant Layers**		2
Phrag. Aus.	Y	N	**(B) Total # of Native co-dominant species for all layers combined**		1
			(C) Total # of Invasive co-dominant species for all layers combined		0
			(D) % of Invasive co-dominant species for all layers combined C/(B+C)		0
			(E) % Invasive cover in AA		2.5

HAB3. # of Plant Layers (A)

Alternative States	Rating (circle one)
4-5 layers	12
2-3 layers	9
1 layer	6
0 layer	3

HAB4. % Co-Dominant Invasive Species (D)

Alternative States	Rating (circle one)
0-15%	12
16-30%	9
31-45%	6
46-100%	3

HAB5. % Invasive Cover in AA (E)

Alternative States	Rating (circle one)
0%	12
>0-25%	9
26-50%	6
>50%	3

COMMENTS:

Mid-Atlantic Tidal Wetland Rapid Assessment Method V.3.0

Site Number: T73 **Site Name:** HRCS Tidal 73 **Date:** 2/10/16

Attributes and Metrics		Scores	Comments
Buffer/Landscape	**Raw #**		
B1. % of AA Perimeter with 5m Buffer	12		
B2. Average Buffer Width	3		
B3. Surrounded Developed	9		
B4. 250 Landscape Condition	6		
B5. Barriers to Landward Migration	3		
((((∑(B1,B2,B3,B4,B5))/60)*100)-25)/75)*100 = **Buffer Attribute Score**		Score: 40.0	
Hydrology	**Raw #**		
H1. Ditching & Draining	12		
H2. Fill & Fragmentation	9		
H3. Diking/Restriction	6		
H4. Point Sources	9		
((((∑(H1,H2,H3,H4))/48)*100)-25)/75)*100 = **Hydrology Attribute Score**		Score: 66.6	
Habitat	**Raw #**		
HAB1. Bearing Capacity	3		
HAB2. Horizontal Vegetative Obstruction	9		
HAB3. Number of Plant Layers	9		
HAB4. Percent Co-dominant Invasive Species	12		
HAB5. Percent Invasives	9		
((((∑(HAB1,HAB2,HAB3,HAB4,HAB5))/60)*100)-25)/75)*100 = **Habitat Attribute Score**		Score: 60.0	

((Buf/Land + Hydrology + Habitat Attribute Scores)/3)= Final Score **Final Score =** 55.5

Photograph 1: T73 North

Photograph 2: T73 East

Photograph 3: T73 South

Photograph 4: T73 West

Photograph 5: T73 Stressor

Mid-Atlantic Tidal Wetland Rapid Assessment Method V3.0

Site # T107 Site Name HRCS Tidal 107 Date 1/28/16

Time of Start& Finish 4 : 20 5 : 30 Crew S. Wender, J. Mann, B. Mauck, B. Conners

Watershed Bailey Creek Sub-Watershed ____

lat/long 36.485144 ; -76.255407 AA shape: circle or rectangle or entire wetland polygon (circle)

AA moved from original location? Yes or No (circle one) If yes, reason ____

Classification: (circle one)	Reference or Assessment (circle one)
Marine Tidal Fringe Fringing Estuarine Tidal Fringe Expansive Estuarine Tidal Fringe Back Barrier Estuarine Tidal Fringe	Natural, Re-establishment, establishment Enhancement, Impoundment (circle one)

What best describes the tidal stage over the course of the time spent in the field? (circle one)
Note: It is recommended that the assessment be conducted at low tide.

Tide Stage

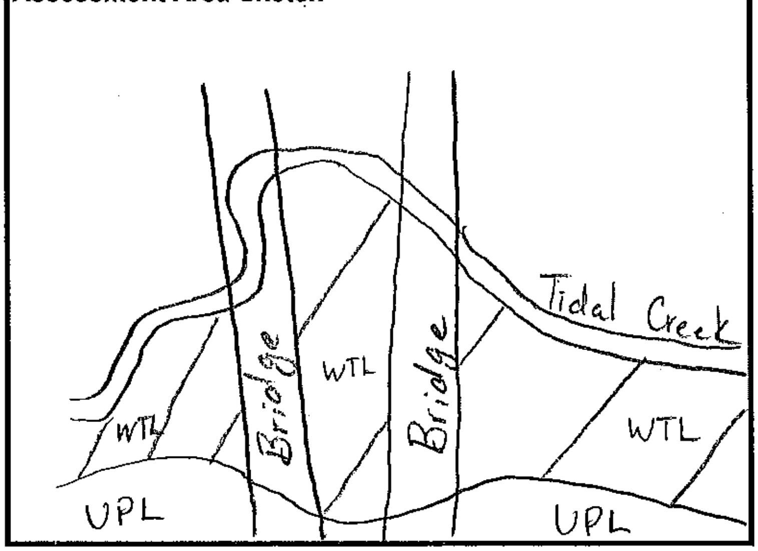
H <--------------------M--------------------> L

5 4 3 2 1

Range of Photo Identification Numbers:

Stressor Photo Description:

Assessment Area Sketch



low marsh or high marsh (circle one)
Distance to Upland 0 **meters**
Distance to Open Water 0 **meters**

Stability of AA (check one)	
	Healthy & Stable
✓	Beginning to deteriorate and/or some fragmentation
	Severe deterioration and/or substantial fragmentation

Soils
Depth of organic layer (cm): > 18 cm
Comments on soil sample:
Muck

Salinity ____ **ppt**

Vegetation Communities and Features

enter midpoint for each species/combination present using the cover class chart below

0	Spartina alterniflora	88.5	Phragmites australis	88.5	root mat
0	Spartina patens	0	pannes, pools, creeks	15.5	unvegetated, mud or sand
15.5	Spart. alterniflora/Spart. cynosuroides	0	open water	0	unhealthy marsh- SWD, deterioration
0	Spartina patens-Distichlis spicata	0	ditches	0	other 1 ____

Cover Classes	MidPt	Cover Classes	MidPt	Cover Classes	MidPt
0	0	6-25%	15.5	76-99%	88.5
<1%	0.5	26-50%	38	100%	100
1-5%	2.5	51-75%	63		

Comments:

Qualitative Disturbance Rating						
1	2	3	4	5	6	(circle one)
Low <----------------------------------Disturbace----------------------------------> High						

Assessment Complete: Yes No (circle one)

Mid-Atlantic Tidal Wetland Rapid Assessment Method V.3.0

Site # T107 Date 1 / 28 / 16

Attribute 1: Buffer/Landscape (All W/in 250m)

B1. Percent of Assessment Area Perimeter with 5m-Buffer

Record Estimated Percent 95 %	
Alternative States(not including open-water areas)	**Rating (circle one)**
Buffer is 100% of AA perimeter.	12
Buffer is 75-99% of AA perimeter.	9
Buffer is 50-74% of AA perimeter.	6
Buffer is <50% of AA perimeter.	3

B2. Average Buffer Width (max 250m)

Line	Buffer Width (m)
A	132
B	160
C	154
D	0
E	250
F	92
G	151
H	9
Average Buffer Width 118.5	
Alternative States	**Rating (circle one)**
Average buffer width 190-250m	12
Average buffer width 130-189m	9
Average buffer width 65-129m	6
Average buffer width 0-64m	3

B3. Surrounding Development between AA edge and 250m

Estimate Development 47 %	
Alternative States	**Rating (circle one)**
0% development	12
>0-5% development	9
>5-15% development	6
>15% development	3

B4. 250m Landscape Condition

Alternative States	Rating (circle one)
AA's surrounding landscape is comprised of only native vegetation, has undisturbed soils, and there is no evidence of human disturbance.	12
AA's surrounding landscape is dominated by native vegetation, has undisturbed soils, and there is to little or no evidence of human visitation.	9
AA's surrounding landscape is characterized by an intermediate mix of native and non-native vegetation, and/or a moderate degree of soil disturbance/compaction, and/or there is evidence of moderate human visitation.	6
AA's surrounding landscape is characterized by barren ground and/or dominated by invasive species and/or highly compacted or otherwise disturbed soils, and/or there is evidence of very intensive human visitation.	3

B5. Barriers to Landward Migration

% Perimeter Obstructed 48 %

Dist. From Center of AA 35 m

Alternative States	Rating (circle one)
Absent: no barriers	12
Low: <10% of perimeter obstructed	9
Moderate: 10-25% of perimeter obstructed	6
High: 26-100% of perimeter obstructed	3

Shoreline Test Metrics (comlete at low tide along open water shoreline)

S1: Shoreline Erosion

	Erosion Rating (1, 0, -1)
Transect #1	
Transect #2	
Transect #3	
Transect #4	
Transect #5	
Average:	

S2: Shoreline Alteration

	Shoreline altered or
Transect #1	
Transect #2	
Transect #3	
Transect #4	
Transect #5	
Average:	

Coorindates of Transects		
#1		
#2		
#3		
#4		
#5		

Attribute 2: Hydrology

H1. Ditching/Draining (AA only)

Alternative States	Rating (circle one)
No Ditching	12
Low Ditching	9
Moderate Ditching	6
Severe Ditching	3

H2. Fill & Fragmentation (AA only)

Alternative States	Rating (circle one)
No fill or fragmentation	12
Low fill or fragmentation	9
Moderate fill or fragmentation	6
Severe fill or fragmentation	3

Estimate amount of fill 5 % of AA

Dimensions of Fill Pile /

H3. Diking & Tidal Restriction (250m)

Description of restriction: Road/Bridge

Alternative States	Rating (circle one)
Absent: no restriction, free flow, normal range	12
Low: restriction presumed (<10% of normal range)	9
Moderate restriction (10-25% normal range)	6
High (26-100 of normal range)	3

H4. Point Sources (250m)

Alternative States	Rating (circle one)
Absent: no discharge	12
Low: one small discharge from a natural area	9
Moderate: one discharge from a developed area or two discharges from a natural area	6
High: ≥ 2 discharges from a developed area or ≥ 3 from a natural area	3

Attribute 3: Habitat (All W/in AA)

used a 15.5 pound fence post driver instead of an 18 pound slide hammer

HAB1. Bearing Capacity (Hummocks)

	Mark Depth (cm)							
	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	Plot 8
Water Depth (cm)	0	0	0	0	0	0	0	0
Initial capacity	3.0	4.0	2.0	2.5	2.0	9.5	2.0	1.0
Blow 1	5.0	5.5	4.5	6.5	5.0	14.0	5.0	3.5
Blow 2	9.0	9.0	6.5	7.0	8.0	17.0	6.5	5.0
Blow 3	16.0	12.0	8.0	8.0	9.0	20.0	7.5	5.5
Blow 4	22.0	15.5	9.5	8.5	10.0	22.0	8.0	6.0
Blow 5 (Final)	28.0	17.0	11.0	9.0	11.0	25.0	9.0	7.0
Final - Initial	25.0	13.0	9.0	6.5	9.0	15.5	7.0	6.0

AVG= 11.38

* % of AA in hollows x hollows average (HAB1) =	/
% of AA in hummocks x hummocks avg (HAB1b)=	/
Sum of two weighted averages =	/

Av. of Final - Initial for the 8 Sub-plots	Rating (circle one)
≤ 1.8	12
1.9-4.0	9
4.1-6.2	6
> 6.2	3

Average Final-Initial = 11.38 cm

HAB2. Horizontal Vegetative Obstruction

Sub-plot	1	3	5	7
0.25m	0	2	0	0
0.50m	0	3	0	0
0.75m	0	4	0	0
Sum	0	9	0	0
Veg. type	Phrag.	Phrag.	Phrag.	Phrag.

Average of 4 Sub-plots	
Average of 4 Sub-plot totals	Rating
< 7	12
< 12 ≥7	9
<22 ≥ 12	6
≥22	3

AA = 8000m² 5% of AA = 400m² = 20mx20m 400m² = 11.3m radius circle

Buffer = 274,750m² 5% of Buffer = 13,737m² = 117m x 117m

HAB1b. Bearing Capacity (Unvegetated Hollows) if applicable*

	Mark Depth (cm)							
	Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8
Water depth (cm)								
Initial capacity								
Blow 1								
Blow 2								
Blow 3								
Blow 4								
Blow 5								
Final - Initial								

AVG=

HAB3-5. Plant Community Worksheet

Floating or Aquatic Spp	Invasive? Y/N	Co-dom?	Short spp <0.3m	Invasive?	Co-dom?

Medium spp 0.3-0.75m	Invasive?	Co-dom?	Tall spp 0.75-1.5m	Invasive?	Co-dom?

Very Tall spp >1.5m	Invasive?	Co-dom?	(A) # of Plant Layers	1
Phrag. Aus.	Y	Y	(B) Total # of Native co-dominant species for all layers combined	1
Spartina Cyn.	N	Y	(C) Total # of Invasive co-dominant species for all layers combined	1
			(D) % of Invasive co-dominant species for all layers combined C/(B+C)	50%
			(E) % Invasive cover in AA	85%

HAB3. # of Plant Layers (A)

Alternative States	Rating (circle one)
4-5 layers	12
2-3 layers	9
1 layer	6
0 layer	3

HAB4. % Co-Dominant Invasive Species (D)

Alternative States	Rating (circle one)
0-15%	12
16-30%	9
31-45%	6
46-100%	3

HAB5. % Invasive Cover in AA (E)

Alternative States	Rating (circle one)
0%	12
>0-25%	9
26-50%	6
>50%	3

COMMENTS:

Mid-Atlantic Tidal Wetland Rapid Assessment Method V.3.0

Site Number: T107 **Site Name:** HRCS Tidal 107 **Date:** 1/28/16

Attributes and Metrics		**Scores**	**Comments**
Buffer/Landscape	**Raw #**		
B1. % of AA Perimeter with 5m Buffer	9		
B2. Average Buffer Width	6		
B3. Surrounded Developed	3		
B4. 250 Landscape Condition	3		
B5. Barriers to Landward Migration	3		
((((∑(B1,B2,B3,B4,B5))/60)*100)-25)/75)*100 = **Buffer Attribute Score**		Score: 20	
Hydrology	**Raw #**		
H1. Ditching & Draining	12		
H2. Fill & Fragmentation	9		
H3. Diking/Restriction	9		
H4. Point Sources	6		
((((∑(H1,H2,H3,H4))/48)*100)-25)/75)*100 = **Hydrology Attribute Score**		Score: 66.7	
Habitat	**Raw #**		
HAB1. Bearing Capacity	3		
HAB2. Horizontal Vegetative Obstruction	12		
HAB3. Number of Plant Layers	6		
HAB4. Percent Co-dominant Invasive Species	3		
HAB5. Percent Invasives	3		
((((∑(HAB1,HAB2,HAB3,HAB4,HAB5))/60)*100)-25)/75)*100 = **Habitat Attribute Score**		Score: 26.7	

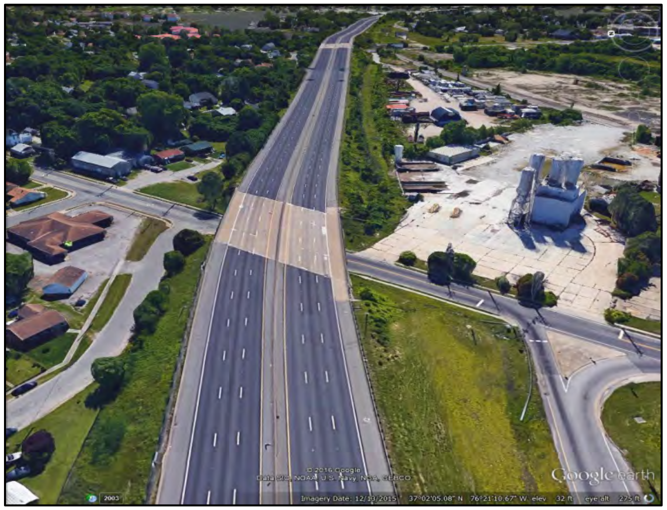
((Buf/Land + Hydrology + Habitat Attribute Scores)/3)= Final Score

Final Score = 37.8

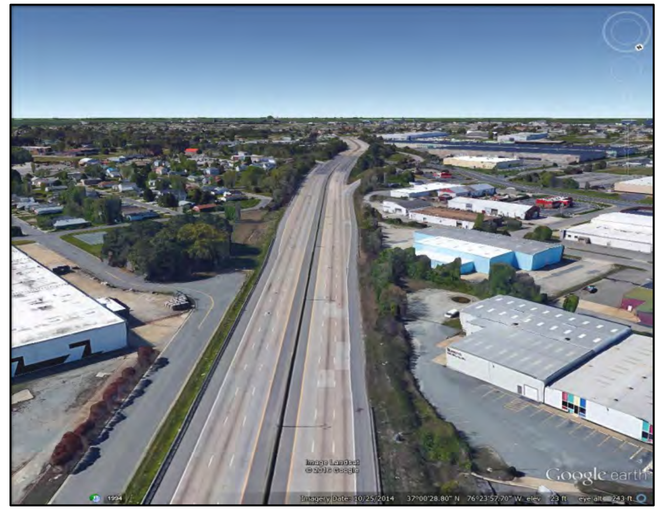
APPENDIX E:

AERIAL PHOTOGRAPHS

I-64 Eastbound at Rip Rap Road
(Alts A, B, & D)

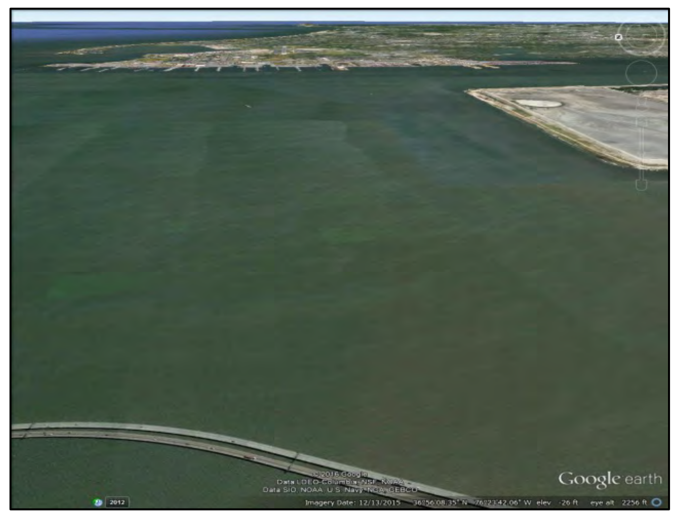


I-664 Southbound at Park Place Neighborhood
(Alts C & D)

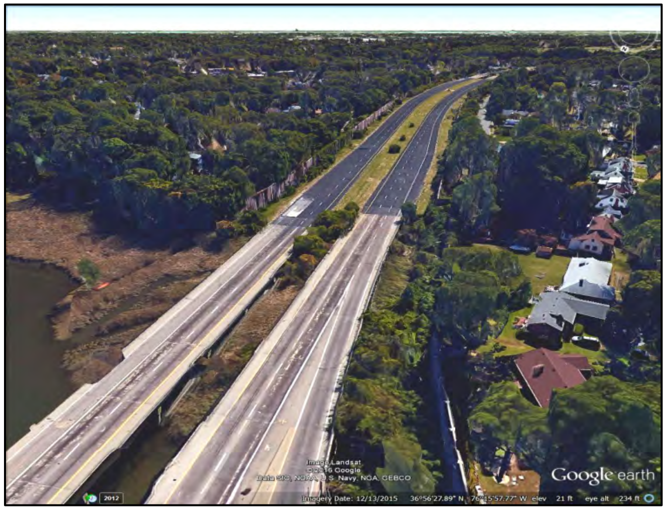


I-64 Westbound, Looking Northwest toward Hampton
(Alts A, B, & D)

Proposed Location of New Crossings (Looking East)
(Alts B, C, & D)



I-64 in Norfolk (Looking South)
(Alts A, B, & D)



VA 164 Looking West
(Alts B, C, & D)

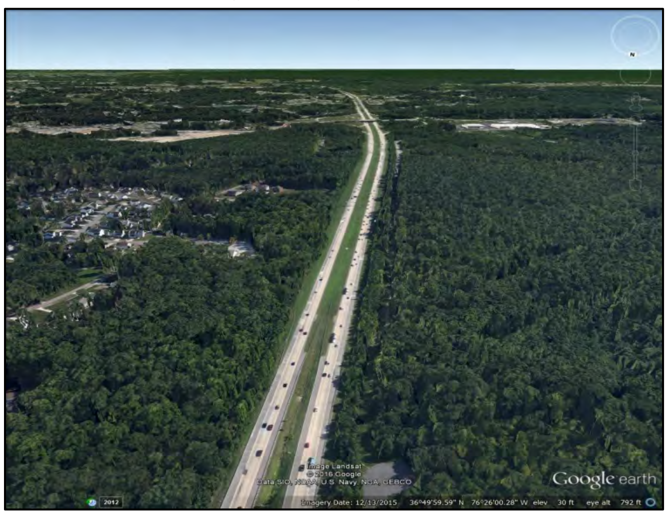
I-64/I-564 Interchange (Looking North)
(Alts A, B, C, & D)

Proposed VA 164 Connector Area (Looking North)
(Alts B, C, & D)

I-664 Downtown Newport News (Looking South)
(Alts C & D)

I-664 in Suffolk
(Alts C & D)

I-664 in Chesapeake
(Alts C & D)



APPENDIX F:

THREATENED AND ENDANGERED SPECIES CORRESPONDENCE

From: Nystrom, Sarah [mailto:sarah_nystrom@fws.gov]
Sent: Tuesday, January 19, 2016 1:34 PM
To: Wender, Sean
Subject: Re: hampton roads

Hi Sean,

Thanks for your follow up call. Given the scope of the project, you and Kenny Presgrave can be considered qualified to conduct the habitat assessment for the Hampton Roads project. Feel free to let me know if you have any additional questions.

Please contact Ruth Boettcher at VDGIF for any additional data about piping plovers and red knots that may potentially be using the project area.

Thanks!

Sarah

On Mon, Jan 4, 2016 at 2:06 PM, Wender, Sean <sean.wender@stantec.com> wrote:

Sarah,

I am following up on your response to Scott Smizik at VDOT on my and Kenny Presgrave's qualifications to survey for the piping plover and red knot. We are conducting a preliminary and conservative estimate of habitat potential to compare impacts between the proposed alternatives. While we do not have much experience with these two species, we have extensive experience with other species of birds and the assessment of specific habitat criteria for terrestrial and aquatic species throughout the state. Most of my shorebird observations have been with birdwatching in my personal time..

There is no question that the route along Craney Island will impact the most habitat. We are just trying to be consistent with our approach for other terrestrial T&E species. We will not be doing any presence/absence surveys for the species as part of this project.

Given the scope of the project, I feel that Kenny and I are qualified to conduct the habitat assessment for these species. I will also be coordinating with one of our biologists out of Maine who does have more experience with shorebirds (resume attached).

At this time I am only requesting approval for this project.

Please let me know if you have any questions or need additional information.

Thank you. Happy New Year.

Sean Wender, PWD

Senior Ecologist
Stantec
1011 Boulder Springs Drive Suite 225 Richmond VA 23225-4951
Phone: (804) 267-3474
Cell: (804) 317-8027
Fax: (804) 267-3470
sean.wender@stantec.com

From: Nystrom, Sarah [mailto:sarah_nystrom@fws.gov]
Sent: Monday, December 14, 2015 8:57 AM
To: Smizik, Scott (VDOT)
Subject: Hampton Roads Crossing Study SEIS

This message responds to your request for concurrence of species requiring survey for the Hampton Roads Crossing Study Supplemental Environmental Impact Statement received November 6, 2015 associated with a project in the independent cities of Chesapeake, Hampton, Newport News, Norfolk, Portsmouth, and Suffolk. The following comments are provided under provisions of the Endangered Species Act of 1973 (16 U.S.C. 1531-1544, 87 Stat. 884), as amended.

Your proposed federally listed species survey plan is consistent with the species that have been identified through the U.S. Fish and Wildlife Service's Information for Planning and Conservation Database for this action area. We concur with your proposed federally listed survey plan.

Habitat assessments and surveys must be conducted by a qualified surveyor. One of the proposed surveyors, Sean Wender, is currently included in the list of individuals who are qualified to conduct habitat assessments/surveys for northern long-eared bat in Virginia.

Sean Wender and Kenny Presgraves are not currently included in the list of individuals who are qualified to conduct habitat assessments/surveys for piping plover (Charadrius melodus) or red knot (Calidris canutus rufa) in Virginia. Please provide these individuals' qualifications to this office for review and approval 60 days prior to the start of the habitat assessment/survey. If a habitat assessment determines there is habitat for one or more of the referenced species, a species survey by an approved surveyor is needed. If the survey determines that any rare species are present, contact this office to allow us the opportunity to work with you to avoid or minimize adverse effects to rare species and their habitats during project design and implementation.

Upon completion of the habitat assessment, include the results of the habitat assessment, including the information as listed in the survey guidance, in in the project review package when it is submitted to this office for review.

Should project plans change or if additional information on the distribution of listed species or critical habitat becomes available, this determination may be reconsidered. If you have any questions, please contact me at (804) 824-2413, or via email at Sarah_Nystrom@fws.gov.

Thanks!

Sarah Nystrom
Fish and Wildlife Biologist
Virginia Field Office - Ecological Services
6669 Short Lane
Gloucester, Virginia 23061
(804) 824-2413

From: Baird, Alice (DCR)
Sent: Wednesday, November 18, 2015 11:49 AM
To: Smizik, Scott (VDOT)
Subject: RE: Hampton Roads Crossing Study - Concurrence of Species Requiring Survey_Habitat Survey Pre-qualification

Scott,

Comments from DCR-DNH to Stantec regarding this project are attached. There are several other rare species that have been documented in the project area. We noted that Elliott's aster (*Symphyotrichum elliottii*, G4/S1/NL/NL)has been historically documented within the project site and we recommended a survey for the resource in the project areas in Goose Creek and Bailey Creek.

Sincerely,

Alli

Molly Joseph Ward
Secretary of Natural Resources

Clyde E. Cristman
Director

Joe Elton
Deputy Director of Operations

Rochelle Altholz
Deputy Director of Administration and Finance

David Dowling
Deputy Director of Soil and Water and Dam Safety

COMMONWEALTH *of* VIRGINIA

DEPARTMENT OF CONSERVATION AND RECREATION

November 12, 2015

Tara Dillard
Stantec Consulting Services, Inc.
1011 Boulder Springs Drive
Richmond, VA 23225

Re: 203400545, HRCS Study – Alternatives A, B, C1 and C2

Dear Ms. Dillard:

The Department of Conservation and Recreation's Division of Natural Heritage (DCR) has searched its Biotics Data System for occurrences of natural heritage resources from the area outlined on the submitted map. Natural heritage resources are defined as the habitat of rare, threatened, or endangered plant and animal species, unique or exemplary natural communities, and significant geologic formations.

Newport News North Quad: Alternatives A, B, C1 and Norfolk South Quad: Alternatives B and C2

Biotics documents the presence of natural heritage resources within two miles of the project area. However, due to the scope of the activity and the distance to the resources, we do not anticipate that this project will adversely impact these natural heritage resources.

Hampton Quad: Alternatives A, B, C1

According to the information currently in our files, the Atlantic sturgeon (*Acipenser oxyrinchus,* G3/S2/LE/LT) has been documented within the project sites. Atlantic sturgeon is a large fish that reaches a maximum length of about 4.3 meters and may live for several decades. The adults migrate between fresh water spawning areas and salt water non-spawning areas. They feed primarily on benthic invertebrates and small fishes as available.

Stocks on the Atlantic slope have been severely reduced by overfishing (mainly late 1800s and early 1900s), pollution, sedimentation, and blockage of access to spawning areas by dams (Gilbert 1989, Burkhead and Jenkins 1991, Marine and Coastal Species Information System 1996). In Chesapeake Bay and elsewhere in the range, hypoxic events have increased and may degrade nursery habitat for Atlantic sturgeon (Secor and Gunderson 1997). Habitat loss due to dam construction and water pollution are thought to be major factors impeding full recovery of populations (Smith 1985, cited by Johnson et al. 1997; Gilbert 1989). A late maturation age and use of estuaries, coastal bays, and upstream areas of rivers for spawning and juvenile development make stocks vulnerable to habitat alterations in many areas (NatureServe 2012). Please note that this species is currently classified as endangered by the National Oceanic and Atmospheric Administration National Marine Fisheries Service (NOAA Fisheries) and threatened by the Virginia Department of Game and Inland Fisheries (VDGIF).

Norfolk North Quad: Alternatives A, B &C2

According to the information currently in our files, these sites are located within the Hampton Roads Bridge Tunnel Conservation Site and the Craney Island Conservation Site. Conservation sites are tools for representing key areas of the landscape that warrant further review for possible conservation action because of the natural heritage resources and habitat they support. Conservation sites are polygons built around one or more rare plant, animal, or natural community designed to include the element and, where possible, its associated habitat, and buffer or other adjacent land thought necessary for the element's conservation. Conservation sites are given a biodiversity significance ranking based on the rarity, quality, and number of element occurrences they contain; on a scale of 1-5, 1 being most significant. Hampton Roads Bridge Tunnel Conservation Site has been given a biodiversity significance ranking of B5, which represents a site of general significance. The natural heritage resources of concern at the Hampton Road Bridge Tunnel Conservation Site are:

Rynchops niger	Black skimmer	G5/S2B,S1N/NL/NL
Gelochelidon nilotica	Gull-billed tern	G5/S2B/NL/LT
Thalasseus maximus	Royal tern	G5/S2B/NL/NL
Thalasseus sandvicensis	Sandwich tern	G5/S1B/NL/NL

The Craney Island Conservation Site has been given a biodiversity significance ranking of B4, which represents a site of moderate significance. The natural heritage resources of concern at the Craney Island Conservation Site are:

Sterna antillarum	Least Tern	G4/S2B/NL/NL
Himantopus mexicanus	Black-necked Stilt	G5/S1B/NL/NL
Circus cyaneus	Northern harrier	G5/S2S2B,S3N/NL/NL

In addition, the Least tern (*Sternula* [=*Sterna*] *antillarum*, G4/S2B/NL/NL) has been documented within the project site on Willoughby Spit and the Atlantic sturgeon (*Acipenser oxyrinchus,* G3/S2/LE/LT) has been documented within the project area.

Furthermore, there is potential for Loggerhead sea turtle (*Caretta caretta,* G3/S1B,S1N/LE/LT) and Kemp's Ridley sea turtle (*Lepidochelys kempii*, G1/S1N/LE/LE) to occur in the project area.

Newport News South Quad: Alternatives B, C1 & C2

According to the information currently in our files, these sites are located within the Craney Island Conservation Site.

Bowers Hill Quad: Alternatives B, C1 and C2

According to the information currently in our files, the Great Dismal Swamp: Northwest Section Conservation Site is located within the project area. Great Dismal Swamp: Northwest Section Conservation Site has been given a biodiversity significance ranking of B5, which represents a site of general significance. The natural heritage resources of concern at this site are:

Crotalus horridus	Canebrake rattlesnake	G4/S1/NL/LE
Sorex longirostris fisheri	Dismal Swamp southeastern shrew	G5T4/S2/NL/LT

Timber and Canebrake rattlesnakes are two forms of the same species (*Crotalus horridus*). The species is widespread throughout eastern United States ranging from New England to Minnesota and south to Florida and Texas. The forms differ in appearance and habitat distribution but share enough genetic similarities that they are the same species (NatureServe, 2009). The Timber rattlesnake is typically darker or yellow-ish (Gibbons and Dorcas, 2005). In Virginia, it is found in the piedmont and mountainous regions. The Canebrake rattlesnake is typically lighter in color, often pinkish, and is found in more coastal areas, including the northern limit of its range in the southeastern counties of the coastal plain of Virginia (Gibbons and Dorcas, 2005).

Canebrake rattlesnakes in Virginia inhabit hardwood and mixed hardwood-pine forests, cane thickets and the ridges and glades of swampy areas (Mitchell and Schwab, 1991). Canebrake rattlesnakes are generally terrestrial and feed on a variety of small animals including small mammals, birds, and amphibians (Mitchell & Schwab, 1991).

The primary threats to the Canebrake rattlesnake are the loss of habitat due to development activities and persecution by humans (Mitchell, 1994). Please note that the coastal plain populations of the Canebrake rattlesnake are currently classified as endangered by the Virginia Department of Game and Inland Fisheries (VDGIF).

The Dismal Swamp southeastern shrew occurs from southeastern Virginia to southeastern North Carolina along the outer coastal plain (U.S. Fish and Wildlife Service, 1998). They occupy a wide variety of habitats, including recently clearcut and regenerating forests, young pine plantations, grassy and brushy roadsides, young forests with shrubs and saplings, and mature pine and deciduous forests. Early successional stages with dense understories support the largest numbers of Dismal Swamp southeastern shrews, but mature pine plantations and mature second growth hardwood forests can also have significant numbers, particularly if there is a dense understory. Despite the lower densities in mature forests, these habitats are likely to be important to the long-term survival of Dismal Swamp southeastern shrew populations (U.S. Fish and Wildlife Service, 1998).

Threats to the Dismal Swamp southeastern shrew include draining and drying of its preferred habitat which allows the more upland *Sorex longirostris longirostris* to invade and compete against it (Rose and Padgett, 1991). Please note that this species is currently classified as threatened by the Virginia Department of Game and Inland Fisheries (VDGIF).

In addition, the Oak toad (*Anaxyrus quercicus*, G5/S2/NL/NL), Elliott's aster (*Symphyotrichum elliottii*, G4/S1/NL/NL) and Lax hornpod (*Mitreola petiolata*, G5/S1/NL/NL) have been historically documented within the project site. The Oak toad ranges along the Coastal Plain from south Virginia south and west to Louisiana (NatureServe, 2009). Typically growing to a length of 19 to 33 mm, the oak toad has been documented in Virginia's coastal plain, south of the James River (Martof et al., 1980). This species inhabits southern pine woods where it hides under all manner of objects. Unlike most other toads, the Oak toad is active by day. Breeding occurs in shallow pools, ditches, cypress ponds and flatwood ponds from April to October, depending on the arrival of warm, heavy rains (Conant, 1991).

The Oak toad does not do well in urban or suburban settings; however it might persist in some agricultural areas (Bartlett and Bartlett, 1999). It is threatened increasing monocultures of loblolly pine and the continuous draining of remaining natural pine woodlands (Mitchell, 1991).

Elliott's Aster is a perennial, colonial aster that grows up to 1.5 meters tall. Numerous stiff, thick leaves are found on the erect stems which terminate in a panicle or corymb of flower heads with pink or lilac ray flowers in mid-fall. In Virginia, this rare plant is known from tidal marshes, tidal swamps, and interdune swales from the cities of Chesapeake and Virginia Beach. (Weakley, et al., 2012). As of 2014, the Virginia Natural Heritage Program has documented 4 occurrences of this state rare plant, 1 extant and 3 historic. The plant is threatened by sea-level rise and competition with the common reed (*Phragmites australis*), an invasive grass that can choke out native species.

Lax hornpod, a state rare herb, inhabits the shores of draw-down rivers with open, sandy and silty banks, peninsulas, bars and flats (Ludwig, 1996). This species is currently known from two locations in Virginia and historically known from several additional locations in the state.

Due to the potential for this site to support populations of Elliott's Aster, DCR recommends an inventory for the resource in the project area in Goose Creek and Bailey Creek. With the survey results we can more accurately evaluate potential impacts to natural heritage resources and offer specific protection recommendations for minimizing impacts to the documented resources.

General Comments

There is potential for the Northern Long-eared bat (*Myotis septentrionalis,* G1G3/S3/LT/NL) to occur within the project area. The Northern Long-eared bat is a small insect-eating bat characterized by its long-rounded ears that when folded forward extend beyond the tip of the nose. Hibernation occurs in caves, mines and tunnels from late fall through early spring and bats occupy summer roosts comprised of older trees including single and multiple tree-fall gaps, standing snags and woody debris. Threats include white nose syndrome and loss of hibernacula, maternity roosts and foraging habitat (NatureServe, 2014). Due to the decline in population numbers, the Northern Long-eared bat has been federally listed as "threatened" by the United States Fish and Wildlife Service (USFWS).

To minimize adverse impacts to the aquatic ecosystem as a result of the proposed activities, DCR recommends the implementation of and strict adherence to applicable state and local erosion and sediment control/storm water management laws and regulations. To avoid and minimize impacts to sea turtles, DCR recommends adherence to time-of-year restrictions from 01 April – 30 November of any year. DCR recommends avoidance of the nesting sites for the Least Tern (April 15-August 1) and Black-necked Stilt (April 15-July 15). Due to the legal status of the Gull-billed tern, Canebrake rattlesnake and Dismal Swamp southeastern shrew, DCR recommends coordination with Virginia's regulatory authority for the management and protection of these species, the VDGIF, to ensure compliance with the Virginia Endangered Species Act (VA ST §§ 29.1-563 – 570). Due to the legal status of the Atlantic sturgeon, DCR also recommends coordination with VDGIF and NOAA Fisheries to ensure compliance with protected species legislation. Furthermore, due to the legal status of Loggerhead sea turtle and Kemp's Ridley sea turtle, DCR recommends coordination with USFWS and VDGIF to ensure compliance with protected species legislation. Finally, DCR recommends coordination with the USFWS regarding potential impacts upon federally threatened Northern Long-eared bats associated with tree removal.

Under a Memorandum of Agreement established between the Virginia Department of Agriculture and Consumer Services (VDACS) and the DCR, DCR represents VDACS in comments regarding potential impacts on state-listed threatened and endangered plant and insect species. The current activity will not affect any documented state-listed plants or insects.

There are no State Natural Area Preserves under DCR's jurisdiction in the project vicinity.

New and updated information is continually added to Biotics. Please re-submit a completed order form and project map for an update on this natural heritage information if the scope of the project changes and/or six months has passed before it is utilized.

~~A fee of $570.00 has been assessed for the service of providing this information. Please find enclosed an invoice for that amount. Please return one copy of the invoice along with your remittance made payable to the Treasurer of Virginia, **DCR - Division of Natural Heritage, 600 East Main Street, 24th Floor, Richmond, VA 23219.** Payment is due within thirty days of the invoice date. Please note the change of address for remittance of payment as of July 1, 2013. Late payment may result in the suspension of project review service for future projects.~~

The Virginia Department of Game and Inland Fisheries (VDGIF) maintains a database of wildlife locations, including threatened and endangered species, trout streams, and anadromous fish waters that may contain information not documented in this letter. Their database may be accessed from http://vafwis.org/fwis/ or contact Ernie Aschenbach at 804-367-2733 or Ernie.Aschenbach@dgif.virginia.gov. This project is located within 2 miles of documented occurrences of state and federally listed animals. Therefore, DCR recommends coordination with the U.S. Fish and Wildlife Service (USFWS) and VDGIF, Virginia's regulatory authority for the management and protection of these species to ensure compliance with endangered species legislation. Should you have any questions or concerns, feel free to contact me at (804) 692-0984. Thank you for the opportunity to comment on this project.

Sincerely,

Alli Baird

Alli Baird, LA, ASLA
Coastal Zone Locality Liaison

Cc: Amy Ewing, VDGIF
Troy Andersen, USFWS
Christine Vaccaro, NOAA

Literature Cited

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From: Smizik, Scott (VDOT)
Sent: Friday, November 06, 2015 3:34 PM
To: 'Smith, Kimberly'; Ewing, Amy (DGIF); Hypes, Rene (DCR); 'david.l.o'brien@noaa.gov'; Baird, Alice (DCR)
Cc: Ed.Sundra@dot.gov; 'george.a.janek@usace.army.mil'; 'okorn.barbara@epa.gov'; 'Pitts, Hal R CIV'; Woodward, Justine CIV NAVFAC MIDLANT, EV; Begg, Steven (VDOT)
Subject: Hampton Roads Crossing Study - Concurrence of Species Requiring Survey_Habitat Survey Pre-qualification
Importance: High

Good afternoon –

Please find attached a letter requesting concurrence of species requiring survey as well as habitat survey pre-qualification for the Hampton Roads Crossing Study SEIS. No hard copy will follow. If you have any questions or require additional information, please do not hesitate to contact me.

Enjoy the weekend.

Scott Smizik
Location Studies Project Manager
Virginia Department of Transportation
Environmental Division
1401 East Broad Street
Richmond, Virginia 23219
Desk: (804) 371-4082
Cell: (804) 306-0920
Fax: (804) 786-7401
Scott.Smizik@VDOT.Virginia.gov

November 4, 2015

Kimberly Smith
U.S. Fish & Wildlife Service
6669 Short Ln.
Gloucester, VA 23061
Kimberly_Smith@fws.gov

Amy Ewing
VA Dept of Game & Inland Fisheries
4010 West Broad St.
Richmond, VA 23230
Amy.Ewing@dgif.virginia.gov

Rene Hypes
Virginia Department of Conservation and Recreation
Natural Heritage Division
600 East Main Street, 24th Floor
Richmond, Virginia 23219
Rene.Hypes@dcr.virginia.gov

David O'Brien
NOAA Fisheries Service
1375 Greate Rd.
P.O. Box 1346
Gloucester Point, VA 23062
David.L.O'Brien@noaa.gov

Re: Concurrence of Species Requiring Survey; Habitat Survey Pre-qualification

Ref: Hampton Roads Crossing Study, VDOT UPC No. 106724
Supplemental Environmental Impact Statement (SEIS)
Hampton Roads and the cities of Hampton, Newport News, Chesapeake, Portsmouth, Norfolk, and Suffolk as well as Isle of Wight County, Virginia

Dear Ms. Smith, Ms. Ewing, Ms. Hypes, Mr. O'Brien:

Rummel, Klepper & Kahl (RK&K) is preparing a Supplemental Environmental Impact Statement (SEIS) in cooperation with the Virginia Department of Transportation (VDOT) and the Federal Highway Administration (FHWA) for the Hampton Roads Crossing Study (HRCS) in Hampton Roads and the cities of Hampton, Newport News, Chesapeake, Portsmouth, Norfolk, and Suffolk as well as Isle of Wight County. The purpose of the SEIS is to evaluate the environmental impacts of Alternatives B, C, & D shown on the maps in Attachment A. The SEIS will address the changes or new information that are the basis for preparing the SEIS and were not addressed in the March 2001 Final EIS (FEIS). Based on coordination between FHWA and VDOT, the issues to be analyzed in the SEIS **will include threatened and endangered species.**

Stantec Consulting Services Inc. (Stantec) has been requested to support the SEIS through the preliminary assessment of habitat for state and federally listed species. Stantec developed the following table which lists the state and federally listed species that have been identified through the USFWS's

Information for Planning and Conservation database (IPaC), VDGIF's Virginia Fish and Wildlife Information Service database (VaFWIS), and VDCR's Department of Natural Heritage (DCR-DNH) database results found in Attachment B. The table also identifies the state and federally listed species addressed in the November 2012 Natural Resources Technical Report for the I-64 Hampton Roads Bridge Tunnel (HRBT-NRTR), and the March 2001 FEIS for the Hampton Roads Crossing Study. The search area conducted for IPaC included the 500' study corridor of the Alternatives as well as the body of water between I-664 and I-64 in the center of the project area. Since the VaFWIS uses a 2-mile radius, its search area consisted of a 4-mile wide corridor along each alternative. DCR-DNH's database places a 2.5 mile wide radius on the project corridor so its search area was a 5-mile wide corridor along each alternative. **We request your approval of the species list in the following table as those which will be addressed in the SEIS.**

		Sources						
Species	**Status**	**IPaC**	**VFWIS**	**DCR-DNH**	**HRBT NRTR**	**FEIS**	**Proposed Review**	**Responsible Surveyor(s)**
Piping Plover	FTST	x	x	x	x	x	Re-evaluate Habitat	Sean Wender / Kenny Presgraves
Wilson's Plover	SE		x	x			Habitat Assessment	Sean Wender / Kenny Presgraves
Gull-billed Tern	ST		x	x	x		Habitat Assessment	Sean Wender / Kenny Presgraves
Red Knot	FT		x				Habitat Assessment	Sean Wender / Kenny Presgraves
Peregrine Falcon	ST		x	x	x	x	Habitat Assessment	Sean Wender / Kenny Presgraves
NLEB	FT	x					Habitat Assessment	Sean Wender / Kenny Presgraves
Dismal Swamp SE Shrew	ST		x	x		x	Habitat Assessment	Sean Wender / Kenny Presgraves
Mabee's Salamander	ST		x	x	x		Habitat Assessment	Sean Wender / Kenny Presgraves
Canebrake Rattlesnake	SE		x	x	x	x	Habitat Assessment	Sean Wender / Kenny Presgraves
Atlantic Sturgeon	FESE		x	x	x	x	No Habitat Assessment	
Kemp's Ridley Sea Turtle	FESE		x		x	x	No Habitat Assessment	
Leatherback Sea Turtle	FESE		x		x		No Habitat Assessment	
Loggerhead Sea Turtle	FTST		x		x	x	No Habitat Assessment	
Green Sea Turtle	FTST				x	x	No Habitat Assessment	
*Hawksbill Sea Turtle **	*FESE*				*x*		No Habitat Assessment	

* According to both the HRBT NRTR and VIMS, only 2 Hawksbill strandings have ever been reported in VA. Both are considered strays from the tropical waters they normally inhabit. Therefore we do not plan to report on this species.

All species will be addressed in the SEIS, though the table separates those species for which habitat assessments will be performed from those that will not, for reasons described in the following paragraphs.

<u>Piping Plover</u>

A Biological Assessment for the Piping plover was completed for the March 2001 FEIS. This study concentrated on the past nesting on Craney Island in Portsmouth. At that time, Piping plovers had only been observed there in 10 of the 24 years of observation. The VFWIS documents a species observation in the vicinity of Fort Monroe Military Reservation to the northwest of the I-64 Hampton Roads Bridge Tunnel. However, according to the November 2012 HRBT-NRTR, Piping plovers have been absent from typical nesting sites within the Hampton Roads vicinity (i.e. Craney Island in Portsmouth and Grandview Beach in

Hampton) for over a decade. These areas are believed to no longer be suitable for nesting Piping plovers due to the presence of predators and human disturbance.

The Biological Assessment concluded that the third crossing will not adversely affect the Piping plover because the third crossing:

- will not directly use Piping plover habitat or induce land use changes on Craney Island that would destroy Piping plovers or their habitat;
- will not serve as a substantial attractor to additional predators that might affect Piping plover breeding success and;
- will not interdict Piping plover access to the island or;
- will not induce additional recreational use, foot or motorized traffic on the island

No impacts are anticipated to the Piping plover after reviewing these documents. However, nesting areas can change from year to year therefore we propose to re-evaluate the project area with particular attention to previously known breeding areas or areas not covered by the BA to reaffirm or update the conclusions previously reached. The re-evaluation would entail 1) contact with subject matter experts and agency personnel to obtain recent locations of nesting occurrences; and 2) analysis of aerial imagery to determine locations of potentially suitable nesting habitat.

Sea Turtles

Virginia nesting sites for sea turtles are primarily limited to ocean facing beaches, and therefore no sea turtles were listed in the IPaC results. The Green sea turtle is scarce in Virginia, and is typically only seen as an accidental migrant, while the Kemp's Ridley, Leatherback, and Loggerhead sea turtles would primarily use the project area to opportunistically forage in appropriate habitat from April to November.

A Biological Assessment for the sea turtle species was completed in July 2000 as part of the March 2001 FEIS. In a letter dated October 3, 2000 the National Marine Fisheries Service (NMFS) wrote "Based upon the location of this project, the proposed time of year restrictions for hopper dredging, and the distribution of listed species in the project area, the proposed Hampton Roads Crossing Study is not likely to adversely affect endangered or threatened sea turtles. No further consultation pursuant to Section 7 of the Endangered Species Act of 1973, as amended, is required."

The information available for the Biological Assessment at that time, as well as in the November 2012 HRBT-NRTR supports this decision. Given the previous finding of not likely to adversely affect, and the plan to adhere to current time-of-year restrictions (April-November), no habitat assessments will be conducted. Potential foraging areas of submerged aquatic vegetation (SAV) and benthic communities will be obtained from other agency sources and discussed in other sections of the SEIS.

Atlantic Sturgeon

The Atlantic sturgeon does not reside in the project area, but rather uses it as a migration corridor. Their nearest spawning areas are approximately 70 miles upstream at Turkey Island, therefore the project will not impact spawning habitat. As with the sea turtles, their distribution in the project vicinity would correlate with suitable benthic invertebrate forage and SAV habitat. Their habitat can be noted through a discussion of the benthic communities, SAV habitat, and anadromous fish use areas. We do not propose to perform habitat assessments for the Atlantic sturgeon.

We request your approval of the proposed review actions noted in the table and the preceding paragraphs.

Stantec will perform an assessment of habitat types that correspond with the requirements of each species, mapping areas of potential habitat, and describing the habitat within the 500' study corridor of the project alternatives. For federally listed species, Stantec will, as part of the IPaC review, prepare a species conclusion table documenting effects determinations (no effect, not likely to adversely affect, or may adversely affect) and submit a project review package to USFWS. The results of the findings will be summarized as appropriate in the SEIS. No formal species surveys are proposed at this time.

Qualifications

Stantec is an engineering and environmental consulting firm, comprised of qualified biologists and ecologists with extensive experience in threatened and endangered species habitat and species surveys throughout Virginia, but in particular in the Coastal Plain. They are recognized experts in aquatic and terrestrial ecology and enjoy a long and successful history of working collaboratively with the USACE, USFWS, VDGIF, VDOT, and other permitting and resource agencies on the identification and protection of state and federally listed species. Stantec and RK&K are partnered to complete large-scale transportation corridor studies for the purposes of satisfying NEPA. This team has a proven track record for providing a high quality of technical expertise performing threatened and endangered species habitat surveys, detailed species surveys, and reporting.

A list of qualified biologists proposed as responsible surveyors in charge of the habitat assessments are identified by species in the preceding table. You will find resumes for Stantec qualified biologists proposed as responsible surveyors for conducting habitat assessments of each species in Attachment C. In addition, since the Northern long-eared bat (NLEB) is the only species on the list with USFWS approved surveyors in Virginia, that list is in Attachment D. You will note several Stantec biologists on that list. **We request your approval of the qualified biologists proposed as responsible surveyors in charge of the habitat assessments for the purposes of providing input to the SEIS.**

Should you have any questions, or require any additional information, please contact me at 804-371-4082. We look forward to working with the USFWS, VDGIF, VDCR, and NOAA on this project.

Sincerely,

Scott Smizik
Location Studies Project Manager
VDOT Environmental Division

Attachments

Cc: George Janek, USACE
Barbara Okorn EPA
John McCambridge, VDOT
Eric Almquist, RK&K
Brian Hawley, Stantec

Attachment A

Alternative Maps


6 Lanes Existing
4 Lanes Existing
6 Lanes Proposed
4 Lanes Proposed
4 Lanes Existing
6 Lanes Proposed
4 Lanes
(Under Construction)
6 Lanes Existing
4 Lanes Proposed
4 Lanes Existing
6 Lanes Proposed
NEWPORT NEWS
HAMPTON
Fort Monroe
Chesapeake Bay
Hampton Roads
Willoughby Bay
James River
Naval Station Norfolk
Craney Island
Elizabeth River
Lafayette River
NORFOLK
SUFFOLK
PORTSMOUTH
CHESAPEAKE
N
0 0.5 1 2 Miles
Legend
Study Corridor
Existing Bridge
Existing Tunnel
Optional Connections
Major Roads
HRCS SEIS
Hampton Roads Crossing Study SEIS
Alternative B

NEWPORT NEWS
HAMPTON
Fort Monroe
Chesapeake Bay
Hampton Roads
James River
Willoughby Bay
Naval Station Norfolk
Craney Island
Elizabeth River
Lafayette River
NORFOLK
SUFFOLK
PORTSMOUTH
CHESAPEAKE
N
4-6 Lanes Existing
8 Lanes Proposed
4 Lanes Existing
8 Lanes Proposed
4 Lanes Proposed
4 Lanes
(Under Construction)
6 Lanes Existing
4 Lanes Proposed
4 Lanes Existing
6-8 Lanes Proposed
4 Lanes Existing
8 Lanes Proposed
0 0.5 1 2
Miles
Legend
Study Corridor
Existing Bridge
Existing Tunnel
Optional Connections
Major Roads
HRCS SEIS
Hampton Roads Crossing Study SEIS
Alternative C

6 Lanes Existing
4-6 Lanes Existing
8 Lanes Proposed
4 Lanes Existing
6 Lanes Proposed
4 Lanes Existing
8 Lanes Proposed
4 Lanes Proposed
4 Lanes Existing
6 Lanes Proposed
4 Lanes Existing
(Under Design)
4 Lanes Proposed
4 Lanes Proposed
4 Lanes Existing
6-8 Lanes Proposed
4 Lanes Existing
8 Lanes Proposed
NEWPORT NEWS
HAMPTON
Fort Monroe
Chesapeake Bay
Hampton Roads
Willoughby Bay
James River
Naval Station Norfolk
Craney Island
Lafayette River
Elizabeth River
NORFOLK
SUFFOLK
PORTSMOUTH
CHESAPEAKE
N
0 0.5 1 2 Miles
Legend
Study Corridor
Existing Bridge
Existing Tunnel
Major Roads
HRCS SEIS
Hampton Roads Crossing Study SEIS
Alternative D

Attachment B

Database Results

Alternative B

IPaC Trust Resource Report

Alternative B

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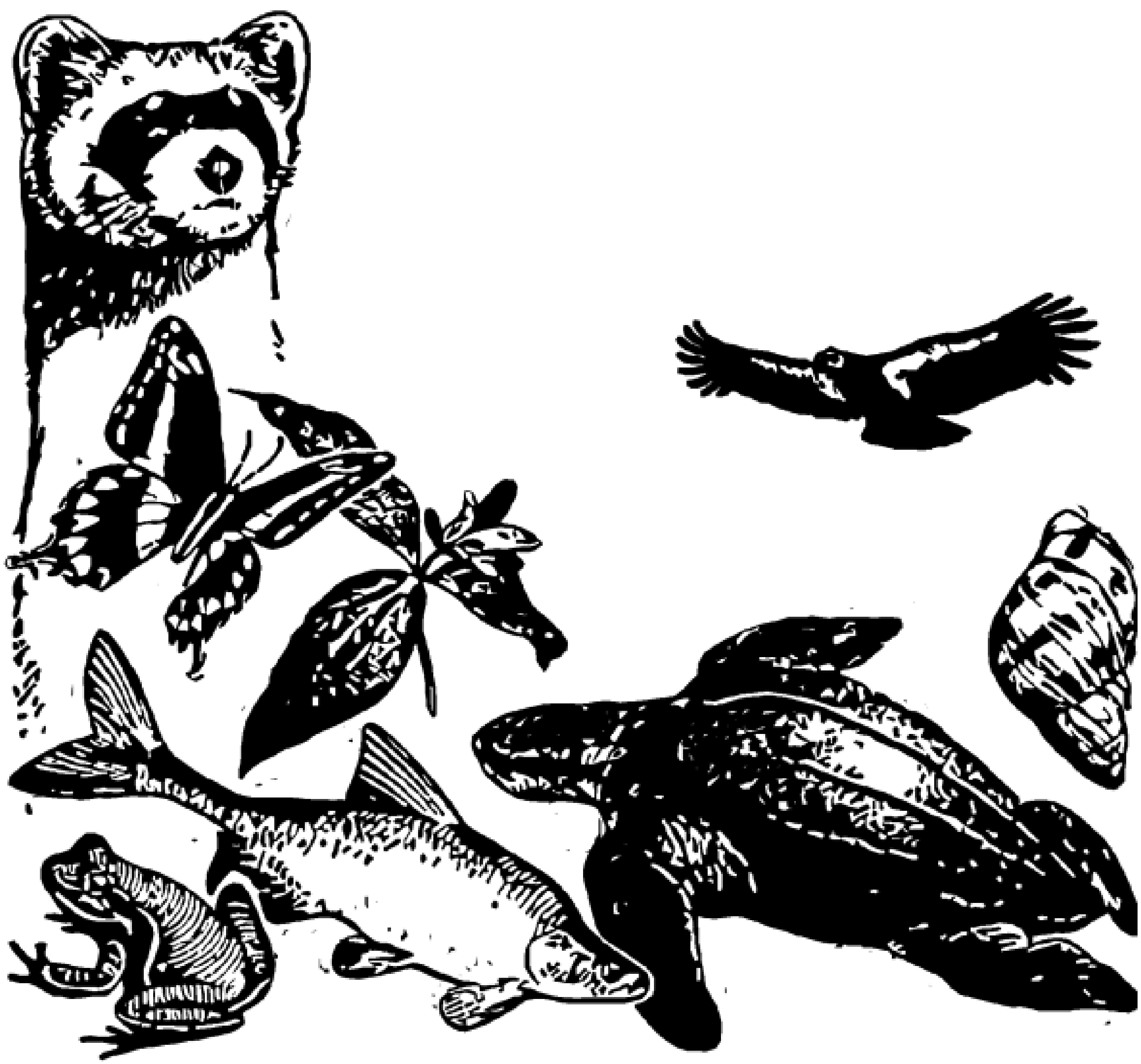
This report is for informational purposes only and should not be used for planning or analyzing project-level impacts. For projects that require FWS review, please return to this project on the IPaC website and request an official species list from the Regulatory Documents page.



US Fish & Wildlife Service

IPaC Trust Resource Report

Project Description

NAME

Alternative B

PROJECT CODE

ZD446-A47YN-D6DOY-XGNSL-VLNNWI

LOCATION

Virginia

DESCRIPTION

No description provided

U.S. Fish & Wildlife Contact Information

Species in this report are managed by:

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

Endangered Species

Proposed, candidate, threatened, and endangered species that are managed by the Endangered Species Program and should be considered as part of an effect analysis for this project.

This unofficial species list is for informational purposes only and does not fulfill the requirements under Section 7 of the Endangered Species Act, which states that Federal agencies are required to "request of the Secretary of Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action." This requirement applies to projects which are conducted, permitted or licensed by any Federal agency.

A letter from the local office and a species list which fulfills this requirement can be obtained by returning to this project on the IPaC website and requesting an official species list on the Regulatory Documents page.

Birds

Piping Plover Charadrius melodus — Threatened

CRITICAL HABITAT
No critical habitat has been designated for this species.

https://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B079

Mammals

Northern Long-eared Bat Myotis septentrionalis — Threatened

CRITICAL HABITAT
No critical habitat has been designated for this species.

https://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=A0JE

Critical Habitats

Potential effects to critical habitat(s) within the project area must be analyzed along with the endangered species themselves.

There is no critical habitat within this project area

Migratory Birds

Birds are protected by the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act.

Any activity which results in the take of migratory birds or eagles is prohibited unless authorized by the U.S. Fish and Wildlife Service (1). There are no provisions for allowing the take of migratory birds that are unintentionally killed or injured.

You are responsible for complying with the appropriate regulations for the protection of birds as part of this project. This involves analyzing potential impacts and implementing appropriate conservation measures for all project activities.

American Kestrel Falco sparverius paulus — Bird of conservation concern
Year-round

American Oystercatcher Haematopus palliatus — Bird of conservation concern
Year-round
https://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B0G8

American Bittern Botaurus lentiginosus — Bird of conservation concern
Season: Wintering
https://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B0F3

Bald Eagle Haliaeetus leucocephalus — Bird of conservation concern
Year-round
https://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B008

Black Rail Laterallus jamaicensis — Bird of conservation concern
Season: Breeding
https://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B09A

Black Skimmer Rynchops niger — Bird of conservation concern
Season: Breeding
https://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B0EO

Black-throated Green Warbler Dendroica virens — Bird of conservation concern
Season: Breeding

Brown-headed Nuthatch Sitta pusilla — Bird of conservation concern
Year-round

Fox Sparrow Passerella iliaca — Bird of conservation concern
Season: Wintering

Gull-billed Tern Gelochelidon nilotica — Bird of conservation concern
Season: Breeding
https://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B0JV

Horned Grebe Podiceps auritus — Bird of conservation concern
Season: Wintering

Hudsonian Godwit Limosa haemastica — Bird of conservation concern
Season: Migrating

Least Bittern Ixobrychus exilis — Bird of conservation concern
Season: Breeding

Least Tern Sterna antillarum — Bird of conservation concern
Season: Breeding

Lesser Yellowlegs Tringa flavipes — Bird of conservation concern
Season: Wintering

Marbled Godwit Limosa fedoa — Bird of conservation concern
Season: Wintering
https://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B0JL

Nelson's Sparrow Ammodramus nelsoni — Bird of conservation concern
Season: Wintering

Peregrine Falcon Falco peregrinus — Bird of conservation concern
Season: Wintering
https://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B0FU

Pied-billed Grebe Podilymbus podiceps — Bird of conservation concern
Year-round

Prairie Warbler Dendroica discolor — Bird of conservation concern
Season: Breeding

Prothonotary Warbler Protonotaria citrea — Bird of conservation concern
Season: Breeding

Purple Sandpiper Calidris maritima — Bird of conservation concern
Season: Wintering

Red Knot Calidris canutus rufa — Bird of conservation concern
Season: Wintering
https://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B0DM

Red-headed Woodpecker Melanerpes erythrocephalus — Bird of conservation concern
Year-round

Rusty Blackbird Euphagus carolinus — Bird of conservation concern
Season: Wintering

Saltmarsh Sparrow Ammodramus caudacutus — Bird of conservation concern
Year-round

Seaside Sparrow Ammodramus maritimus — Bird of conservation concern
Year-round

Sedge Wren Cistothorus platensis — Bird of conservation concern
Season: Wintering

Short-billed Dowitcher Limnodromus griseus — Bird of conservation concern
Season: Wintering

Short-eared Owl Asio flammeus — Bird of conservation concern
Season: Wintering
https://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B0HD

Snowy Egret Egretta thula — Bird of conservation concern
Season: Breeding

Swainson's Warbler Limnothlypis swainsonii — Bird of conservation concern
Season: Breeding

Wood Thrush Hylocichla mustelina — Bird of conservation concern
Season: Breeding

Worm Eating Warbler Helmitheros vermivorum — Bird of conservation concern
Season: Breeding

Refuges

Any activity proposed on National Wildlife Refuge lands must undergo a 'Compatibility Determination' conducted by the Refuge. If your project overlaps or otherwise impacts a Refuge, please contact that Refuge to discuss the authorization process.

There are no refuges within this project area

Wetlands

Impacts to NWI wetlands and other aquatic habitats from your project may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal Statutes.

Project proponents should discuss the relationship of these requirements to their project with the Regulatory Program of the appropriate U.S. Army Corps of Engineers District.

DATA LIMITATIONS

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

DATA EXCLUSIONS

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

DATA PRECAUTIONS

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

Estuarine And Marine Deepwater

E1UBL	2510000.0 acres
E1UBLx	19.6 acres
E1UB4L	1.53 acres

Estuarine And Marine Wetland

E2EM1P	216.0 acres
E2US2P	113.0 acres
E2USN	87.4 acres
E2EM1Pd	4.73 acres
E2EM1N	1.25 acres

Freshwater Emergent Wetland

PEM1C	22.6 acres
PEM1Ed	21.4 acres
PEM1B	19.0 acres
PEM1/SS1C	12.6 acres
PEM1Eh	7.79 acres
PEM1Cs	4.82 acres
PEM5R	2.6 acres
PEM1A	2.07 acres
PEM1E	1.5 acres
PEM1R	0.496 acre

Freshwater Forested/shrub Wetland

PFO1Cd	53.8 acres
PSS1/4Bd	50.5 acres
PSS1Bd	40.1 acres
PFO1Bd	32.2 acres
PFO4Bd	25.7 acres
PSS3/FO1C	23.4 acres
PFO1C	18.0 acres
PSS4A	11.6 acres
PFO4A	11.2 acres
PFO1E	10.9 acres
PFO1A	10.5 acres
PFO1R	7.78 acres
PSS1C	6.73 acres
PFO4R	6.19 acres
PFO4/1R	5.87 acres
PFO4/SS3F	2.96 acres
PSS4R	2.32 acres
PFO4Ad	1.31 acres
PFO4S	1.23 acres
PFO4C	1.08 acres
PSS1R	0.991 acre
PSS1Ch	0.828 acre
PSS1Eh	0.235 acre

Freshwater Pond

PUBHx	31.4 acres
PUS/EM1C	9.04 acres
PUBFh	1.94 acres

Lake

L2USAhs	645.0 acres
L2USChs	491.0 acres
L1UBHx	31.2 acres
L2USCs	27.5 acres

U.S. Fish & Wildlife Service

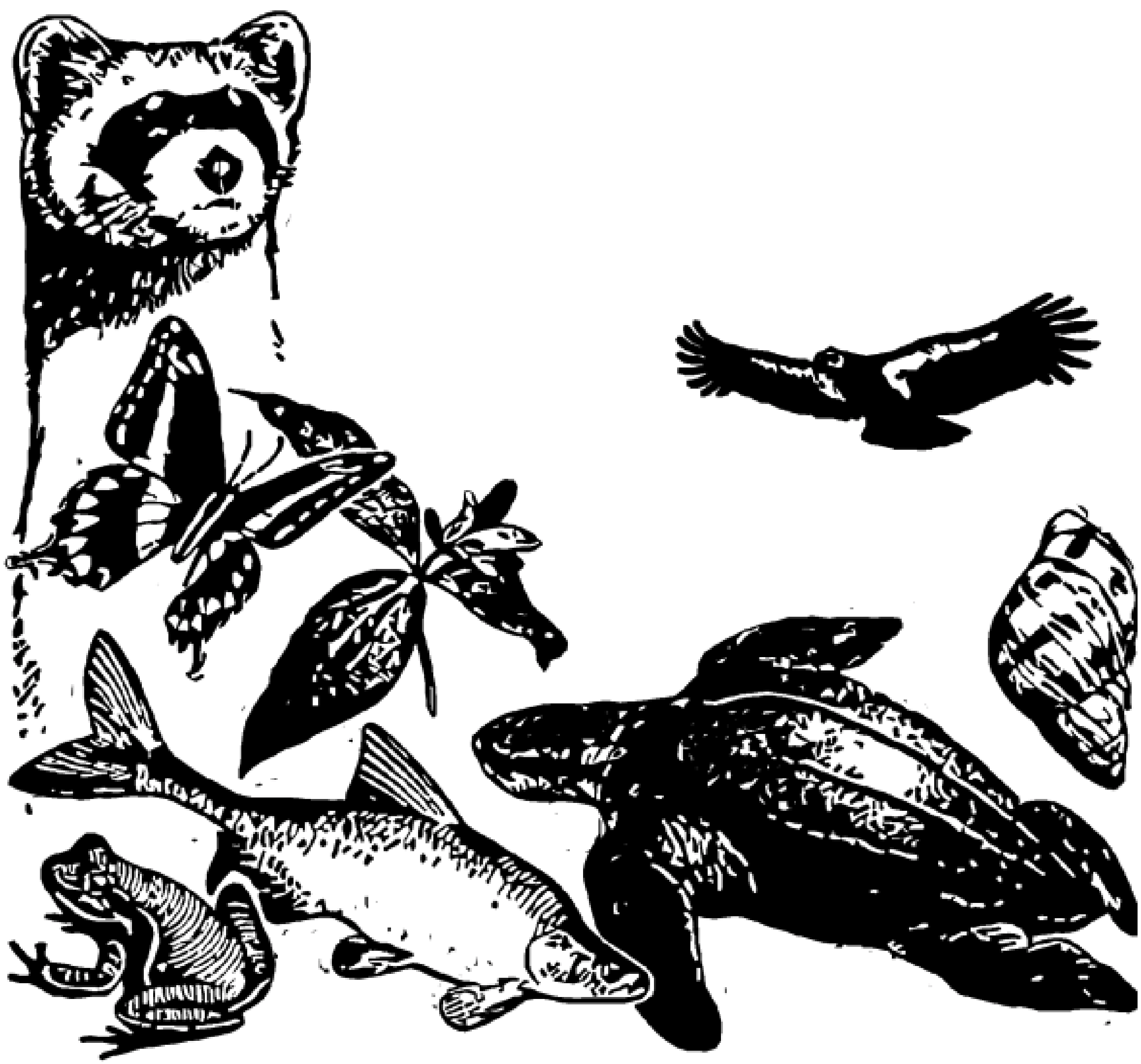
Alternative C

IPaC Trust Resource Report

Alternative C

Generated October 12, 2015 11:42 AM MDT

This report is for informational purposes only and should not be used for planning or analyzing project-level impacts. For projects that require FWS review, please return to this project on the IPaC website and request an official species list from the Regulatory Documents page.



US Fish & Wildlife Service

IPaC Trust Resource Report

Project Description

NAME

Alternative C

PROJECT CODE

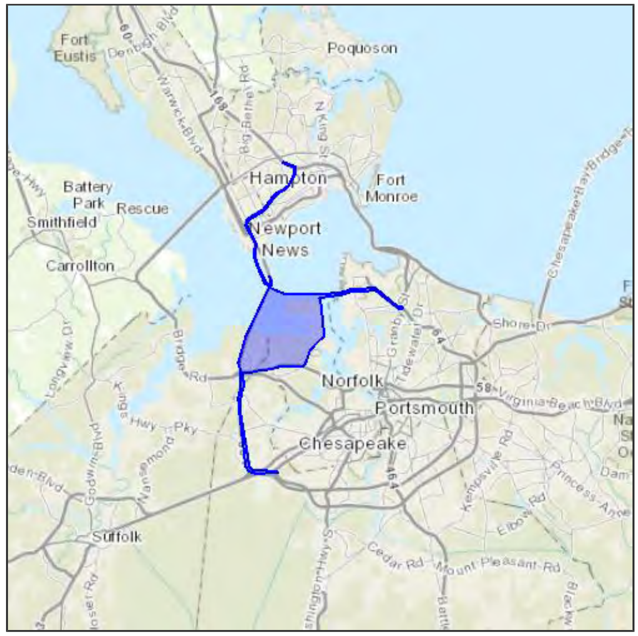
N34DU-ECNCV-GVLLK-PS6Q5-EHP4IU

LOCATION

Virginia

DESCRIPTION

No description provided



U.S. Fish & Wildlife Contact Information

Species in this report are managed by:

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

Endangered Species

Proposed, candidate, threatened, and endangered species that are managed by the Endangered Species Program and should be considered as part of an effect analysis for this project.

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A letter from the local office and a species list which fulfills this requirement can be obtained by returning to this project on the IPaC website and requesting an official species list on the Regulatory Documents page.

Birds

Piping Plover Charadrius melodus — Threatened

CRITICAL HABITAT
No critical habitat has been designated for this species.

https://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B079

Mammals

Northern Long-eared Bat Myotis septentrionalis — Threatened

CRITICAL HABITAT
No critical habitat has been designated for this species.

https://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=A0JE

Critical Habitats

Potential effects to critical habitat(s) within the project area must be analyzed along with the endangered species themselves.

There is no critical habitat within this project area

Migratory Birds

Birds are protected by the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act.

Any activity which results in the take of migratory birds or eagles is prohibited unless authorized by the U.S. Fish and Wildlife Service (1). There are no provisions for allowing the take of migratory birds that are unintentionally killed or injured.

You are responsible for complying with the appropriate regulations for the protection of birds as part of this project. This involves analyzing potential impacts and implementing appropriate conservation measures for all project activities.

American Kestrel Falco sparverius paulus — Bird of conservation concern
Year-round

American Oystercatcher Haematopus palliatus — Bird of conservation concern
Year-round
https://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B0G8

American Bittern Botaurus lentiginosus — Bird of conservation concern
Season: Wintering
https://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B0F3

Bald Eagle Haliaeetus leucocephalus — Bird of conservation concern
Year-round
https://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B008

Black Rail Laterallus jamaicensis — Bird of conservation concern
Season: Breeding
https://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B09A

Black Skimmer Rynchops niger — Bird of conservation concern
Season: Breeding
https://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B0EO

Black-throated Green Warbler Dendroica virens — Bird of conservation concern
Season: Breeding

Brown-headed Nuthatch Sitta pusilla — Bird of conservation concern
Year-round

Fox Sparrow Passerella iliaca — Bird of conservation concern
Season: Wintering

Gull-billed Tern Gelochelidon nilotica — Bird of conservation concern
Season: Breeding
https://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B0JV

Horned Grebe Podiceps auritus — Bird of conservation concern
Season: Wintering

Hudsonian Godwit Limosa haemastica — Bird of conservation concern
Season: Migrating

Least Bittern Ixobrychus exilis — Bird of conservation concern
Season: Breeding

Least Tern Sterna antillarum — Bird of conservation concern
Season: Breeding

Lesser Yellowlegs Tringa flavipes — Bird of conservation concern
Season: Wintering

Marbled Godwit Limosa fedoa — Bird of conservation concern
Season: Wintering
https://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B0JL

Nelson's Sparrow Ammodramus nelsoni — Bird of conservation concern
Season: Wintering

Peregrine Falcon Falco peregrinus — Bird of conservation concern
Season: Wintering
https://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B0FU

Pied-billed Grebe Podilymbus podiceps — Bird of conservation concern
Year-round

Prairie Warbler Dendroica discolor — Bird of conservation concern
Season: Breeding

Prothonotary Warbler Protonotaria citrea — Bird of conservation concern
Season: Breeding

Purple Sandpiper Calidris maritima — Bird of conservation concern
Season: Wintering

Red Knot Calidris canutus rufa — Bird of conservation concern
Season: Wintering
https://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B0DM

Red-headed Woodpecker Melanerpes erythrocephalus — Bird of conservation concern
Year-round

Rusty Blackbird Euphagus carolinus — Bird of conservation concern
Season: Wintering

Saltmarsh Sparrow Ammodramus caudacutus — Bird of conservation concern
Year-round

Seaside Sparrow Ammodramus maritimus — Bird of conservation concern
Year-round

Sedge Wren Cistothorus platensis — Bird of conservation concern
Season: Wintering

Short-billed Dowitcher Limnodromus griseus — Bird of conservation concern
Season: Wintering

Short-eared Owl Asio flammeus — Bird of conservation concern
Season: Wintering
https://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B0HD

Snowy Egret Egretta thula — Bird of conservation concern
Season: Breeding

Swainson's Warbler Limnothlypis swainsonii — Bird of conservation concern
Season: Breeding

Wood Thrush Hylocichla mustelina — Bird of conservation concern
Season: Breeding

Worm Eating Warbler Helmitheros vermivorum — Bird of conservation concern
Season: Breeding

Refuges

Any activity proposed on National Wildlife Refuge lands must undergo a 'Compatibility Determination' conducted by the Refuge. If your project overlaps or otherwise impacts a Refuge, please contact that Refuge to discuss the authorization process.

There are no refuges within this project area

Wetlands

Impacts to NWI wetlands and other aquatic habitats from your project may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal Statutes.

Project proponents should discuss the relationship of these requirements to their project with the Regulatory Program of the appropriate U.S. Army Corps of Engineers District.

DATA LIMITATIONS

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

DATA EXCLUSIONS

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

DATA PRECAUTIONS

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

Estuarine And Marine Deepwater

E1UBL	2510000.0 acres
E1UBLx	19.6 acres

Estuarine And Marine Wetland

E2EM1P	340.0 acres
E2USN	105.0 acres
E2EM1Px	8.36 acres
E2US2P	7.56 acres
E2US2Ps	3.24 acres
E2SS1P	2.35 acres
E2EM1N	1.43 acres
E2EM1/SS1P	1.12 acres

E2SS3P 0.482 acre

Freshwater Emergent Wetland

PEM1C 24.6 acres
PEM1Ed 21.4 acres
PEM1B 20.5 acres
PEM1/SS1C 11.6 acres
PEM1Cs 4.82 acres
PEM1Ad 4.64 acres
PEM1Ex 3.92 acres
PEM1Chs 3.86 acres
PEM1Cd 1.49 acres
PEM1E 1.46 acres
PEM1R 1.15 acres
PEM1Kx 0.826 acre
PEM1A 0.769 acre
PEM1Eh 0.212 acre

Freshwater Forested/shrub Wetland

PFO4Cd 173.0 acres
PFO1Cd 106.0 acres
PFO1/4B 43.2 acres
PFO1/4Cd 35.6 acres
PFO1Bd 32.2 acres
PFO1B 31.2 acres
PFO1E 30.8 acres
PFO1C 26.0 acres
PSS3/FO1C 23.4 acres
PFO1R 15.3 acres
PFO1A 13.4 acres
PSS1R 12.6 acres
PSS4A 11.6 acres
PSS1Bd 11.1 acres
PSS1Ex 9.94 acres
PFO4R 6.25 acres
PFO4Bd 5.46 acres
PSS1C 4.67 acres
PFO1/4C 4.49 acres
PFO1/4E 3.29 acres
PFO1S 2.53 acres
PFO1Eh 2.44 acres
1.83 acres

PSS1E	
PSS1Eh	1.6 acres
PFO4Ad	1.31 acres
PFO4C	1.08 acres
PFO1Ch	0.94 acre

Freshwater Pond

PUBHh	41.0 acres
PUBHx	40.7 acres
PUSCx	1.28 acres
PUBFx	0.836 acre
PABFh	0.632 acre
PUBFh	0.227 acre

Lake

L2USChs	1060.0 acres
L2USAhs	742.0 acres
L2UBFhs	309.0 acres
L2UBGhs	40.4 acres
L1UBHx	32.4 acres
L2USCs	27.5 acres

Other

Pf	0.624 acre

U.S. Fish & Wildlife Service

Combined Alternative Build

IPaC Trust Resource Report

Alternative D

Generated October 12, 2015 12:51 PM MDT

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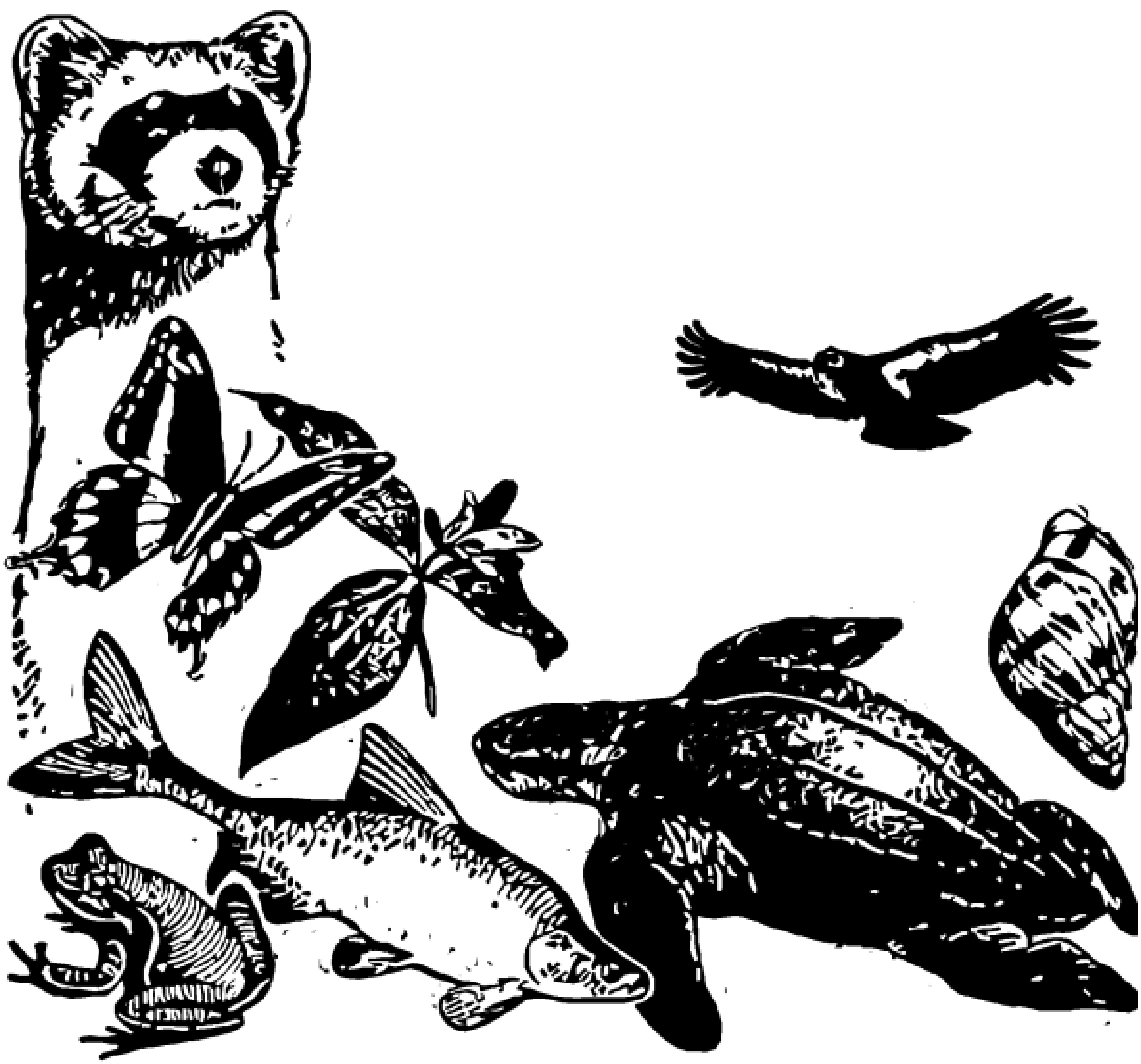
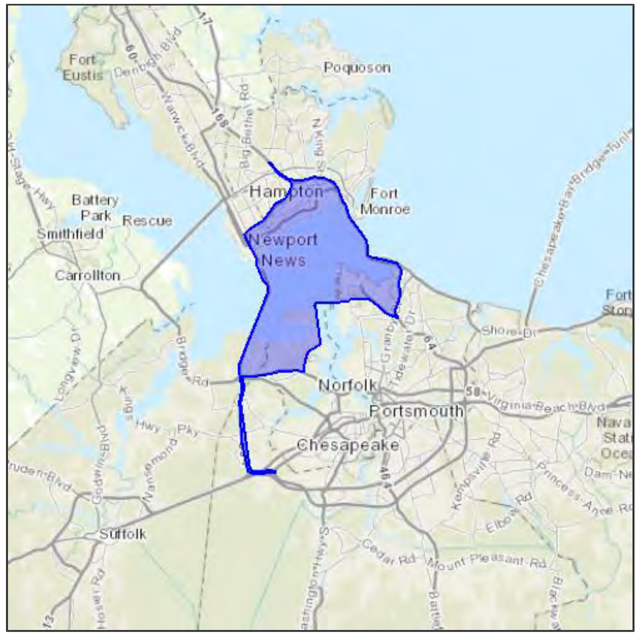


US Fish & Wildlife Service

IPaC Trust Resource Report

Project Description



NAME

Combined Alternative Build

PROJECT CODE

FLYCB-ING6R-CDXCL-T6553-UTNBBU

LOCATION

Virginia

DESCRIPTION

No description provided

U.S. Fish & Wildlife Contact Information

Species in this report are managed by:

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

Endangered Species

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Birds

Piping Plover Charadrius melodus — Threatened

CRITICAL HABITAT
No critical habitat has been designated for this species.

https://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B079

Mammals

Northern Long-eared Bat Myotis septentrionalis — Threatened

CRITICAL HABITAT
No critical habitat has been designated for this species.

https://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=A0JE

Critical Habitats

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Migratory Birds

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American Kestrel Falco sparverius paulus — **Bird of conservation concern**
Year-round

American Oystercatcher Haematopus palliatus — **Bird of conservation concern**
Year-round
https://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B0G8

American Bittern Botaurus lentiginosus — **Bird of conservation concern**
Season: Wintering
https://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B0F3

Bald Eagle Haliaeetus leucocephalus — **Bird of conservation concern**
Year-round
https://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B008

Black Rail Laterallus jamaicensis — **Bird of conservation concern**
Season: Breeding
https://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B09A

Black Skimmer Rynchops niger — **Bird of conservation concern**
Season: Breeding
https://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B0EO

Black-throated Green Warbler Dendroica virens — **Bird of conservation concern**
Season: Breeding

Brown-headed Nuthatch Sitta pusilla — **Bird of conservation concern**
Year-round

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Season: Wintering

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Season: Wintering
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Peregrine Falcon Falco peregrinus — Bird of conservation concern
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Year-round

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Season: Breeding

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Season: Breeding

Purple Sandpiper Calidris maritima — Bird of conservation concern
Season: Wintering

Red Knot Calidris canutus rufa — Bird of conservation concern
Season: Wintering
https://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B0DM

Red-headed Woodpecker Melanerpes erythrocephalus — Bird of conservation concern
Year-round

Rusty Blackbird Euphagus carolinus — Bird of conservation concern
Season: Wintering

Saltmarsh Sparrow Ammodramus caudacutus — Bird of conservation concern
Year-round

Seaside Sparrow Ammodramus maritimus — Bird of conservation concern
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Season: Wintering

Short-eared Owl Asio flammeus — Bird of conservation concern
Season: Wintering
https://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B0HD

Snowy Egret Egretta thula — Bird of conservation concern
Season: Breeding

Swainson's Warbler Limnothlypis swainsonii — Bird of conservation concern
Season: Breeding

Wood Thrush Hylocichla mustelina — Bird of conservation concern
Season: Breeding

Worm Eating Warbler Helmitheros vermivorum — Bird of conservation concern
Season: Breeding

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There are no wetlands identified in this project area

VaFWIS - Department of Game and Inland Fisheries

36,57,15.0 -76,20,44.4 is the Search Point

Submit Cancel

Search Point
- Change to "clicked" map point
- Fixed at 36,57,15.0 -76,20,44.4

Show Position Rings
- Yes
- No

4 miles and 1 mile at the Search Point

Show Search Area
- Yes
- No

2 Search distance miles buffer

Search Point is at map center

Base Map Choices
Topography

Map Overlay Choices
Current List: Search

Map Overlay Legend

2 mile radius Search Area

Alternative B

Refresh Browser Page

Map Click: Pan Id M — Map Scale: In Zoom Out — Screen Size: Small Size Big — Help

Point of Search 36,57,15.0 -76,20,44.4
Map Location 36,57,15.0 -76,20,44.4

Select Coordinate System:
- Degrees,Minutes,Seconds Latitude - Longitude
- Decimal Degrees Latitude - Longitude
- Meters UTM NAD83 East North Zone
- Meters UTM NAD27 East North Zone

Base Map source: USGS 1:250,000 topographic maps (see Microsoft terraserver-usa.com for details)

Map projection is UTM Zone 18 NAD 1983 with left 360995 and top 4109834. Pixel size is 44. . Coordinates displayed are Degrees, Minutes, Seconds North and West. Map is currently displayed as 600 columns by 600 rows for a total of 360000 pixles. The map display represents 38400 meters east to west by 38400 meters north to south for a total of 1474.5 square kilometers. The map display represents 126005 feet east to west by 126005 feet north to south for a total of 569.5 square miles.

Topographic maps and Black and white aerial photography for year 1990+-
are from the United States Department of the Interior, United States Geological Survey.
Color aerial photography aquired 2002 is from Virginia Base Mapping Program, Virginia Geographic Information Network.
Shaded topographic maps are from TOPO! ©2006 National Geographic
http://www.national.geographic.com/topo
All other map products are from the Commonwealth of Virginia Department of Game and Inland Fisheries.

map assembled 2015-10-12 12:32:52 (qa/qc December 5, 2012 8:04 - tn=686395 dist=3218 I)
$poi=37.0469100 -76.4015500

VaFWIS Search Report Compiled on 10/12/2015, 12:38:03 PM

Help

Known or likely to occur within a 2 mile buffer around line beginning 37,02,48.8 -76,24,05.5 in 550 Chesapeake City, 650 Hampton City, 700 Newport News City, 710 Norfolk City, 740 Portsmouth City, 800 Suffolk City, VA

Alternative B

View Map of Site Location

702 Known or Likely Species ordered by Status Concern for Conservation (displaying first 58) (58 species with Status* or Tier I** or Tier II**)

BOVA Code	Status*	Tier**	Common Name	Scientific Name	Confirmed	Database(s)
040228	FESE	I	Woodpecker, red-cockaded	Picoides borealis		BOVA
010032	FESE	II	Sturgeon, Atlantic	Acipenser oxyrinchus	Yes	BOVA,Habitat,SppObs,HU6
040183	FESE	IV	Tern, roseate	Sterna dougallii dougallii		HU6
030073	FESE		Turtle, hawksbill sea	Eretmochelys imbricata		BOVA
030074	FESE		Turtle, Kemp's ridley sea	Lepidochelys kempii	Yes	BOVA,SppObs,HU6
030075	FESE		Turtle, leatherback sea	Dermochelys coriacea	Yes	BOVA,SppObs,HU6
120030	FESE		Manatee, West Indian	Trichechus manatus		BOVA,HU6
030071	FTST	I	Turtle, loggerhead sea	Caretta caretta	Yes	BOVA,SppObs,HU6
040120	FTST	I	Plover, piping	Charadrius melodus	Yes	BOVA,Habitat,BBA,SppObs,CWB,HU6
100361	FTST	II	Beetle, northeastern beach tiger	Cicindela dorsalis dorsalis		HU6
040144	FT	IV	Knot, red	Calidris canutus rufa	Yes	BOVA,SppObs,HU6
030072	FTST		Turtle, green sea	Chelonia mydas		BOVA,HU6
050022	FT		Bat, northern long-eared	Myotis septentrionalis		BOVA
030064	SE	I	Turtle, eastern chicken	Deirochelys reticularia reticularia		HU6

040118	SE	I	Plover, Wilson's	Charadrius wilsonia	Yes	BOVA,Habitat,SppObs,CWB,HU6
040110	SE	I	Rail, black	Laterallus jamaicensis	Potential	BOVA,Habitat,HU6
050034	SE	I	Bat, Rafinesque's eastern big-eared	Corynorhinus rafinesquii macrotis		BOVA,HU6
030013	SE	II	Rattlesnake, canebrake	Crotalus horridus	Yes	BOVA,Habitat,SppObs,HU6
040096	ST	I	Falcon, peregrine	Falco peregrinus	Yes	BOVA,SppObs,HU6
040129	ST	I	Sandpiper, upland	Bartramia longicauda		BOVA
040293	ST	I	Shrike, loggerhead	Lanius ludovicianus		BOVA
040379	ST	I	Sparrow, Henslow's	Ammodramus henslowii	Potential	Habitat,HU6
040179	ST	I	Tern, gull-billed	Sterna nilotica	Yes	BOVA,Habitat,SppObs,CWB,HU6
020044	ST	II	Salamander, Mabee's	Ambystoma mabeei	Yes	BOVA,Habitat,SppObs,HU6
020002	ST	II	Treefrog, barking	Hyla gratiosa		HU6
050008	ST	IV	Shrew, Dismal Swamp southeastern	Sorex longirostris fisheri		BOVA,HU6
040292	ST		Shrike, migrant loggerhead	Lanius ludovicianus migrans		BOVA
070131	FS	I	Isopod, Phreatic	Caecidotea phreatica		BOVA
100176	FS	I	Skipper, Arogos	Atrytone arogos arogos		BOVA
040093	FS	II	Eagle, bald	Haliaeetus leucocephalus	Yes	BOVA,SppObs,BAEANests,HU6
110353	FS	II	SPIDER, FUNNEL-WEB	Barronopsis jeffersi		HU6
070105	FS	III	Crayfish, Chowanoke	Orconectes virginiensis		BOVA
100192	FS	III	Roadside-skipper, dusky	Amblyscirtes alternata		BOVA
100002	FS	III	Skipper, Duke's (or scarce	Euphyes dukesi		BOVA

			swamp)			
010038	FS	IV	Alewife	Alosa pseudoharengus		BOVA,HU6
100001	FS	IV	fritillary, Diana	Speyeria diana		BOVA
010045	FS		Herring, blueback	Alosa aestivalis		BOVA,HU6
030067	CC	II	Terrapin, northern diamond-backed	Malaclemys terrapin terrapin	Yes	BOVA,Habitat,SppObs,HU6
030063	CC	III	Turtle, spotted	Clemmys guttata	Yes	BOVA,SppObs,HU6
040225		I	Sapsucker, yellow-bellied	Sphyrapicus varius	Yes	BOVA,SppObs
040319		I	Warbler, black-throated green	Dendroica virens		BOVA
040306		I	Warbler, golden-winged	Vermivora chrysoptera	Yes	BOVA,SppObs
040422		I	Warbler, Wayne's	Dendroica virens waynei		HU6
020063		II	Toad, oak	Anaxyrus quercicus	Yes	BOVA,SppObs,HU6
040038		II	Bittern, American	Botaurus lentiginosus	Yes	BOVA,SppObs
040052		II	Duck, American black	Anas rubripes	Yes	BOVA,BBA,SppObs,HU6
040029		II	Heron, little blue	Egretta caerulea caerulea	Yes	BOVA,SppObs
040036		II	Night-heron, yellow-crowned	Nyctanassa violacea violacea	Yes	BOVA,BBA,SppObs,CWB
040213		II	Owl, northern saw-whet	Aegolius acadicus		HU6
040114		II	Oystercatcher, American	Haematopus palliatus	Yes	BOVA,Habitat,BBA,SppObs,HU6
040105		II	Rail, king	Rallus elegans	Potential	BOVA,Habitat,HU6
040192		II	Skimmer, black	Rynchops niger	Yes	BOVA,Habitat,BBA,SppObs,CWB,HU6
040381		II	Sparrow, saltmarsh sharp-tailed	Ammodramus caudacutus		BOVA,HU6
				Sterna		

040186		II	Tern, least	antillarum	Yes	BOVA,Habitat,BBA,SppObs,CWB,HU6
040187		II	Tern, royal	Sterna maxima maximus	Yes	BOVA,Habitat,BBA,SppObs,CWB,HU6
040320		II	Warbler, cerulean	Dendroica cerulea		BOVA,HU6
040304		II	Warbler, Swainson's	Limnothlypis swainsonii		BOVA,HU6
040266		II	Wren, winter	Troglodytes troglodytes	Yes	BOVA,SppObs

To view All 702 species View 702

* FE=Federal Endangered; FT=Federal Threatened; SE=State Endangered; ST=State Threatened; FC=Federal Candidate; FS=Federal Species of Concern; 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

View Map of All Query Results from All Observation Tables

Bat Colonies or Hibernacula: Not Known

Anadromous Fish Use Streams (5 records) View Map of All Anadromous Fish Use Streams

Stream ID	Stream Name	Reach Status	Anadromous Fish Species			View Map
			Different Species	Highest TE*	Highest Tier**	
C20	Elizabeth river	Confirmed	1			Yes
C92	James River 1	Confirmed	6	FC	IV	Yes
P118	Nansemond river	Potential	0			Yes
P177	West Creek	Potential	0			Yes
P87	Knotts creek	Potential	0			Yes

Impediments to Fish Passage (1 records) View Map of All Fish Impediments

ID	Name	River	View Map
786	MATHEWS DAM	STREETER CREEK	Yes

Colonial Water Bird Survey (48 records - displaying first 20 , 3 Observations with Threatened or Endangered species) View Map of All Query Results Colonial Water Bird Survey

Colony_Name	N Obs	Latest Date	N Species			View Map
			Different Species	Highest TE*	Highest Tier**	

CRANEY ISLAND	10	Jun 5 2008	3	FT	I	Yes
HRB Tunnel Island	4	Jun 12 2008	7	ST	I	Yes
Hampton Roads Bridge-Tunn	1	Jun 1 1993	3	ST	I	Yes
Hermitage	1	Jul 12 2008	2		II	Yes
Newport	2	Jul 12 2008	1		II	Yes
River Road	1	Jul 12 2008	1		II	Yes
Suburban	1	Jul 12 2008	1		II	Yes
West Belvedere	2	Jul 12 2008	1		II	Yes

[VaFWIS](https://vafwis.dgif.virginia.gov) - Department of Game and Inland Fisheries

36,54,29.9 -76,21,08.3 is the Search Point

Submit Cancel

Search Point
- Change to "clicked" map point
- Fixed at 36,54,29.9 -76,21,08.3

Show Position Rings
Yes No
4 miles and 1 mile at the Search Point

Show Search Area
Yes No
2 Search distance miles buffer

Search Point is at map center

Base Map Choices
Topography

Map Overlay Choices
Current List: Search

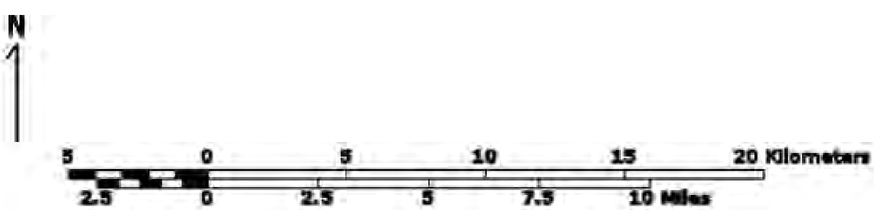
Map Overlay Legend

2 mile radius Search Area

Alternative C

Refresh Browser Page

Map Click Pan Id M | Map Scale In Zoom Out | Screen Size Small Size Big | Help



Point of Search 36,54,29.9 -76,21,08.3
Map Location 36,54,29.9 -76,21,08.3

Select Coordinate System:
- Degrees,Minutes,Seconds Latitude - Longitude
- Decimal Degrees Latitude - Longitude
- Meters UTM NAD83 East North Zone
- Meters UTM NAD27 East North Zone

Base Map source: USGS 1:250,000 topographic maps (see Microsoft terraserver-usa.com for details)

Map projection is UTM Zone 18 NAD 1983 with left 360330 and top 4104757. Pixel size is 57. . Coordinates displayed are Degrees, Minutes, Seconds North and West. Map is currently displayed as 600 columns by 600 rows for a total of 360000 pixles. The map display represents 38400 meters east to west by 38400 meters north to south for a total of 1474.5 square kilometers. The map display represents 126005 feet east to west by 126005 feet north to south for a total of 569.5 square miles.

Topographic maps and Black and white aerial photography for year 1990+-
are from the United States Department of the Interior, United States Geological Survey.
Color aerial photography aquired 2002 is from Virginia Base Mapping Program, Virginia Geographic Information Network.
Shaded topographic maps are from TOPO! ©2006 National Geographic http://www.national.geographic.com/topo
All other map products are from the Commonwealth of Virginia Department of Game and Inland Fisheries.

map assembled 2015-10-12 14:24:54 (qa/qc December 5, 2012 8:04 - tn=686435 dist=3218 I)
$poi=36.9439200 -76.3743000

| DGIF | Credits | Disclaimer | Contact shirl.dressler@dgif.virginia.gov |Please view our privacy policy |

VaFWIS Search Report Compiled on 10/12/2015, 2:28:20 PM

Help

Known or likely to occur within a 2 mile buffer around line beginning 36,56,38.0 -76,22,27.4
in 093 Isle of Wight County, 550 Chesapeake City, 650 Hampton City, 700 Newport News City,
710 Norfolk City, 740 Portsmouth City, 800 Suffolk City, VA

View Map of Site Location

Alternative C

725 Known or Likely Species ordered by Status Concern for Conservation
(displaying first 58) (58 species with Status* or Tier I** or Tier II**)

BOVA Code	Status*	Tier**	Common Name	Scientific Name	Confirmed	Database(s)
040228	FESE	I	Woodpecker, red-cockaded	Picoides borealis		BOVA
010032	FESE	II	Sturgeon, Atlantic	Acipenser oxyrinchus	Yes	BOVA,Habitat,SppObs,HU6
040183	FESE	IV	Tern, roseate	Sterna dougallii dougallii		HU6
030073	FESE		Turtle, hawksbill sea	Eretmochelys imbricata		BOVA
030074	FESE		Turtle, Kemp's ridley sea	Lepidochelys kempii		BOVA,HU6
030075	FESE		Turtle, leatherback sea	Dermochelys coriacea		BOVA,HU6
120030	FESE		Manatee, West Indian	Trichechus manatus		BOVA
030071	FTST	I	Turtle, loggerhead sea	Caretta caretta	Yes	BOVA,SppObs,HU6
040120	FTST	I	Plover, piping	Charadrius melodus	Yes	BOVA,Habitat,BBA,SppObs,CWB,HU6
040144	FT	IV	Knot, red	Calidris canutus rufa		BOVA,HU6
030072	FTST		Turtle, green sea	Chelonia mydas		BOVA,HU6
050022	FT		Bat, northern long-eared	Myotis septentrionalis		BOVA
030064	SE	I	Turtle, eastern chicken	Deirochelys reticularia reticularia		BOVA,HU6
040118	SE	I	Plover, Wilson's	Charadrius wilsonia	Yes	BOVA,Habitat,SppObs,CWB,HU6
040110	SE	I	Rail, black	Laterallus	Potential	BOVA,Habitat,HU6

				jamaicensis		
050034	SE	I	Bat, Rafinesque's eastern big-eared	Corynorhinus rafinesquii macrotis		BOVA,HU6
020052	SE	II	Salamander, eastern tiger	Ambystoma tigrinum		BOVA
030013	SE	II	Rattlesnake, canebrake	Crotalus horridus	Yes	BOVA,Habitat,SppObs,HU6
040096	ST	I	Falcon, peregrine	Falco peregrinus	Yes	BOVA,SppObs,HU6
040129	ST	I	Sandpiper, upland	Bartramia longicauda		BOVA
040293	ST	I	Shrike, loggerhead	Lanius ludovicianus		BOVA
040379	ST	I	Sparrow, Henslow's	Ammodramus henslowii	Potential	Habitat,HU6
040179	ST	I	Tern, gull-billed	Sterna nilotica		BOVA,HU6
020044	ST	II	Salamander, Mabee's	Ambystoma mabeei	Yes	BOVA,Habitat,SppObs,HU6
020002	ST	II	Treefrog, barking	Hyla gratiosa		BOVA,HU6
050008	ST	IV	Shrew, Dismal Swamp southeastern	Sorex longirostris fisheri	Yes	BOVA,Habitat,SppObs,HU6
040292	ST		Shrike, migrant loggerhead	Lanius ludovicianus migrans		BOVA
070131	FS	I	Isopod, Phreatic	Caecidotea phreatica		BOVA
100176	FS	I	Skipper, Arogos	Atrytone arogos arogos		BOVA
040093	FS	II	Eagle, bald	Haliaeetus leucocephalus	Yes	BOVA,SppObs,BAEANests,HU6
110353	FS	II	SPIDER, FUNNEL-WEB	Barronopsis jeffersi		HU6
070105	FS	III	Crayfish, Chowanoke	Orconectes virginiensis		BOVA
100192	FS	III	Roadside-skipper, dusky	Amblyscirtes alternata		BOVA
100002	FS	III	Skipper, Duke's (or scarce swamp)	Euphyes dukesi		BOVA

010038	FS	IV	Alewife	Alosa pseudoharengus	Yes	BOVA,SppObs,HU6
100001	FS	IV	fritillary, Diana	Speyeria diana		BOVA
010045	FS		Herring, blueback	Alosa aestivalis	Yes	BOVA,SppObs,HU6
030067	CC	II	Terrapin, northern diamond-backed	Malaclemys terrapin terrapin	Yes	BOVA,Habitat,SppObs,HU6
030063	CC	III	Turtle, spotted	Clemmys guttata	Yes	BOVA,SppObs,HU6
040225		I	Sapsucker, yellow-bellied	Sphyrapicus varius		BOVA
040319		I	Warbler, black-throated green	Dendroica virens		BOVA
040306		I	Warbler, golden-winged	Vermivora chrysoptera		BOVA
040422		I	Warbler, Wayne's	Dendroica virens waynei	Potential	Habitat,HU6
020063		II	Toad, oak	Anaxyrus quercicus	Yes	BOVA,SppObs,HU6
040038		II	Bittern, American	Botaurus lentiginosus		BOVA
040052		II	Duck, American black	Anas rubripes	Potential	BOVA,BBA,HU6
040029		II	Heron, little blue	Egretta caerulea caerulea		BOVA
040036		II	Night-heron, yellow-crowned	Nyctanassa violacea violacea	Yes	BOVA,BBA,SppObs,CWB
040213		II	Owl, northern saw-whet	Aegolius acadicus		HU6
040114		II	Oystercatcher, American	Haematopus palliatus	Potential	BOVA,Habitat,HU6
040105		II	Rail, king	Rallus elegans	Potential	BOVA,Habitat,HU6
040192		II	Skimmer, black	Rynchops niger	Potential	BOVA,BBA,HU6
040381		II	Sparrow, saltmarsh sharp-tailed	Ammodramus caudacutus		BOVA
040186		II	Tern, least	Sterna antillarum	Yes	BOVA,Habitat,BBA,SppObs,CWB,HU6

040187		II	Tern, royal	Sterna maxima maximus	Potential	BOVA,BBA,HU6
040320		II	Warbler, cerulean	Dendroica cerulea		BOVA,HU6
040304		II	Warbler, Swainson's	Limnothlypis swainsonii		BOVA,HU6
040266		II	Wren, winter	Troglodytes troglodytes		BOVA

To view All 725 species View 725

* FE=Federal Endangered; FT=Federal Threatened; SE=State Endangered; ST=State Threatened; FC=Federal Candidate; FS=Federal Species of Concern; 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

View Map of All Query Results from All Observation Tables

Bat Colonies or Hibernacula: Not Known

Anadromous Fish Use Streams (5 records)

View Map of All Anadromous Fish Use Streams

Stream ID	Stream Name	Reach Status	Anadromous Fish Species			View Map
			Different Species	Highest TE*	Highest Tier**	
C20	Elizabeth river	Confirmed	1			Yes
C92	James River 1	Confirmed	6	FC	IV	Yes
P118	Nansemond river	Potential	0			Yes
P177	West Creek	Potential	0			Yes
P87	Knotts creek	Potential	0			Yes

Impediments to Fish Passage (1 records)

View Map of All Fish Impediments

ID	Name	River	View Map
786	MATHEWS DAM	STREETER CREEK	Yes

Colonial Water Bird Survey (33 records - displaying first 20 , 1 Observation with Threatened or Endangered species)

View Map of All Query Results Colonial Water Bird Survey

Colony_Name	N Obs	Latest Date	N Species			View Map
			Different Species	Highest TE*	Highest Tier**	
CRANEY ISLAND	10	Jun 5 2008	3	FT	I	Yes
Hermitage	1	Jul 12 2008	2		II	Yes

VaFWIS - Department of Game and Inland Fisheries

Alternative D

Refresh Browser Page

Map Click Pan Id M | Map Scale In Zoom Out | Screen Size Small Size Big | Help

36,54,48.6 -76,20,58.5
is the Search Point

Submit Cancel

Search Point
- Change to "clicked" map point
- Fixed at 36,54,48.6 -76,20,58.5

Show Position Rings
Yes No
4 miles and 1 mile at the Search Point

Show Search Area
Yes No
2 Search distance miles buffer

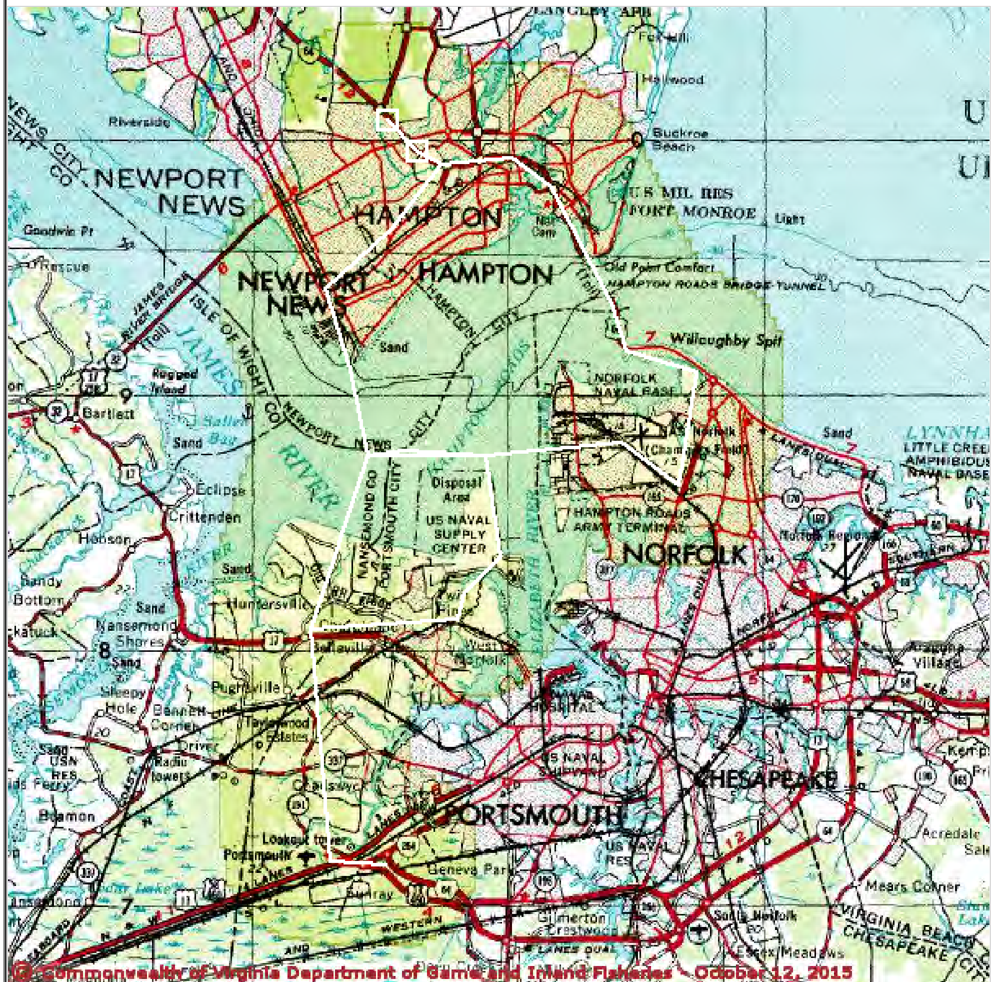
Search Point is at map center

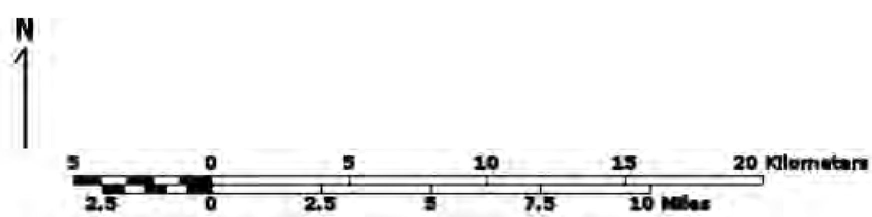
Base Map Choices
Topography

Map Overlay Choices
Current List: Search

Map Overlay Legend

2 mile radius
Search Area





Point of Search 36,54,48.6 -76,20,58.5
Map Location 36,54,48.6 -76,20,58.5

Select Coordinate System:
- Degrees,Minutes,Seconds Latitude - Longitude
- Decimal Degrees Latitude - Longitude
- Meters UTM NAD83 East North Zone
- Meters UTM NAD27 East North Zone

Base Map source: USGS 1:250,000 topographic maps (see Microsoft terraserver-usa.com for details)

Map projection is UTM Zone 18 NAD 1983 with left 360582 and top 4105329. Pixel size is 59. . Coordinates displayed are Degrees, Minutes, Seconds North and West. Map is currently displayed as 600 columns by 600 rows for a total of 360000 pixles. The map display represents 38400 meters east to west by 38400 meters north to south for a total of 1474.5 square kilometers. The map display represents 126005 feet east to west by 126005 feet north to south for a total of 569.5 square miles.

Topographic maps and Black and white aerial photography for year 1990+-
are from the United States Department of the Interior, United States Geological Survey.
Color aerial photography aquired 2002 is from Virginia Base Mapping Program, Virginia Geographic Information Network.
Shaded topographic maps are from TOPO! ©2006 National Geographic
http://www.national.geographic.com/topo
All other map products are from the Commonwealth of Virginia Department of Game and Inland Fisheries.

map assembled 2015-10-12 15:07:17 (qa/qc December 5, 2012 8:04 - tn=686459 dist=3218 I)
$poi=36.9540600 -76.3610400

VaFWIS Search Report Compiled on 10/12/2015, 3:10:00 PM

Help

Known or likely to occur within a 2 mile buffer around polygon; center 36,57,14.6 -76,21,39.7
in 093 Isle of Wight County, 550 Chesapeake City, 650 Hampton City, 700 Newport News City,
710 Norfolk City, 740 Portsmouth City, 800 Suffolk City, VA

View Map of
Site Location

Alternative D

727 Known or Likely Species ordered by Status Concern for Conservation
(displaying first 59) (59 species with Status* or Tier I** or Tier II**)

BOVA Code	Status*	Tier**	Common Name	Scientific Name	Confirmed	Database(s)
040228	FESE	I	Woodpecker, red-cockaded	Picoides borealis		BOVA
010032	FESE	II	Sturgeon, Atlantic	Acipenser oxyrinchus	Yes	BOVA,Habitat,SppObs,HU6
040183	FESE	IV	Tern, roseate	Sterna dougallii dougallii		HU6
030073	FESE		Turtle, hawksbill sea	Eretmochelys imbricata		BOVA
030074	FESE		Turtle, Kemp's ridley sea	Lepidochelys kempii	Yes	BOVA,SppObs,HU6
030075	FESE		Turtle, leatherback sea	Dermochelys coriacea	Yes	BOVA,SppObs,HU6
120030	FESE		Manatee, West Indian	Trichechus manatus		BOVA,HU6
030071	FTST	I	Turtle, loggerhead sea	Caretta caretta	Yes	BOVA,SppObs,HU6
040120	FTST	I	Plover, piping	Charadrius melodus	Yes	BOVA,Habitat,BBA,SppObs,CWB,HU6
100361	FTST	II	Beetle, northeastern beach tiger	Cicindela dorsalis dorsalis		HU6
040144	FT	IV	Knot, red	Calidris canutus rufa	Yes	BOVA,SppObs,HU6
030072	FTST		Turtle, green sea	Chelonia mydas		BOVA,HU6
050022	FT		Bat, northern long-eared	Myotis septentrionalis		BOVA
030064	SE	I	Turtle, eastern chicken	Deirochelys reticularia reticularia		BOVA,HU6

040118	SE	I	Plover, Wilson's	Charadrius wilsonia	Yes	BOVA,Habitat,SppObs,CWB,HU6
040110	SE	I	Rail, black	Laterallus jamaicensis	Potential	BOVA,Habitat,HU6
050034	SE	I	Bat, Rafinesque's eastern big-eared	Corynorhinus rafinesquii macrotis		BOVA,HU6
020052	SE	II	Salamander, eastern tiger	Ambystoma tigrinum		BOVA
030013	SE	II	Rattlesnake, canebrake	Crotalus horridus	Yes	BOVA,Habitat,SppObs,HU6
040096	ST	I	Falcon, peregrine	Falco peregrinus	Yes	BOVA,SppObs,HU6
040129	ST	I	Sandpiper, upland	Bartramia longicauda		BOVA
040293	ST	I	Shrike, loggerhead	Lanius ludovicianus		BOVA
040379	ST	I	Sparrow, Henslow's	Ammodramus henslowii	Potential	Habitat,HU6
040179	ST	I	Tern, gull-billed	Sterna nilotica	Yes	BOVA,Habitat,SppObs,CWB,HU6
020044	ST	II	Salamander, Mabee's	Ambystoma mabeei	Yes	BOVA,Habitat,SppObs,HU6
020002	ST	II	Treefrog, barking	Hyla gratiosa		BOVA,HU6
050008	ST	IV	Shrew, Dismal Swamp southeastern	Sorex longirostris fisheri	Yes	BOVA,Habitat,SppObs,HU6
040292	ST		Shrike, migrant loggerhead	Lanius ludovicianus migrans		BOVA
070131	FS	I	Isopod, Phreatic	Caecidotea phreatica		BOVA
100176	FS	I	Skipper, Arogos	Atrytone arogos arogos		BOVA
040093	FS	II	Eagle, bald	Haliaeetus leucocephalus	Yes	BOVA,SppObs,BAEANests,HU6
110353	FS	II	SPIDER, FUNNEL-WEB	Barronopsis jeffersi		HU6
070105	FS	III	Crayfish, Chowanoke	Orconectes virginiensis		BOVA
100192	FS	III	Roadside-skipper, dusky	Amblyscirtes alternata		BOVA

100002	FS	III	Skipper, Duke's (or scarce swamp)	Euphyes dukesi		BOVA
010038	FS	IV	Alewife	Alosa pseudoharengus	Yes	BOVA,SppObs,HU6
100001	FS	IV	fritillary, Diana	Speyeria diana		BOVA
010045	FS		Herring, blueback	Alosa aestivalis	Yes	BOVA,SppObs,HU6
030067	CC	II	Terrapin, northern diamond-backed	Malaclemys terrapin terrapin	Yes	BOVA,Habitat,SppObs,HU6
030063	CC	III	Turtle, spotted	Clemmys guttata	Yes	BOVA,SppObs,HU6
040225		I	Sapsucker, yellow-bellied	Sphyrapicus varius	Yes	BOVA,SppObs
040319		I	Warbler, black-throated green	Dendroica virens		BOVA
040306		I	Warbler, golden-winged	Vermivora chrysoptera	Yes	BOVA,SppObs
040422		I	Warbler, Wayne's	Dendroica virens waynei	Potential	Habitat,HU6
020063		II	Toad, oak	Anaxyrus quercicus	Yes	BOVA,SppObs,HU6
040038		II	Bittern, American	Botaurus lentiginosus	Yes	BOVA,SppObs
040052		II	Duck, American black	Anas rubripes	Yes	BOVA,BBA,SppObs,HU6
040029		II	Heron, little blue	Egretta caerulea caerulea	Yes	BOVA,SppObs
040036		II	Night-heron, yellow-crowned	Nyctanassa violacea violacea	Yes	BOVA,BBA,SppObs,CWB
040213		II	Owl, northern saw-whet	Aegolius acadicus		HU6
040114		II	Oystercatcher, American	Haematopus palliatus	Yes	BOVA,Habitat,BBA,SppObs,HU6
040105		II	Rail, king	Rallus elegans	Potential	BOVA,Habitat,HU6
040192		II	Skimmer, black	Rynchops niger	Yes	BOVA,Habitat,BBA,SppObs,CWB,HU6
040381		II	Sparrow, saltmarsh	Ammodramus		BOVA,HU6

			sharp-tailed	caudacutus		
040186		II	Tern, least	Sterna antillarum	Yes	BOVA,Habitat,BBA,SppObs,CWB,HU6
040187		II	Tern, royal	Sterna maxima maximus	Yes	BOVA,Habitat,BBA,SppObs,CWB,HU6
040320		II	Warbler, cerulean	Dendroica cerulea		BOVA,HU6
040304		II	Warbler, Swainson's	Limnothlypis swainsonii		BOVA,HU6
040266		II	Wren, winter	Troglodytes troglodytes	Yes	BOVA,SppObs

To view All 727 species View 727

* FE=Federal Endangered; FT=Federal Threatened; SE=State Endangered; ST=State Threatened; FC=Federal Candidate; FS=Federal Species of Concern; 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

View Map of All Query Results from All Observation Tables

Bat Colonies or Hibernacula: Not Known

Anadromous Fish Use Streams (5 records)

View Map of All Anadromous Fish Use Streams

Stream ID	Stream Name	Reach Status	Anadromous Fish Species			View Map
			Different Species	Highest TE*	Highest Tier**	
C20	Elizabeth river	Confirmed	1			Yes
C92	James River 1	Confirmed	6	FC	IV	Yes
P118	Nansemond river	Potential	0			Yes
P177	West Creek	Potential	0			Yes
P87	Knotts creek	Potential	0			Yes

Impediments to Fish Passage (1 records)

View Map of All Fish Impediments

ID	Name	River	View Map
786	MATHEWS DAM	STREETER CREEK	Yes

Colonial Water Bird Survey (54 records - displaying first 20, 3 Observations with Threatened or Endangered species)

View Map of All Query Results Colonial Water Bird Survey

	N		N Species			View

Colony_Name	Obs	Latest Date	Different Species	Highest TE*	Highest Tier**	Map
CRANEY ISLAND	10	Jun 5 2008	3	FT	I	Yes
HRB Tunnel Island	4	Jun 12 2008	7	ST	I	Yes
Hampton Roads Bridge-Tunn	1	Jun 1 1993	3	ST	I	Yes
Hermitage	1	Jul 12 2008	2		II	Yes
Newport	2	Jul 12 2008	1		II	Yes
River Road	1	Jul 12 2008	1		II	Yes
Suburban	1	Jul 12 2008	1		II	Yes
West Belvedere	2	Jul 12 2008	1		II	Yes
22nd Avenue	1	May 31 2008	1		II	Yes
Mohawk	1	May 31 2008	1		II	Yes
Peterson Yacht Basin	1	May 31 2008	1		II	Yes
Pine Grove	1	May 31 2008	1		II	Yes
Raleigh Terrace	2	May 31 2008	1		II	Yes
Treasure Point	1	May 31 2008	1		II	Yes
Greenbriar	2	May 18 2008	1		II	Yes
Lovett Point	2	May 18 2008	1		II	Yes
Pine Wells	1	May 8 2008	1		II	Yes
Brittany Woods	1	Jul 11 2003	1		II	Yes
Pinehurst	2	Jul 11 2003	2		II	Yes
Morwin	2	Jul 10 2003	1		II	Yes

Displayed 20 Colonial Water Bird Survey

Selected 54 Observations View all 54 Colonial Water Bird Survey

Threatened and Endangered Waters

N/A

Managed Trout Streams

N/A

Bald Eagle Concentration Areas and Roosts

N/A

Bald Eagle Nests (10 records)

View Map of All Query Results
Bald Eagle Nests

Nest	N Obs	Latest Date	DGIF Nest Status	View Map
CP0301	12	Apr 25 2011	RECENTLY ACTIVE	Yes
CP0701	4	Mar 1 2008	UNKNOWN	Yes
CP0801	6	Feb 17 2010	UNKNOWN	Yes
HM1101	1	Jun 20 2011	RECENTLY ACTIVE	Yes
NO1001	2	May 20 2011	RECENTLY ACTIVE	Yes
PM0001	5	Jan 1 2003	HISTORIC	Yes
PM0101	2	May 1 2001	HISTORIC	Yes
PM9901	6	Apr 24 2000	HISTORIC	Yes
SK0201	7	Apr 26 2006	HISTORIC	Yes
SK0401	15	Apr 18 2011	RECENTLY ACTIVE	Yes

Displayed 10 Bald Eagle Nests

Species Observations (548 records - displaying first 142 , 142 Observations with Threatened or Endangered species)

View Map of All Query Results
Species Observations

obsID	class	Date Observed	Observer	N Species			View Map
				Different Species	Highest TE*	Highest Tier**	
319029	SppObs	Jun 13 2007	John Musick	2	FESE	I	Yes
63110	SppObs	Nov 4 1997	USFWS	1	FESE	II	Yes
63043	SppObs	Oct 2 1997	USFWS	1	FESE	II	Yes
62980	SppObs	May 8 1997	USFWS	1	FESE	II	Yes

Web Project ID: WEB0000004286

Client Project Number: 203400545B

PROJECT INFORMATION

TITLE: HRCS Study- Alternative B

Alternative B

DESCRIPTION: Alternatives analysis for VDOT

EXISTING SITE CONDITIONS: Existing and proposed interstate corridor

QUADRANGLES: Newport News North, Hampton, Newport News South, Norfolk North, Bowers Hill, Norfolk South

COUNTIES: City of Chesapeake, City of Hampton, City of Newport News, City of Norfolk, City of Portsmouth, City of Suffolk

Latitude/Longitude (DMS): 36°56'5.3386"N / 76°18'16.2015"W

Acreage: 4983 acres

Comments:

REQUESTOR INFORMATION

Priority: N Tier Level: Tier II Tax ID:

Contact Name: Tara Dillard

Company Name: Stantec

Address: 1011 Boulder Springs Drive

City: Richmond State: VA Zip: 23225

Phone: (804) 267-3474 Fax: (804) 267-3470 Email: tara.dillard@stantec.com

Conservation Site	Site Type	Brank	Acreage	Listed Species Presence
BIG BETHEL FLATWOODS	Conservation Site	B4	65	NL
KECOUGHTAN	Conservation Site	B5	152	NL
SANDY BOTTOM	Conservation Site	B2	501	NL
HAMPTON ROADS BRIDGE TUNNEL	Conservation Site	B5	20	SL
CRANEY ISLAND	Conservation Site	B4	2827	NL
PINEHURST	Conservation Site	B5	32	NL
	GLNHR	NA	0	NL
	GLNHR	NA	0	SL
	GLNHR	NA	0	SL
	GLNHR	NA	0	FL
	GLNHR	NA	0	SL
	GLNHR	NA	0	FL
	GLNHR	NA	0	NL
	GLNHR	NA	0	NL
	GLNHR	NA	0	NL
	GLNHR	NA	0	NL
	GLNHR	NA	0	NL
	GLNHR	NA	0	NL
	GLNHR	NA	0	NL
	GLNHR	NA	0	NL
	GLNHR	NA	0	SL
	GLNHR	NA	0	SL

Natural Heritage Screening Features within Search Radius

Site Name	Group Name	Common Name	Scientific Name	GRANK	SRANK	Fed Status	State Status	EO Rank	Last Obs Date	Precision
	Vertebrate Animal	Atlantic Sturgeon	Acipenser oxyrinchus	G3	S2	LE	LE	E	2007-05	
Fox Corner	Vertebrate Animal	Mabee's Salamander	Ambystoma mabeei	G4	S1S2		LT	X	1985-11-16	S
PINEHURST	Vertebrate Animal	Great Egret	Ardea alba	G5	S2S3B, S3N			B	1989-	S
	Vertebrate Animal	Great Egret	Ardea alba	G5	S2S3B, S3N			H?	1988-	S
	Vertebrate Animal	Piping Plover	Charadrius melodus	G3	S2B,S1N	LT	LT	H	1997	M
	Vertebrate Animal	Wilson's Plover	Charadrius wilsonia	G5	S1B		LE	H	2010-07	
CRANEY ISLAND	Vertebrate Animal	Northern Harrier	Circus cyaneus	G5	S1S2B, S3N			E	roughly 1996	

Site Name	Group Name	Common Name	Scientific Name	GRANK	SRANK	Fed Status	State Status	EO Rank	Last Obs Date	Precision
	Vertebrate Animal	Canebrake Rattlesnake	Crotalus horridus [Coastal Plain population]	G4T4	S1		LE	D	2007-05-31	
SANDY BOTTOM	Vertebrate Animal	Canebrake Rattlesnake	Crotalus horridus [Coastal Plain population]	G4T4	S1		LE	D	2010-08-08	
SANDY BOTTOM	Vascular Plant	Big-seed Alfafa dodder	Cuscuta indecora	G5	S1			H	1963-08-05	
	Vertebrate Animal	Peregrine Falcon	Falco peregrinus	G4	S1B,S2N		LT	E	1998-	M
HAMPTON ROADS BRIDGE TUNNEL	Vertebrate Animal	Gull-billed Tern	Gelochelidon nilotica	G5	S2B		LT	E	2010	
CRANEY ISLAND	Vertebrate Animal	Black-necked Stilt	Himantopus mexicanus	G5	S1B			B	2004	M
	Vascular Plant	Dune marsh-elder	Iva imbricata	G5?	S1			H	1898-07-20	G
	Vascular Plant	Dune marsh-elder	Iva imbricata	G5?	S1			H	1879-09-20	M
KECOUGHTAN	Vertebrate Animal	Yellow-crowned Night-heron	Nyctanassa violacea	G5	S2S3B, S3N			E	2014-06-15	M
	Vascular Plant	Sand laurel oak	Quercus hemisphaerica	G5	S1			D	2003-07-08	
HAMPTON ROADS BRIDGE TUNNEL	Vertebrate Animal	Black Skimmer	Rynchops niger	G5	S2B,S1N			B	2010	S
	Vascular Plant	One-flowered sclerolepis	Sclerolepis uniflora	G4	S1			H	1840	
	Vascular Plant	Twisted leaf goldenrod	Solidago tortifolia	G4G5	S1			H	1968-09-21	S
	Vertebrate Animal	Least Tern	Sternula antillarum	G4	S2B			D	1989-07	M
CRANEY ISLAND	Vertebrate Animal	Least Tern	Sternula antillarum	G4	S2B			B	2012	M
HAMPTON ROADS BRIDGE TUNNEL	Vertebrate Animal	Royal Tern	Thalasseus maximus	G5	S2B			E	2010	
HAMPTON ROADS BRIDGE TUNNEL	Vertebrate Animal	Sandwich Tern	Thalasseus sandvicensis	G5	S1B			E	2010	
	Vascular Plant	Virginia Least Trillium	Trillium pusillum var. virginianum	G3T2	S2	SOC		E	1990-04-20	M

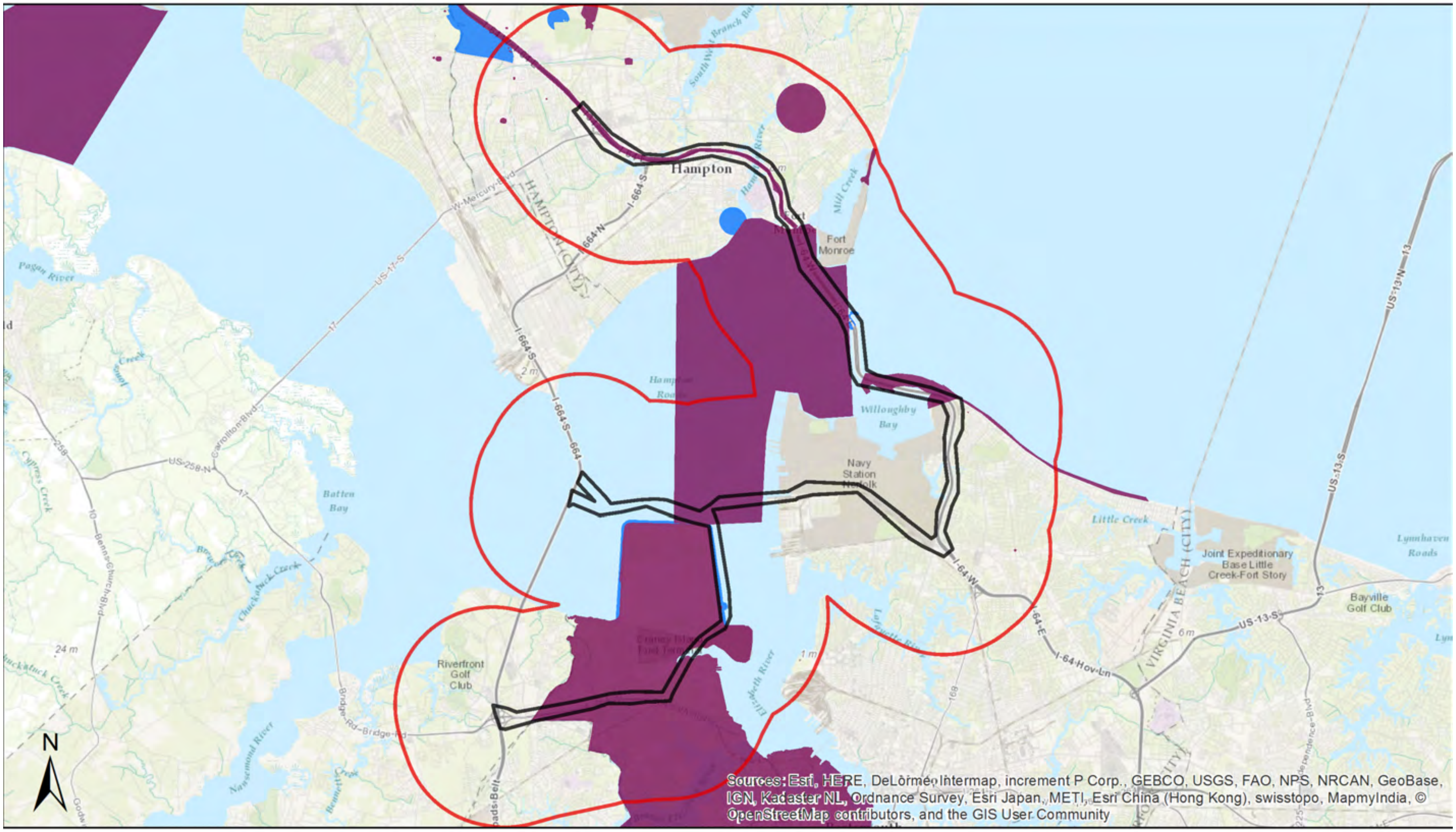
Site Name	Group Name	Common Name	Scientific Name	GRANK	SRANK	Fed Status	State Status	EO Rank	Last Obs Date	Precision
BIG BETHEL FLATWOODS	Vascular Plant	Virginia Least Trillium	Trillium pusillum var. virginianum	G3T2	S2	SOC		C	1997-03	S

Natural Heritage Resources within Search Radius

Intersecting Predictive Models

Predictive Model Results

HRCS Study- Alternative B



Project Area	Conservation Site
Buffered	GLNHR
NH Screening Features	SCU

1:213,258

0 1.75 3.5 7 mi

0 2.75 5.5 11 km

Quads: Newport News North, Hampton, Newport News South, Norfolk North, Bowers Hill, Norfolk South

Counties: City of Chesapeake, City of Hampton, City of Newport News, City of Norfolk, City of Portsmouth, City of Suffolk

Company: Stantec

Lat/Long: 365605 / -761816

Molly Joseph Ward
Secretary of Natural Resources

Clyde E. Cristman
Director

COMMONWEALTH of VIRGINIA
DEPARTMENT OF CONSERVATION AND RECREATION

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DCR
Department of Conservation & Recreation
CONSERVING VIRGINIA'S NATURAL & RECREATIONAL RESOURCES

Web Project ID: WEB0000004288

Client Project Number: 203400545C2

PROJECT INFORMATION

TITLE: HRCS Study- Alternative C (2)

Alternative C - Mid segment

DESCRIPTION: Alternatives analysis for VDOT

EXISTING SITE CONDITIONS: Existing and proposed interstate corridor

QUADRANGLES: Newport News South, Norfolk North, Bowers Hill, Norfolk South

COUNTIES: City of Chesapeake, City of Newport News, City of Norfolk, City of Portsmouth, City of Suffolk

Latitude/Longitude (DMS): 36°52'20.4341"N / 76°23'32.6078"W

Acreage: 2026 acres

Comments:

REQUESTOR INFORMATION

Priority: N | Tier Level: Tier II | Tax ID:

Contact Name: Tara Dillard

Company Name: Stantec

Address: 1011 Boulder Springs Drive

City: Richmond | State: VA | Zip: 23225

Phone: (804) 267-3474 | Fax: (804) 267-3470 | Email: tara.dillard@stantec.com

Conservation Site	Site Type	Brank	Acreage	Listed Species Presence
CRANEY ISLAND	Conservation Site	B4	2827	NL
PINEHURST	Conservation Site	B5	32	NL
	GLNHR	NA	0	SL
	GLNHR	NA	0	FL
	GLNHR	NA	0	SL
	GLNHR	NA	0	FL
	GLNHR	NA	0	NL
	GLNHR	NA	0	NL
	GLNHR	NA	0	NL

Natural Heritage Screening Features within Search Radius

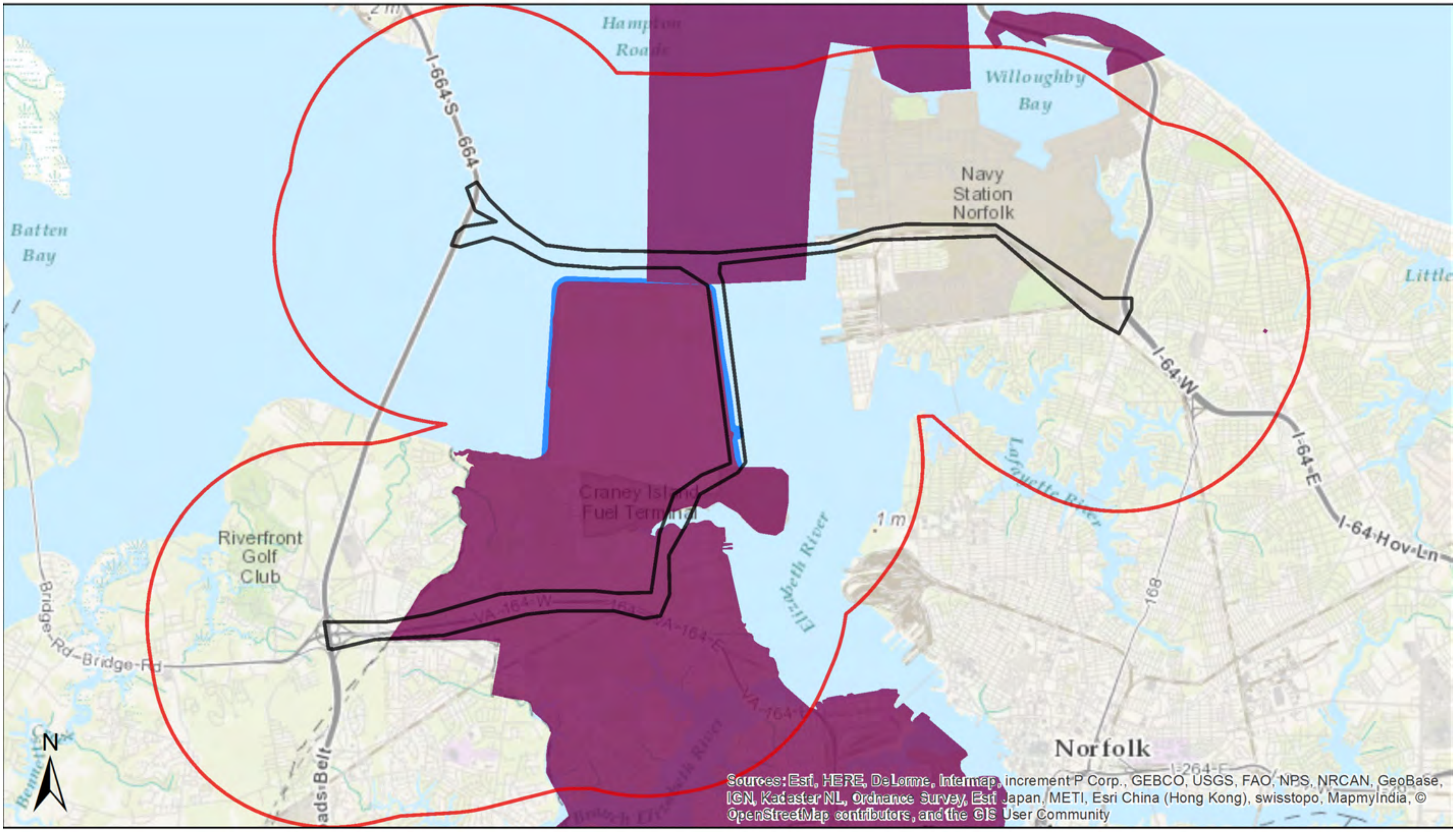
Site Name	Group Name	Common Name	Scientific Name	GRANK	SRANK	Fed Status	State Status	EO Rank	Last Obs Date	Precision
	Vertebrate Animal	Atlantic Sturgeon	Acipenser oxyrinchus	G3	S2	LE	LE	E	2007-05	
PINEHURST	Vertebrate Animal	Great Egret	Ardea alba	G5	S2S3B, S3N			B	1989-	S
	Vertebrate Animal	Piping Plover	Charadrius melodus	G3	S2B,S1N	LT	LT	H	1997	M
	Vertebrate Animal	Wilson's Plover	Charadrius wilsonia	G5	S1B		LE	H	2010-07	
CRANEY ISLAND	Vertebrate Animal	Northern Harrier	Circus cyaneus	G5	S1S2B, S3N			E	roughly 1996	
	Vertebrate Animal	Peregrine Falcon	Falco peregrinus	G4	S1B,S2N		LT	E	1998-	M
CRANEY ISLAND	Vertebrate Animal	Black-necked Stilt	Himantopus mexicanus	G5	S1B			B	2004	M
	Vascular Plant	One-flowered sclerolepis	Sclerolepis uniflora	G4	S1			H	1840	
	Vascular Plant	Twisted leaf goldenrod	Solidago tortifolia	G4G5	S1			H	1968-09-21	S
	Vertebrate Animal	Least Tern	Sternula antillarum	G4	S2B			D	1989-07	M
CRANEY ISLAND	Vertebrate Animal	Least Tern	Sternula antillarum	G4	S2B			B	2012	M

Natural Heritage Resources within Search Radius

Intersecting Predictive Models

Predictive Model Results

HRCS Study- Alternative C (2)



Project Area	Conservation Site
Buffered	GLNHR
NH Screening Features	SCU

1:117,646

0 1 2 4 mi

0 1.5 3 6 km

Quads: Newport News South, Norfolk North, Bowers Hill, Norfolk South

Counties: City of Chesapeake, City of Newport News, City of Norfolk, City of Portsmouth, City of Suffolk

Company: Stantec

Lat/Long: 365220 / -762332

Molly Joseph Ward
Secretary of Natural Resources

Clyde E. Cristman
Director

COMMONWEALTH of VIRGINIA
DEPARTMENT OF CONSERVATION AND RECREATION

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Department of Conservation & Recreation
CONSERVING VIRGINIA'S NATURAL & RECREATIONAL RESOURCES

Web Project ID: WEB0000004287

Client Project Number: 203400545C1

PROJECT INFORMATION

TITLE: HRCS Study- Alternative C (1)

Alternative C - West segment

DESCRIPTION: Alternatives analysis for VDOT

EXISTING SITE CONDITIONS: Existing and proposed interstate corridor

QUADRANGLES: Newport News North, Hampton, Newport News South, Bowers Hill

COUNTIES: City of Chesapeake, City of Hampton, City of Newport News, City of Suffolk

Latitude/Longitude (DMS): 36°47'13.545"N / 76°25'11.7937"W

Acreage: 5031 acres

Comments:

REQUESTOR INFORMATION

Priority: N   Tier Level: Tier II   Tax ID:

Contact Name: Tara Dillard

Company Name: Stantec

Address: 1011 Boulder Springs Drive

City: Richmond   State: VA   Zip: 23225

Phone: (804) 267-3474   Fax: (804) 267-3470   Email: tara.dillard@stantec.com

Conservation Site	Site Type	Brank	Acreage	Listed Species Presence
KECOUGHTAN	Conservation Site	B5	152	NL
GREAT DISMAL SWAMP: NORTHWEST SECTION	Conservation Site	B5	9686	SL
CRANEY ISLAND	Conservation Site	B4	2827	NL
GREAT DISMAL SWAMP	Conservation Site	B2	99013	SL
	GLNHR	NA	0	FL
	GLNHR	NA	0	SL
	GLNHR	NA	0	FL
	GLNHR	NA	0	NL
	GLNHR	NA	0	NL
	GLNHR	NA	0	NL
	GLNHR	NA	0	NL
	GLNHR	NA	0	NL
	GLNHR	NA	0	NL
	GLNHR	NA	0	NL
	GLNHR	NA	0	SL
	GLNHR	NA	0	SL
	GLNHR	NA	0	NL

Natural Heritage Screening Features within Search Radius

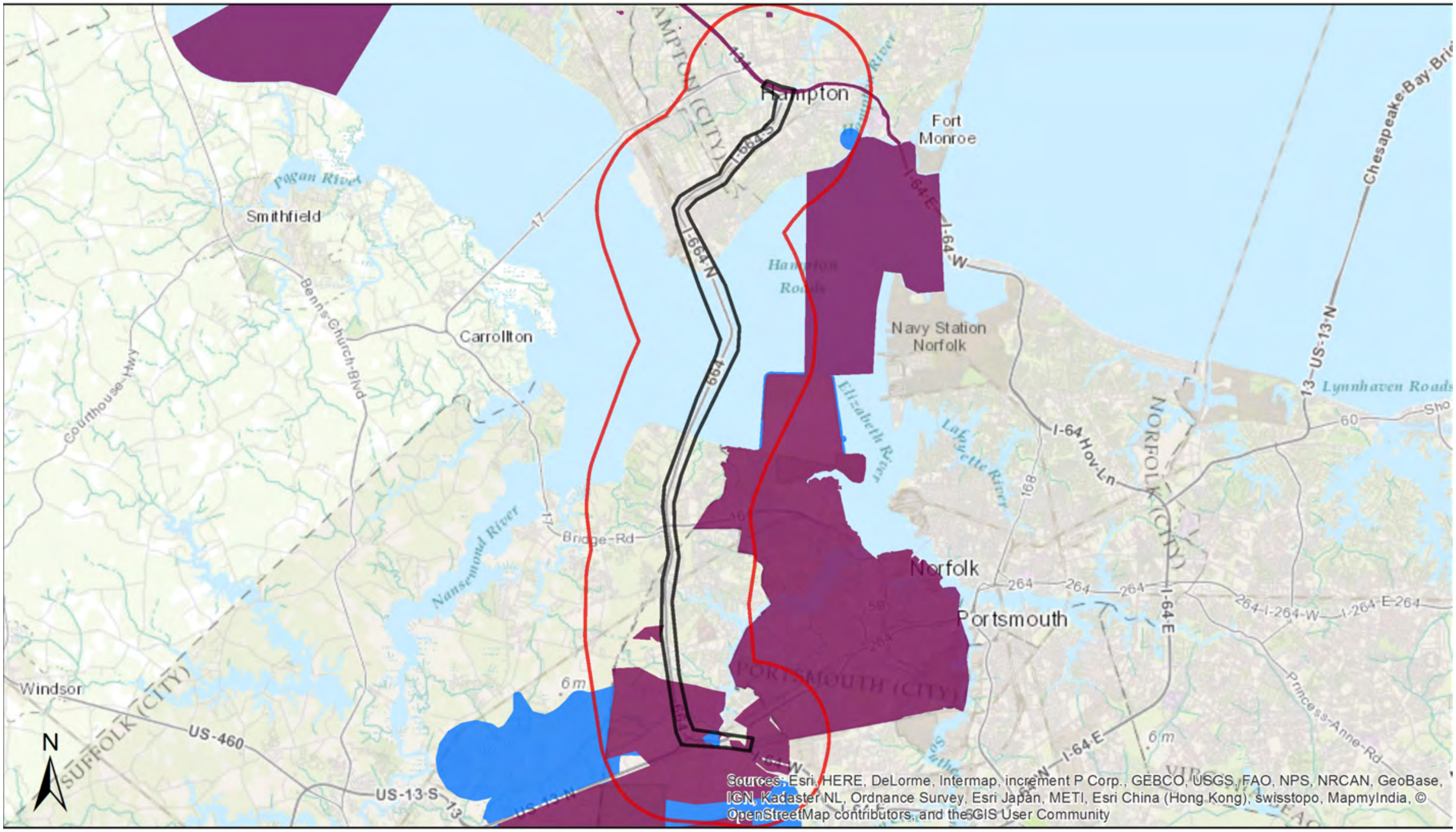
Site Name	Group Name	Common Name	Scientific Name	GRANK	SRANK	Fed Status	State Status	EO Rank	Last Obs Date	Preci sion
	Vertebrate Animal	Atlantic Sturgeon	Acipenser oxyrinchus	G3	S2	LE	LE	E	2007-05	
	Vertebrate Animal	Oak Toad	Anaxyrus quercicus	G5	S2			H	1965-07-18	M
	Vertebrate Animal	Piping Plover	Charadrius melodus	G3	S2B,S1N	LT	LT	H	1997	M
	Vertebrate Animal	Wilson's Plover	Charadrius wilsonia	G5	S1B		LE	H	2010-07	
CRANEY ISLAND	Vertebrate Animal	Northern Harrier	Circus cyaneus	G5	S1S2B, S3N			E	roughly 1996	
GREAT DISMAL SWAMP	Vascular Plant	Large spreading pogonia	Cleistesiopsis divaricata	G4	S1			E	2001-06-06	S
	Vertebrate Animal	Canebrake Rattlesnake	Crotalus horridus [Coastal Plain population]	G4T4	S1		LE	D	2007-05-31	
GREAT DISMAL SWAMP: NORTHWEST SECTION, GREAT	Vertebrate Animal	Canebrake Rattlesnake	Crotalus horridus [Coastal Plain population]	G4T4	S1		LE	A	2013-09-18	S

Site Name	Group Name	Common Name	Scientific Name	GRANK	SRANK	Fed Status	State Status	EO Rank	Last Obs Date	Precision
DISMAL SWAMP, RT 32 NEAR BAINES HILL										
SANDY BOTTOM	Vertebrate Animal	Canebrake Rattlesnake	Crotalus horridus [Coastal Plain population]	G4T4	S1		LE	D	2010-08-08	
SANDY BOTTOM	Vascular Plant	Big-seed Alfafa dodder	Cuscuta indecora	G5	S1			H	1963-08-05	
GREAT DISMAL SWAMP	Invertebrate Animal	Black Dash	Euphyes conspicua	G4	S1S3			H	1944-06-03	
NORTHWEST RIVER: HEADWATERS, GREAT DISMAL SWAMP: SMITH RIDGE, GREAT DISMAL SWAMP	Invertebrate Animal	Dukes' Skipper	Euphyes dukesi	G3	S2			E	1993-07-17	
CRANEY ISLAND	Vertebrate Animal	Black-necked Stilt	Himantopus mexicanus	G5	S1B			B	2004	M
GREAT DISMAL SWAMP	Vascular Plant	Big gallberry	Ilex coriacea	G5	S1			A	1995-10-18	S
GREAT DISMAL SWAMP	Invertebrate Animal	Yucca Giant Skipper	Megathymus yuccae	G5	SH			H	1970-late	
	Vascular Plant	Lax Hornpod	Mitreola petiolata	G5	S1			H	1949-08-23	G
KECOUGHTAN	Vertebrate Animal	Yellow-crowned Night-heron	Nyctanassa violacea	G5	S2S3B, S3N			E	2014-06-15	M
GREAT DISMAL SWAMP	Vascular Plant	Walter's paspalum	Paspalum dissectum	G4?	S2			B	2012-09-10	S
	Vascular Plant	One-flowered sclerolepis	Sclerolepis uniflora	G4	S1			H	1840	
GREAT DISMAL SWAMP	Vascular Plant	Elliott's goldenrod	Solidago latissimifolia	G5	S2			B	1995-10-02	S
GREAT DISMAL SWAMP	Vascular Plant	Elliott's goldenrod	Solidago latissimifolia	G5	S2			E	2001-10-25	S
GREAT DISMAL SWAMP	Vertebrate Animal	Dismal Swamp Southeastern Shrew	Sorex longirostris fisheri	G5T4	S2		LT	A	1994-01-07	S
CRANEY ISLAND	Vertebrate Animal	Least Tern	Sternula antillarum	G4	S2B			B	2012	M
	Vascular Plant	Elliott's Aster	Symphyotrichum elliottii	G4	S1			H	1978-09-29	G

Site Name	Group Name	Common Name	Scientific Name	GRANK	SRANK	Fed Status	State Status	EO Rank	Last Obs Date	Precision
Natural Heritage Resources within Search Radius										

Intersecting Predictive Models
Predictive Model Results

HRCS Study- Alternative C (1)



Project Area
Buffered
NH Screening Features
Conservation Site
GLNHR
SCU

1:273,534

0 2.25 4.5 9 mi

0 3.75 7.5 15 km

Quads: Newport News North, Hampton, Newport News South, Bowers Hill

Counties: City of Chesapeake, City of Hampton, City of Newport News, City of Suffolk

Company: Stantec

Lat/Long: 364713 / -762511

Molly Joseph Ward
Secretary of Natural Resources

Clyde E. Cristman
Director

COMMONWEALTH of VIRGINIA
DEPARTMENT OF CONSERVATION AND RECREATION

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Web Project ID: WEB0000004283

Client Project Number: 203400545A

Department of Conservation & Recreation
CONSERVING VIRGINIA'S NATURAL & RECREATIONAL RESOURCES

PROJECT INFORMATION

TITLE: HRCS Study- Alternative A

The combination of Alternatives A, C(1), & C(2) = Alternative D

DESCRIPTION: Alternative A

EXISTING SITE CONDITIONS: Interstate corridor

QUADRANGLES: Newport News North, Hampton, Norfolk North

COUNTIES: City of Hampton, City of Norfolk

Latitude/Longitude (DMS): 37°1'32.64"N / 76°19'57.1764"W

Acreage: 3237 acres

Comments:

REQUESTOR INFORMATION

Priority: N

Tier Level: Tier II

Tax ID:

Contact Name: Tara Dillard

Company Name: Stantec

Address: 1011 Boulder Springs Drive

City: Richmond

State: VA

Zip: 23225

Phone: (804) 267-3474

Fax: (804) 267-3470

Email: tara.dillard@stantec.com

Conservation Site	Site Type	Brank	Acreage	Listed Species Presence
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KECOUGHTAN	Conservation Site	B5	152	NL
SANDY BOTTOM	Conservation Site	B2	501	NL
HAMPTON ROADS BRIDGE TUNNEL	Conservation Site	B5	20	SL
	GLNHR	NA	0	NL
	GLNHR	NA	0	SL
	GLNHR	NA	0	FL
	GLNHR	NA	0	NL
	GLNHR	NA	0	NL
	GLNHR	NA	0	NL
	GLNHR	NA	0	NL
	GLNHR	NA	0	NL
	GLNHR	NA	0	NL
	GLNHR	NA	0	NL
	GLNHR	NA	0	SL
	GLNHR	NA	0	SL

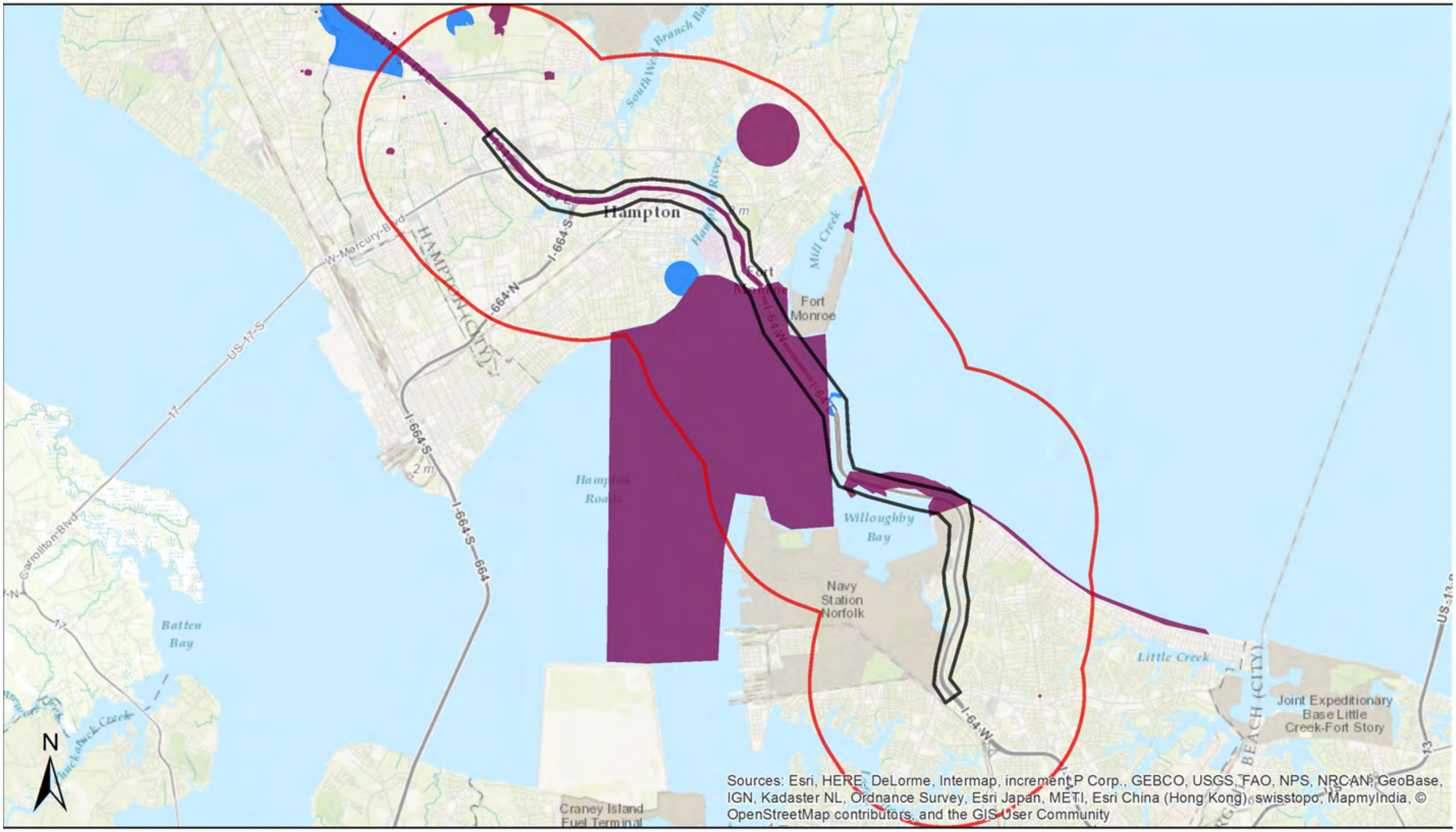
Natural Heritage Screening Features within Search Radius

Site Name	Group Name	Common Name	Scientific Name	GRANK	SRANK	Fed Status	State Status	EO Rank	Last Obs Date	Preci sion
	Vertebrate Animal	Atlantic Sturgeon	Acipenser oxyrinchus	G3	S2	LE	LE	E	2007-05	
Fox Corner	Vertebrate Animal	Mabee's Salamander	Ambystoma mabeei	G4	S1S2		LT	X	1985-11-16	S
	Vertebrate Animal	Great Egret	Ardea alba	G5	S2S3B, S3N			H?	1988-	S
	Vertebrate Animal	Canebrake Rattlesnake	Crotalus horridus [Coastal Plain population]	G4T4	S1		LE	D	2007-05-31	
SANDY BOTTOM	Vertebrate Animal	Canebrake Rattlesnake	Crotalus horridus [Coastal Plain population]	G4T4	S1		LE	D	2010-08-08	
SANDY BOTTOM	Vascular Plant	Big-seed Alfafa dodder	Cuscuta indecora	G5	S1			H	1963-08-05	
HAMPTON ROADS BRIDGE TUNNEL	Vertebrate Animal	Gull-billed Tern	Gelochelidon nilotica	G5	S2B		LT	E	2010	
	Vascular Plant	Dune marsh-elder	Iva imbricata	G5?	S1			H	1898-07-20	G
	Vascular Plant	Dune marsh-elder	Iva imbricata	G5?	S1			H	1879-09-20	M
KECOUGHTAN	Vertebrate	Yellow-crowned	Nyctanassa violacea	G5	S2S3B,			E	2014-06-15	M

Site Name	Group Name	Common Name	Scientific Name	GRANK	SRANK	Fed Status	State Status	EO Rank	Last Obs Date	Precision
	Animal	Night-heron			S3N					
	Vascular Plant	Sand laurel oak	Quercus hemisphaerica	G5	S1			D	2003-07-08	
HAMPTON ROADS BRIDGE TUNNEL	Vertebrate Animal	Black Skimmer	Rynchops niger	G5	S2B,S1N			B	2010	S
	Vascular Plant	Twisted leaf goldenrod	Solidago tortifolia	G4G5	S1			H	1968-09-21	S
	Vertebrate Animal	Least Tern	Sternula antillarum	G4	S2B			D	1989-07	M
HAMPTON ROADS BRIDGE TUNNEL	Vertebrate Animal	Royal Tern	Thalasseus maximus	G5	S2B			E	2010	
HAMPTON ROADS BRIDGE TUNNEL	Vertebrate Animal	Sandwich Tern	Thalasseus sandvicensis	G5	S1B			E	2010	
	Vascular Plant	Virginia Least Trillium	Trillium pusillum var. virginianum	G3T2	S2	SOC		E	1990-04-20	M
BIG BETHEL FLATWOODS	Vascular Plant	Virginia Least Trillium	Trillium pusillum var. virginianum	G3T2	S2	SOC		C	1997-03	S
Natural Heritage Resources within Search Radius										

Intersecting Predictive Models
Predictive Model Results

HRCS Study- Alternative A



Project Area
Buffered
NH Screening Features
Conservation Site
GLNHR
SCU

1:168,017
0 1.25 2.5 5 mi
0 2.25 4.5 9 km

Quads: Newport News North, Hampton, Norfolk North

Counties: City of Hampton, City of Norfolk

Company: Stantec

Lat/Long: 370132 / -761957

Molly Joseph Ward
Secretary of Natural Resources

Clyde E. Cristman
Director

COMMONWEALTH of VIRGINIA
DEPARTMENT OF CONSERVATION AND RECREATION

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DCR
Department of Conservation & Recreation
CONSERVING VIRGINIA'S NATURAL & RECREATIONAL RESOURCES

Web Project ID: WEB0000004288

Client Project Number: 203400545C2

PROJECT INFORMATION

TITLE: HRCS Study- Alternative C (2)

The combination of Alternatives A, C(1), & C(2) = Alternative D

DESCRIPTION: Alternatives analysis for VDOT

EXISTING SITE CONDITIONS: Existing and proposed interstate corridor

QUADRANGLES: Newport News South, Norfolk North, Bowers Hill, Norfolk South

COUNTIES: City of Chesapeake, City of Newport News, City of Norfolk, City of Portsmouth, City of Suffolk

Latitude/Longitude (DMS): 36°52'20.4341"N / 76°23'32.6078"W

Acreage: 2026 acres

Comments:

REQUESTOR INFORMATION

Priority: N	Tier Level: Tier II	Tax ID:
Contact Name: Tara Dillard		
Company Name: Stantec		
Address: 1011 Boulder Springs Drive		
City: Richmond	State: VA	Zip: 23225
Phone: (804) 267-3474	Fax: (804) 267-3470	Email: tara.dillard@stantec.com

Conservation Site	Site Type	Brank	Acreage	Listed Species Presence
CRANEY ISLAND	Conservation Site	B4	2827	NL
PINEHURST	Conservation Site	B5	32	NL
	GLNHR	NA	0	SL
	GLNHR	NA	0	FL
	GLNHR	NA	0	SL
	GLNHR	NA	0	FL
	GLNHR	NA	0	NL
	GLNHR	NA	0	NL
	GLNHR	NA	0	NL

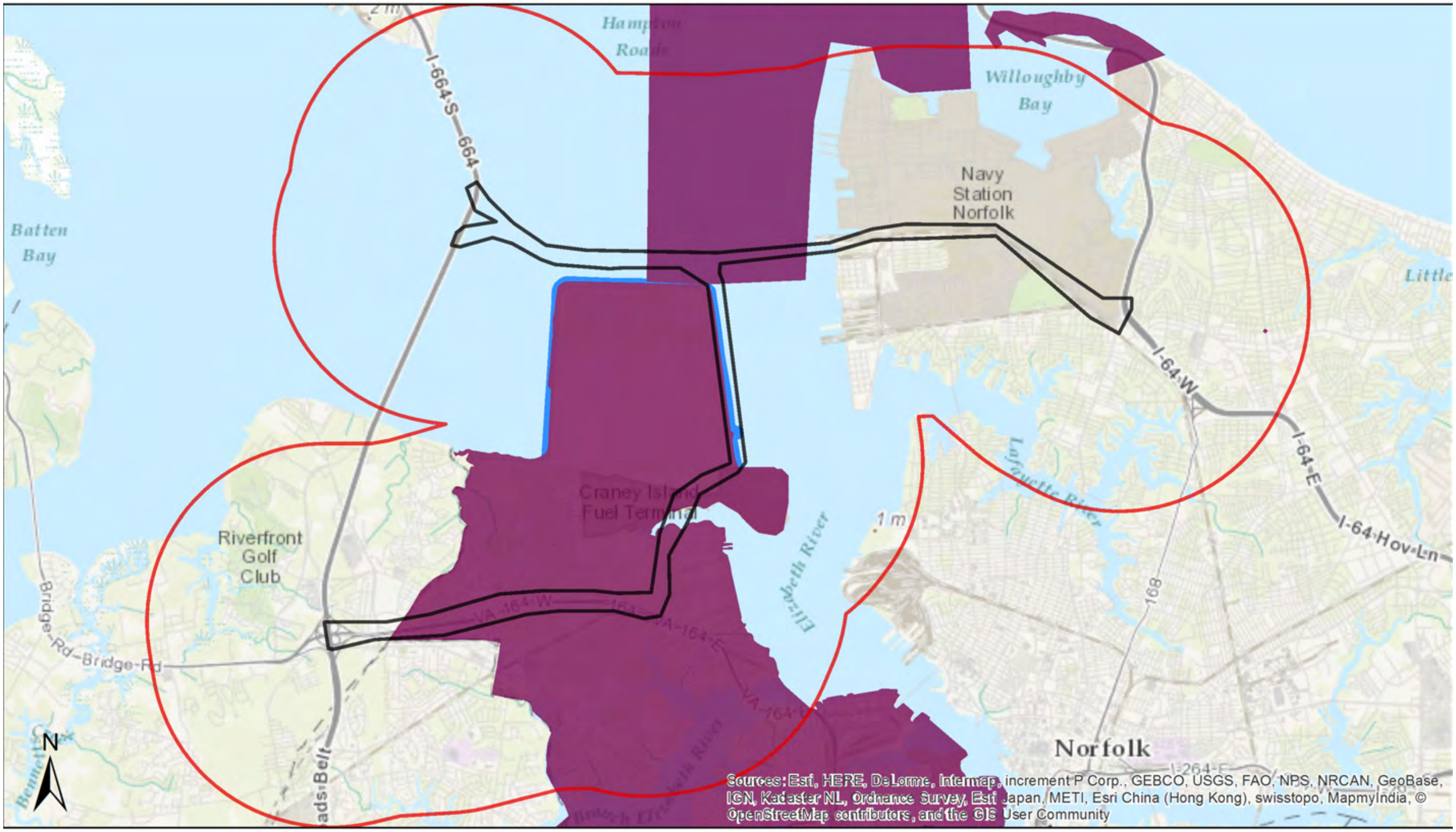
Natural Heritage Screening Features within Search Radius

Site Name	Group Name	Common Name	Scientific Name	GRANK	SRANK	Fed Status	State Status	EO Rank	Last Obs Date	Precision
	Vertebrate Animal	Atlantic Sturgeon	Acipenser oxyrinchus	G3	S2	LE	LE	E	2007-05	
PINEHURST	Vertebrate Animal	Great Egret	Ardea alba	G5	S2S3B, S3N			B	1989-	S
	Vertebrate Animal	Piping Plover	Charadrius melodus	G3	S2B,S1N	LT	LT	H	1997	M
	Vertebrate Animal	Wilson's Plover	Charadrius wilsonia	G5	S1B		LE	H	2010-07	
CRANEY ISLAND	Vertebrate Animal	Northern Harrier	Circus cyaneus	G5	S1S2B, S3N			E	roughly 1996	
	Vertebrate Animal	Peregrine Falcon	Falco peregrinus	G4	S1B,S2N		LT	E	1998-	M
CRANEY ISLAND	Vertebrate Animal	Black-necked Stilt	Himantopus mexicanus	G5	S1B			B	2004	M
	Vascular Plant	One-flowered sclerolepis	Sclerolepis uniflora	G4	S1			H	1840	
	Vascular Plant	Twisted leaf goldenrod	Solidago tortifolia	G4G5	S1			H	1968-09-21	S
	Vertebrate Animal	Least Tern	Sternula antillarum	G4	S2B			D	1989-07	M
CRANEY ISLAND	Vertebrate Animal	Least Tern	Sternula antillarum	G4	S2B			B	2012	M

Natural Heritage Resources within Search Radius

Intersecting Predictive Models
Predictive Model Results

HRCS Study- Alternative C (2)



Project Area	Conservation Site
Buffered	GLNHR
NH Screening Features	SCU

1:117,646

0 1 2 4 mi

0 1.5 3 6 km

Quads: Newport News South, Norfolk North, Bowers Hill, Norfolk South

Counties: City of Chesapeake, City of Newport News, City of Norfolk, City of Portsmouth, City of Suffolk

Company: Stantec

Lat/Long: 365220 / -762332

Molly Joseph Ward
Secretary of Natural Resources

Clyde E. Cristman
Director

COMMONWEALTH of VIRGINIA
DEPARTMENT OF CONSERVATION AND RECREATION

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Department of Conservation & Recreation
CONSERVING VIRGINIA'S NATURAL & RECREATIONAL RESOURCES

Web Project ID: WEB0000004287

Client Project Number: 203400545C1

PROJECT INFORMATION

TITLE: HRCS Study- Alternative C (1)

The combination of Alternatives A, C(1), & C(2) = Alternative D

DESCRIPTION: Alternatives analysis for VDOT

EXISTING SITE CONDITIONS: Existing and proposed interstate corridor

QUADRANGLES: Newport News North, Hampton, Newport News South, Bowers Hill

COUNTIES: City of Chesapeake, City of Hampton, City of Newport News, City of Suffolk

Latitude/Longitude (DMS): 36°47'13.545"N / 76°25'11.7937"W

Acreage: 5031 acres

Comments:

REQUESTOR INFORMATION

Priority: N

Tier Level: Tier II

Tax ID:

Contact Name: Tara Dillard

Company Name: Stantec

Address: 1011 Boulder Springs Drive

City: Richmond

State: VA

Zip: 23225

Phone: (804) 267-3474

Fax: (804) 267-3470

Email: tara.dillard@stantec.com

Conservation Site	Site Type	Brank	Acreage	Listed Species Presence
KECOUGHTAN	Conservation Site	B5	152	NL
GREAT DISMAL SWAMP: NORTHWEST SECTION	Conservation Site	B5	9686	SL
CRANEY ISLAND	Conservation Site	B4	2827	NL
GREAT DISMAL SWAMP	Conservation Site	B2	99013	SL
	GLNHR	NA	0	FL
	GLNHR	NA	0	SL
	GLNHR	NA	0	FL
	GLNHR	NA	0	NL
	GLNHR	NA	0	NL
	GLNHR	NA	0	NL
	GLNHR	NA	0	NL
	GLNHR	NA	0	NL
	GLNHR	NA	0	NL
	GLNHR	NA	0	NL
	GLNHR	NA	0	SL
	GLNHR	NA	0	SL
	GLNHR	NA	0	NL

Natural Heritage Screening Features within Search Radius

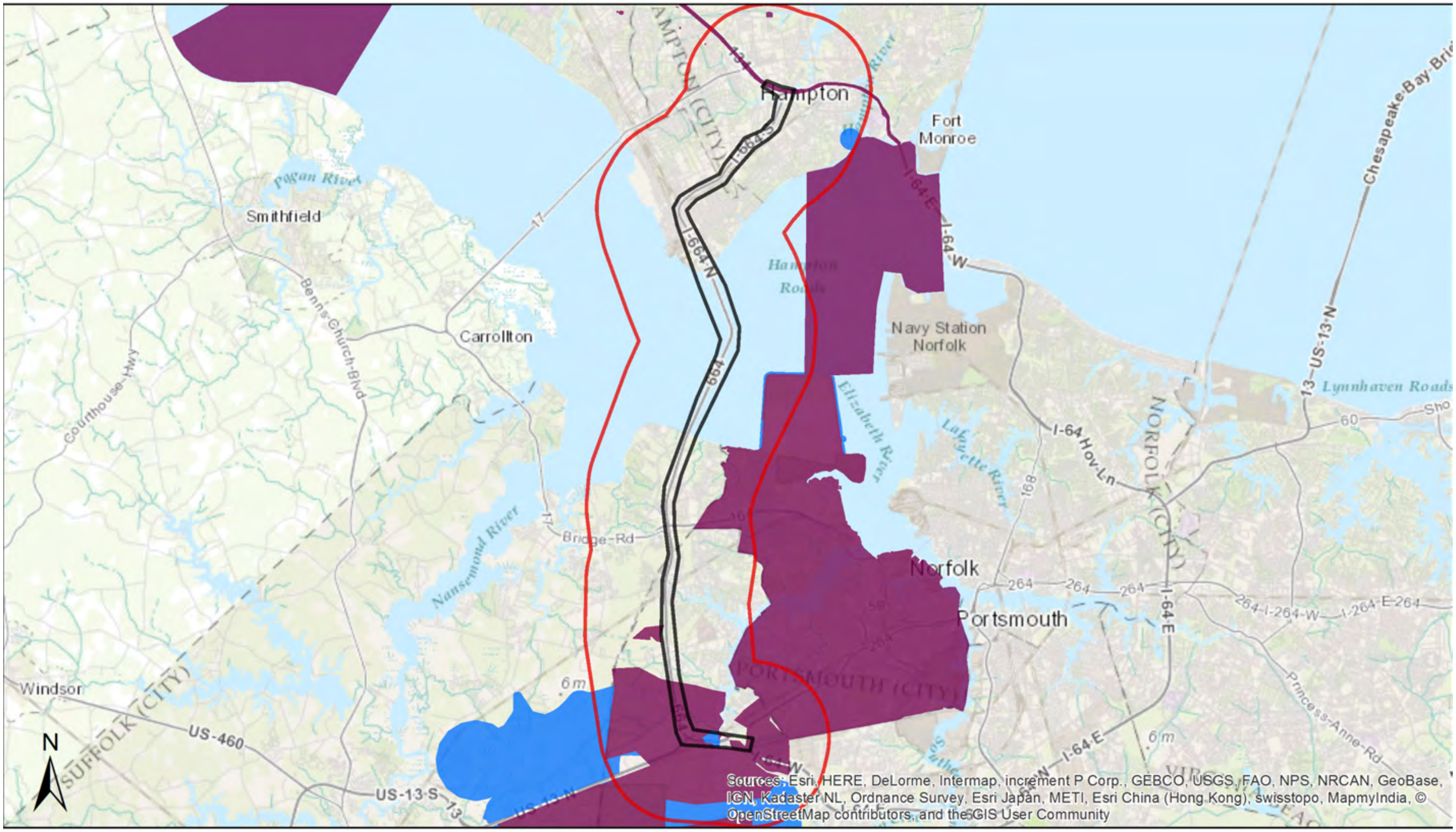
Site Name	Group Name	Common Name	Scientific Name	GRANK	SRANK	Fed Status	State Status	EO Rank	Last Obs Date	Precision
	Vertebrate Animal	Atlantic Sturgeon	Acipenser oxyrinchus	G3	S2	LE	LE	E	2007-05	
	Vertebrate Animal	Oak Toad	Anaxyrus quercicus	G5	S2			H	1965-07-18	M
	Vertebrate Animal	Piping Plover	Charadrius melodus	G3	S2B,S1N	LT	LT	H	1997	M
	Vertebrate Animal	Wilson's Plover	Charadrius wilsonia	G5	S1B		LE	H	2010-07	
CRANEY ISLAND	Vertebrate Animal	Northern Harrier	Circus cyaneus	G5	S1S2B, S3N			E	roughly 1996	
GREAT DISMAL SWAMP	Vascular Plant	Large spreading pogonia	Cleistesiopsis divaricata	G4	S1			E	2001-06-06	S
	Vertebrate Animal	Canebrake Rattlesnake	Crotalus horridus [Coastal Plain population]	G4T4	S1		LE	D	2007-05-31	
GREAT DISMAL SWAMP: NORTHWEST SECTION, GREAT	Vertebrate Animal	Canebrake Rattlesnake	Crotalus horridus [Coastal Plain population]	G4T4	S1		LE	A	2013-09-18	S

Site Name	Group Name	Common Name	Scientific Name	GRANK	SRANK	Fed Status	State Status	EO Rank	Last Obs Date	Precision
DISMAL SWAMP, RT 32 NEAR BAINES HILL										
SANDY BOTTOM	Vertebrate Animal	Canebrake Rattlesnake	Crotalus horridus [Coastal Plain population]	G4T4	S1		LE	D	2010-08-08	
SANDY BOTTOM	Vascular Plant	Big-seed Alfafa dodder	Cuscuta indecora	G5	S1			H	1963-08-05	
GREAT DISMAL SWAMP	Invertebrate Animal	Black Dash	Euphyes conspicua	G4	S1S3			H	1944-06-03	
NORTHWEST RIVER: HEADWATERS, GREAT DISMAL SWAMP: SMITH RIDGE, GREAT DISMAL SWAMP	Invertebrate Animal	Dukes' Skipper	Euphyes dukesi	G3	S2			E	1993-07-17	
CRANEY ISLAND	Vertebrate Animal	Black-necked Stilt	Himantopus mexicanus	G5	S1B			B	2004	M
GREAT DISMAL SWAMP	Vascular Plant	Big gallberry	Ilex coriacea	G5	S1			A	1995-10-18	S
GREAT DISMAL SWAMP	Invertebrate Animal	Yucca Giant Skipper	Megathymus yuccae	G5	SH			H	1970-late	
	Vascular Plant	Lax Hornpod	Mitreola petiolata	G5	S1			H	1949-08-23	G
KECOUGHTAN	Vertebrate Animal	Yellow-crowned Night-heron	Nyctanassa violacea	G5	S2S3B, S3N			E	2014-06-15	M
GREAT DISMAL SWAMP	Vascular Plant	Walter's paspalum	Paspalum dissectum	G4?	S2			B	2012-09-10	S
	Vascular Plant	One-flowered sclerolepis	Sclerolepis uniflora	G4	S1			H	1840	
GREAT DISMAL SWAMP	Vascular Plant	Elliott's goldenrod	Solidago latissimifolia	G5	S2			B	1995-10-02	S
GREAT DISMAL SWAMP	Vascular Plant	Elliott's goldenrod	Solidago latissimifolia	G5	S2			E	2001-10-25	S
GREAT DISMAL SWAMP	Vertebrate Animal	Dismal Swamp Southeastern Shrew	Sorex longirostris fisheri	G5T4	S2		LT	A	1994-01-07	S
CRANEY ISLAND	Vertebrate Animal	Least Tern	Sternula antillarum	G4	S2B			B	2012	M
	Vascular Plant	Elliott's Aster	Symphyotrichum elliottii	G4	S1			H	1978-09-29	G

Site Name	Group Name	Common Name	Scientific Name	GRANK	SRANK	Fed Status	State Status	EO Rank	Last Obs Date	Precision
Natural Heritage Resources within Search Radius										

Intersecting Predictive Models
Predictive Model Results

HRCS Study- Alternative C (1)



Project Area
Buffered
NH Screening Features
Conservation Site
GLNHR
SCU

1:273,534

0 2.25 4.5 9 mi

0 3.75 7.5 15 km

Quads: Newport News North, Hampton, Newport News South, Bowers Hill

Counties: City of Chesapeake, City of Hampton, City of Newport News, City of Suffolk

Company: Stantec

Lat/Long: 364713 / -762511

Molly Joseph Ward
Secretary of Natural Resources

Clyde E. Cristman
Director

COMMONWEALTH of VIRGINIA
DEPARTMENT OF CONSERVATION AND RECREATION

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Attachment C

Stantec Resumes

Sean M. Wender PWD

Senior Ecologist

As a Senior Ecologist and Team Leader, Mr. Wender is responsible for managing and completing multi-faceted, complex projects for a variety of clientele, as well as overseeing various teams and ecology work throughout the mid-Atlantic region. He provides technical supervision and quality assurance as well as management and scheduling for his teams, as well as providing support to regulatory staff on NEPA documentation and state and federal permitting. As a project manager, Mr. Wender coordinates all tasks related to individual projects, with attention given to ecological services. Additional technical responsibilities include wetland delineations and assessments, mitigation feasibility and monitoring, environmental constraints analysis, environmental assessments, threatened and endangered species surveys, water quality monitoring, forest stand delineations, floristic surveys and stream assessments. Mr. Wender is also a Virginia state certified Professional Wetland Delineator (PWD).

Mr. Wender routinely coordinates with state and federal regulatory agencies, develops work plans and serves as team lead on threatened and endangered species surveys. Mr. Wender has held/currently holds Threatened/Endangered Species Permits for several listed species with the Virginia Department of Game and Inland Fisheries. Mr. Wender is also a U.S. Fish and Wildlife approved **survey contact in Virginia for acoustic bat surveys, small whorled pogonia (Isotria medeoloides), smooth coneflower (Echinacea laevigata), swamp pink (Helonias bullata), and Virginia sneezeweed (Helenium virginicum)**.

EDUCATION

M.S., Biology, James Madison University, Harrisonburg, Virginia, 1996

B.S., Biology, Bridgewater College, Bridgewater, Virginia, 1992

CERTIFICATIONS & TRAINING

Bat Acoustic Data Management Workshop, Bat Conservation and Management, Pennsylvania, 2015

U.S. Fish and Wildlife Service Survey Contact for Acoustic Bat Surveys, Statewide, Virginia, 2015

U.S. Fish and Wildlife Service Survey Contact: Small Whorled Pogonia, Swamp Pink, Sneezeweed, and Smooth Coneflower, Statewide, Virginia, 2015

Managing Utility Rights-of-Way for Wildlife Habitat, National Conservation Training (Online), Richmond, Virginia, 2014

AT Level 1 Awareness Training (Certificate of Completion), Department of Defense, Richmond, Virginia, 2013

Bat Conservation International, Bat Conservation and Management Workshop, Barree, Pennsylvania, 2012

Non Game Wildlife Survey Techniques, U.S. Fish and Wildlife Service, National Conservation Training Center, Shepherdstown, West Virginia, 2008

Grasses, Sedges and Rushes, Environmental Concern Inc., St. Michaels, Maryland, 2004

REGISTRATIONS

Certified Wetland Delineator #3402 00081, Commonwealth of Virginia

MEMBERSHIPS

Member, The Wildlife Society

Member, Virginia Association of Wetland Professionals

Member, Virginia Herpetological Society

Member, Virginia Society of Ornithology

Member, Bat Conservation International

Sean M. Wender PWD

Senior Ecologist

PROJECT EXPERIENCE

Virginia Department of Transportation (VDOT) On-Call Contracts, Statewide, Virginia

Mr. Wender is a Senior Ecologist providing detailed wetland delineation surveys and Corps submittal/confirmation, as well as various threatened and endangered species/habitat surveys on past and current open-end contracts Stantec has with VDOT.

Dominion Virginia Power On-Call Contracts, Statewide, Virginia

Mr. Wender is a Senior Ecologist providing detailed wetland delineation surveys and Corps submittal/confirmation, as well as various threatened and endangered species/habitat surveys for various transmission and undergrounding projects resulting from Stantec's current open-end contracts with Dominion.

U.S. Route 121, Section II, Buchanan, Dickenson and Wise Counties, Virginia

*Mr. Wender is the Senior Ecologist in charge of coordinating and conducting habitat surveys for multiple state and federally threatened and endangered species including the **northern long-eared bat, Virginia big-eared bat, Indiana bat, gray bat, brown supercoil, Appalachian Bewick's wren, Virginia spiraea, and Big Sandy crayfish**. Mr. Wender consolidated the findings into a biological assessment for submission to the Federal Highway Administration in support of the Supplemental Environmental Impact Statement (SEIS).*

Virginia Department of Transportation (VDOT) Bat Surveys, Multiple Districts, Virginia

*Mr. Wender conducted habitat assessments and acoustic surveys for the **northern long-eared bat** for road and bridge projects on ten separate projects, as well as submitting study plans and final reports to USFWS. Mr. Wender also conducted a habitat assessment and mist net survey for the **Indiana bat** and **northern long-eared bat** under the same contract.*

Fairfax County Stream Restoration Projects, Fairfax County, Virginia (Senior Ecologist)

*Mr. Wender was the task manager and senior ecologist in charge of conducting habitat assessments and acoustic surveys for the **northern long eared bat** (Myotis septentrionalis) on four separate stream restoration projects. Submitted a study plan and final report to USFWS.*

Bridge Bat Inspections*, VDOT Staunton District, Virginia (Senior Ecologist)

Mr. Wender conducted bridge bat inventory inspections under the firm's statewide wetlands and water quality open-end contract with VDOT. The purpose of this project was to assist the VDOT in complying with the Endangered Species Act (ESA) by inventorying bridges within the Section 7 ranges for federally protected bat species by determining if bats are using these bridges prior to beginning maintenance. Coordinated with VDOT in the implementation and development of bridge survey protocols.

Carson-Suffolk-Thrasher 500kV PO70182979*, Virginia (Senior Ecologist)

*Mr. Wender provided regulatory support, literature review, threatened and endangered species report and coordination, flora habitat survey, fauna habitat survey including **Canebrake Rattlesnake (Croatalus horridus), Mabee's salamander (Ambystoma mabeei), Dismal Swamp southeast shrew (Sorex longirostris)**, frog and toad call survey, **Bachman's sparrow and Swainson's warbler survey**, wetland delineation, submittal, and confirmation. Coordinated with VDGIF and conducted site visits of potential habitat for various wildlife species. The project included the construction of a 60.3-mile 500kV transmission line from the Carson substation in Dinwiddie County to the Suffolk substation in the City of Suffolk, as well as a 21.5-mile rebuild of a 230kV transmission line from the Suffolk substation to the Thrasher substation in the City of Chesapeake, Virginia.*

Indiana Bat (*Myotis sodalis*) Mist Net Survey, Leach Run Parkway, Front Royal, Virginia (Senior Ecologist)

*Mr. Wender was the senior ecologist in charge of conducting a habitat assessment for the **Indiana bat** and prepared a report in support of the permitting process. Mr. Wender participated in a mist netting survey for the Indiana bat and study plan and report preparation.*

Route 5 Virginia Capital Trail- Park Phase*, Henrico County, Virginia

*Mr. Wender was the Senior Ecologist and conducted a detailed plant survey for the federally threatened **small whorled pogonia** (Isotria medeoloides) and the federally threatened **swamp pink** (Helonias bullata) along this 3.5 mile long section of the Virginia Capital Trail that meanders through Route 5 in Henrico County.*

** denotes projects completed with other firms*

Sean M. Wender PWD

Senior Ecologist

Hillsville By-Pass*, Carroll County, Virginia (Senior Ecologist)

*Mr. Wender was the senior ecologist and task manager for conducting **bog turtle** surveys prior to the construction of the Hillsville Bypass in Virginia. Obtained threatened and endangered species permit from the Virginia Department of Game and Inland Fisheries prior to the survey and developed study plan in coordination with sub-consultant. Organized and conducted bog turtle trapping and surveys over a 2 month period. Upon capturing 2 specimens, coordinated with VDGIF on the relocation of the turtles.*

Lower James Stream Mitigation Bank*, Surry County, Virginia (Senior Ecologist)

*Mr. Wender was the task manager and senior ecologist in charge of threatened and endangered database review, **barking treefrog** and **small whorled pogonia** habitat surveys, preliminary waters of the US investigation, delineation of the waters of the US, USACE submittal and confirmation, invasive species assessment and control plan, and GPS on-site resources. Conducted automated acoustic monitoring for **barking treefrog** and confirmed presence in coordination with VDGIF. Provided support in the development of mitigation banking instrument, IRT meetings and coordination, threatened and endangered species monitoring, long term management plan and project coordination.*

Colonial Pipeline Line 44-8 & 44-10*, Maryland, New Jersey, Pennsylvania (Senior Ecologist)

*Mr. Wender provided preliminary regulatory work, **bog turtle** coordination, wetland delineation, and threatened and endangered species surveys. This project involved the time-sensitive inspection and repair of any anomalies within portions of a 162-mile fuel supply line that extends from Baltimore, Maryland through Newark, New Jersey.*

Pleasant View-Hamilton Transmission Line*, Loudoun County, Virginia (Senior Ecologist)

*Mr. Wender was the senior ecologist and task manager in charge of delineation of waters of the US, jurisdictional confirmation site visit with USACE, natural heritage inventory (species-specific surveys included **loggerhead shrike, upland sandpiper**), and GPS mapping. The project's transmission line is approximately 16 miles long and traverses existing Dominion and Virginia Department of Transportation (VDOT) easements as well as forested and agricultural land.*

Reedy Creek Mitigation*, Dinwiddie County, Virginia (Senior Ecologist)

*Mr. Wender was the senior ecologist and task manager in charge of delineation of waters of the US, Corps submittal and confirmation, invasive species assessment, threatened and endangered species review and habitat assessment, and project coordination. Worked with a subcontractor to conduct a survey for **Michaux's sumac** and provided subcontractor oversight and coordination for mussel and fish surveys. Assisted in the development of the MBI, invasive species control plan, threatened and endangered species monitoring criteria, and long-term management plan. This project involved all necessary tasks in order to establish this site in Dinwiddie County, Virginia as a Mitigation Bank.*

Airport Landside Infrastructure

New Kent County Airport*, New Kent County, Virginia (Project Manager)

*Mr. Wender was the project manager and senior ecologist in charge of delineation of waters of the US, confirmation submittal and site visit, and threatened and endangered species surveys. Conducted a habitat assessment for **Rafinesque's big-eared bat** and an onsite visit with VDGIF to review and concur with the results.*

Chickahominy- Skiffes Creek-Whealton Transmission Line*, Charles City, James City, York, and Surry Counties; Cities of Newport News and Hampton, Virginia (Senior Ecologist)

Mr. Wender provided environmental services for the off-site identification and mapping of waters of the U.S. (WOUS), including wetlands, as part of the projects alternatives analysis and environmental constraints analysis. Additional responsibilities included field delineation of WOUS (with GPS location), threatened and endangered species coordination and surveys, as well as regulatory coordination.

Camp Peary NEPA and Environmental Planning*, Virginia (Senior Ecologist)

*Mr. Wender provided field work, **small whorled pogonia** survey, and miscellaneous environmental services for this 1000+ acre Department of Defense (DoD) location.*

** denotes projects completed with other firms*

Sean M. Wender PWD

Senior Ecologist

Route 460 Corridor Improvements Project, Suffolk/Isle of Wight Counties, Virginia (Senior Ecologist)

Mr. Wender conducted the off-site identification and mapping of waters of the U.S. (WOUS), including wetlands, during the scoping process for the 55-mile highway project. Mr. Wender then provided assistance in the wetland delineation for the design and construction of the proposed highway over an area totaling approximately 3,400 acres.

** denotes projects completed with other firms*

Kenrick H. Presgraves PWD

Senior Ecologist

Mr. Presgraves is a Senior Ecologist who has over 16 years of field experience conducting natural resources surveys including threatened and endangered species investigations. His experience also includes the examination of thousands of acres of wetlands throughout the mid-Atlantic region, northwest, northeast, and the Caribbean; most of which has required confirmation by the U.S. Army Corps of Engineers. These responsibilities include conducting and preparing technical reports for environmental constraints analysis, environmental assessments, threatened and endangered species surveys, forest stand delineations, floristic surveys, wetland delineations and assessments, as well environmental monitoring associated with permit requirements and wetland mitigation monitoring. He is responsible for various ecological surveys under multiple federal and state- level regulation requirements, including the Clean Water Act, Endangered Species Act, Virginia Endangered Plant and Insect Species Act, Chesapeake Bay Preservation Act, Section 62.1-3 of the Code of Virginia, and projects that require Federal Section 404 Permits and State 401 Certificates.

As a Team Lead, Mr. Presgraves is responsible for completing multi-faceted projects for a variety of clientele, developing work plans, managing budgets, and providing technical supervision and quality assurance on a variety of issues related to natural resources. He routinely coordinates with regulatory agencies and provides support to regulatory staff on state and federal permitting. He is a Virginia certified Professional Wetland Delineator (PWD) and is recognized as a **USFWS-approved surveyor for the federally-list small whorled pogonia (*Isotria medeoloides*) and swamp pink (*Helonias bullata*)**.

EDUCATION

B.S. Biology, Christopher Newport University, Newport News, Virginia, 1998

CERTIFICATIONS & TRAINING

Erosion and Sediment Control (Inspector), Virginia Department of Environmental Quality, Gloucester, Virginia, 2015

Stormwater Management (Basic), Virginia Department of Environmental Quality, Hampton, Virginia, 2015

Erosion and Sediment Control (Basic), Virginia Department of Environmental Quality, Virginia Beach, Virginia, 2015

Basic Wetland Delineation, Institute for Wetland & Environmental Education and Research, Clinton, Maryland, 2005

Basic Process in Hydric Soils, North Carolina State University, Raleigh, North Carolina, 2006

Winter Botany, Virginia Institute of Marine Science, Gloucester, Virginia, 2003

Grasses, Sedges, and Rushes Environmental Concern, St, Michaels, Maryland, 2007

Advanced Hydrology for Wetland Determinations, Wetland Training Institute, Inc., Frederick, Maryland, 2008

Uniform Mitigation Assessment Method, Richard Chinn Environmental Training, Inc., Tampa, Florida, 2010

U.S. Fish and Wildlife Service Survey Contact: Small Whorled Pogonia and Swamp Pink (2008 and 2012)

REGISTRATIONS

Virginia Certified Professional Wetland Delineator (#3402000114), Department of Professional and Occupational Regulation, Board for Professional Soils Scientists and Wetland Professionals

Erosion and Sediment Control Inspector (ESIN 0231), Commonwealth of Virginia, State Water Control Board

Kenrick H. Presgraves PWD

Senior Ecologist

PROJECT EXPERIENCE

Carson-Suffolk-Thrasher Transmission 500kV, Multiple localities, Virginia (Senior Ecologist)

Mr. Presgraves provided habitat surveys and reporting services for a variety of rare, threatened, or endangered species documented within the project vicinity. Species included the ***Canebrake Rattlesnake (Croatalus horridus), Mabee's salamander (Ambystoma mabeei), Dismal Swamp southeast shrew (Sorex longirostris)****. Additional tasks included frog and toad call surveys, delineation of waters of the U.S., including wetlands, with U.S. Army Corps of Engineers confirmation; a global positioning system (GPS) survey of the limits of wetlands and other waters of the U.S. The project included the construction of a 60.3-mile 500kV transmission line from the Carson substation in Dinwiddie County to the Suffolk substation in the City of Suffolk, as well as a 21.5-mile rebuild of a 230kV transmission line from the Suffolk substation to the Thrasher substation in the City of Chesapeake, Virginia. The width of the proposed right-of-way varied along the project corridor, from 150-feet to 275-feet wide.*

Dare nTelos Site, York County, Virginia (Senior Engineer)

Mr. Presgraves provided a ***canebrake rattlesnake*** *habitat assessment within and immediately adjacent to the proposed cellular tower location. The assessment was preceded by a database review for the purposes of identifying documented species sightings in the vicinity of the project area and coordination with the Virginia Department of Game and Inland Fisheries. The assessment was followed by reporting as well as client and County coordination for site planning approval.*

Cow Creek Subdivision, Gloucester County, Virginia (Senior Ecologist)

Mr. Presgraves conducted a detailed delineation of waters of the U.S., including wetlands and provided Corps submittal and confirmation services. In addition, Mr. Presgraves performed rare, threatened, and endangered species habitat surveys for ***Virginia least trillium, small whorled pogonia, bald eagle, Mabee's salamander, barking treefrog, and eastern tiger salamander****.*

Hayes – Yorktown 230 kV Transmission Line, Gloucester and York Counties, Virginia (Senior Ecologist)

Mr. Presgraves provided wetland delineation and Corps submittal and confirmation. In addition, Mr. Presgraves performed rare, threatened, and endangered species habitat surveys for bald eagle, ***peregrine falcon****,* ***upland sandpiper****,* ***piping plover****, and* ***Mabee's salamander****.*

Patriot's Colony, James City County, Virginia (Senior Ecologist)

Mr. Presgraves provided a detailed delineation of waters of the U.S., including wetlands, as well as performed habitat surveys for ***Mabee's salamander*** *and* ***small whorled pogonia****. Reporting and regulatory coordination were also conducted for the proposed expansion of the healthcare facility.*

Old Church - Chickahominy Transmission Line, Hanover, Henrico, and New Kent Counties, Virginia (Senior Ecologist)

Mr. Presgraves provided wetland delineation and Corps submittal and confirmation. Also performed threatened and endangered species surveys for ***small whorled pogonia and New Jersey rush****, Virginia Marine Resource Commission stream assessment, DEQ permit compliance, Functions and Values Assessment, and project team coordination. The results of the field analysis determined that approximately 58-acres of jurisdictional wetlands and 6.5-acres of other waters of the U.S. were present within the alignment.*

Maymont, Fairfax County, Virginia (Senior Ecologist)

Mr. Presgraves provided ***wood turtle*** *survey coordination including the verification of the designated optimal turtle habitat areas onsite with the VDGIF. Also provided appropriate signage for a proposed walking trail, agency an and contractor meetings, as well as project coordination.*

New Town- Small Whorled Pogonia Survey, James City County, Virginia (Senior Ecologist)

Mr. Presgraves provided a detailed ***small whorled pogonia*** *survey and report for this mixed-use development in James City County and continues to provide annual small whorled pogonia monitoring services as required by U.S. Army Corps of Engineers and Virginia Department of Environmental Quality permits.*

Kenrick H. Presgraves PWD

Senior Ecologist

Hillsville By-Pass, Carroll County, Virginia (Senior Ecologist)

*Mr. Presgraves conducted **bog turtle** surveys over a 2 month period prior to the construction of the Hillsville Bypass in Hillsville, Virginia. Participated in data collection, data entry, and reporting tasks.*

Surry-Skiffes Creek-Whealton Transmission Line, Charles City County, Surry County, James City County, York County, City of Newport News, and City of Hampton, Virginia (Senior Ecologist)

*Mr. Presgraves was the senior ecologist and task leader for several of the environmental services provided on this project. The project was initiated with an off-site analysis and mapping of waters of the U.S. (WOUS), including wetlands, as part of the projects alternatives analysis and environmental constraints analysis for the proposed 500 kV transmission corridor. Subsequent tasks included field delineation of WOUS (with GPS location), jurisdictional determination with the U.S. Army Corps of Engineers, threatened and endangered species coordination and surveys, as well as regulatory coordination. Threatened and endangered species surveys included detailed searches for **small whorled pogonia** and the coordination detailed searches for **sensitive joint vetch** (Aeschynomene virginica). Additional surveys included raptor nest surveys.*

Route 5 Virginia Capital Trail- Park Phase, Henrico County, Virginia (Senior Ecologist)

*Mr. Presgraves conducted a detailed plant survey for the federally threatened **small whorled pogonia** (Isotria medeoloides) and the federally threatened **swamp pink** (Helonias bullata) along this 3.5 mile long section of the Virginia Capital Trail that meanders through Route 5 in Henrico County.*

Route 460 Corridor Improvements Project, Suffolk/Isle of Wight Counties, Virginia (Senior Ecologist)

Mr. Presgraves conducted the off-site identification and mapping of waters of the U.S. (WOUS), including wetlands, during the scoping process for the 55-mile highway project. Mr. Presgraves also worked closely with the project team and provided field staff coordination, assistance in the wetland delineation, and agency meetings for the Corps confirmation of the proposed highway.

Route 60 Relocation Delineation Services, City of Newport News and James City County, Virginia (Senior Ecologist)

Mr. Presgraves conducted a delineation of wetlands and other waters of the U.S. (WOUS) within the project area subject to jurisdiction by the Corps under Section 404 of the Clean Water Act. In addition, Mr. Presgraves coordinated with VDOT personnel regarding specific project details and subsequently prepared a draft delineation report for VDOT.

Dominion Virginia Power On-Call Contracts, Statewide, Virginia

Mr. Presgraves is a Senior Ecologist providing, as needed, detailed wetland delineation surveys and Corps submittal/confirmation, various threatened and endangered species/habitat surveys, as well as compliance inspections for various transmission and distribution, substation, and undergrounding projects resulting from Stantec's current open-end contracts with Dominion.

Pamunkey Farms Mitigation Bank, New Kent County, Virginia (Senior Ecologist)

Mr. Presgraves provided wetland delineation and Corps submittal and confirmation, wetland mitigation project coordination, stream preservation, bald eagle surveys, and vegetation and invasive species monitoring for this 2,020-acre wetland, stream, and nutrient mitigation bank which includes approximately 23.6 acres of wetland restoration, 8.1 acres of wetland creation, 133.2 acres of wetland preservation, 408.7 acres of upland buffer preservation, and 523.3 acres of tidal wetland preservation. The stream mitigation component of the Bank includes 42,851 LF of stream preservation, 6,769 LF of riparian buffer enhancement, 8,450 LF of stream restoration, and 9,334 LF of tidal stream preservation.

MTC Fort Pickett Environmental Services, Blackstone, Virginia (Senior Ecologist)

Mr. Presgraves served as an Ecologist and performed a variety of ecological services on the 48,000 acre facility including wetland area analyses, wetland delineations, and U.S. Army Corps of Engineers submittals and confirmations. He took part in the efforts to map all wetland boundaries in detail using a combination of GPS technology and field mapping. While conducting fieldwork, he reviewed the site for unique and environmentally sensitive areas and/or Natural Heritage resources in accordance with classifications provided by the Virginia Department of Conservation and recreation, Division of Natural Heritage.

Kenrick H. Presgraves PWD

Senior Ecologist

Yorktown Crude Oil Unloading Facility, York County, Virginia (Senior Ecologist)

Mr. Presgraves conducted a delineation of wetlands and other waters of the U.S. (WOUS) within the project area subject to jurisdiction by the Corps under Section 404 of the Clean Water Act. He utilized the currently accepted Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region (Version 2.0) (Supplement) to identify and delineate the WOUS boundaries within the project area. Additionally, he visited the site with the Corps and obtained a written confirmation of the delineation. Mr. Presgraves also worked closely with the project team and regulatory staff on agency coordination and permit issuance.

ADDITIONAL EXPERIENCE

Wildlife Biologist/Park Ranger, Sandy Bottom Nature Park, City of Hampton, Virginia

*Mr. Presgraves was responsible for the development of the Sandy Bottom Nature Park Natural Resource Management Plan, wildlife habitat enhancement projects, and the design and implementation of all flora and fauna surveys and research endeavors. Mr. Presgraves conducted small mammal surveys and multi-year herpetofauna surveys. In addition, Mr. Presgraves worked closely with VDGIF and Old Dominion University in a multi-year effort to document the existing population of **canebrake rattlesnakes** and **Mabee's salamander** at Sandy Bottom Nature Park. The effort included the trapping, pit-tagging, and release of more than 30 canebrake rattlesnakes over a 5 year period. To monitor the existing population of Mabee's salamander, Mr. Presgraves installated and monitored several drift fence and pit fall trap arrays throughout the park. Additional survey efforts included **piping plover** nest surveys at Grandview Island.*

Attachment D

USFWS Approved Survey Contact List for Bats

Approved Surveyors in Virginia for:
Gray bat (*Myotis grisescens*)
Indiana bat *(Myotis sodalis)*
Northern long-eared bat *(Myotis septentrionalis)*
Virginia big-eared bat (*Corynorhinus townsendii virginianus*)

This list contains the names of individuals who are qualified to conduct habitat assessments/surveys for the referenced species in Virginia. If you select an individual not on this list to conduct habitat assessments/surveys for the referenced species, provide that individual's qualifications to this office for review and approval 60 days prior to the start of the survey. If a habitat assessment determines there is habitat for one or more of the referenced species, a species survey by an approved surveyor is needed. If the survey determines that any rare species are present, contact this office to allow us the opportunity to work with you to avoid or minimize adverse effects to rare species and their habitats during project design and implementation. Email correspondence and survey results to virginiafieldoffice@fws.gov. Inclusion of names on this list does not constitute endorsement by the U.S. Fish and Wildlife Service or any other U.S. Government agency.

**Approved for acoustic surveys only

Last Updated:	08 September 2015

Joel Beverly
Apogee Environmental Consultants
PO Box 338
Ermine, KY 41815
(606) 633-7677
joelbeverly@hotmail.com

Neil Bossart
Pittsburgh Wildlife & Environmental
853 Beagle Club Road
McDonald, PA 15057
(724) 796-5137
(717) 860-7679 cell
nbossart@windstream.net

Virgil Brack
Environmental Solutions & Innovations
4525 Este Avenue
Cincinnati, OH 45232
(513) 451-1777
vbrack@environmentalsi.com

Matt Brennan**
Angler Environmental
5367 Telephone Road
Warrenton, VA 20187
(703) 393-4844

Karen Campbell
Biology Department
Albright College
Reading, PA 19614
(610) 921-2381
kcampbell@alb.edu

Civil & Environmental Consultants, Inc.
530 E. Ohio Street, Suite G
Indianapolis, IN 46204
(877) 746-0749
cmurphy@cecinc.com
Ryan Slack
Jack Basiger
Amanda Janicki
Craig Rockey
Cory Murphy
Brent Mock
Jody Nicholson
Nate Light
Shannon Williams

Copperhead Env. Consulting
P.O. Box 73
Paint Lick, KY 40461
Mark Gumbert
(859) 925-9012
(859) 619-6242 cell
mwgumbert@copperheadconsulting.com
Jeff Schwierjohann
(859) 925-9012
jschwierjohann@copperheadconsulting.com

Mary Frazer
Three Oaks Engineering
(919) 215-5724
mary.frazer@threeoaksengineering.com

GAI Consultants, Inc
1830 Airport Exchange Blvd.
Suite 220
Erlanger, KY 41018
(859) 647-6647
(859) 444-7734 cell
a.mann@gaiconsultants.com
Adam Mann
Thomas Czubek
Jason Duffey
Cynthia Hauser
Beth Meyer

Michael Gannon
Department of Biology
Penn State University
3000 Ivyside Park
Altoona, PA 16601-3760
(814) 949-5210
mrg5@psu.edu

Mary Gilmore
EnviroScience
5070 Stow Road
Stow, OH 44224
(330) 688-0111
mrg5@psu.edu

Chris Isaac
Appalachian Tech. Services
P.O. Box 3537
Wise, VA 24293
(276) 328-4200
cisaac@atsone.com

Daniel Judy
Kleinfelder
1174 Camp Avenue
Mount Dora, FL 32757
(352) 383-1444
(352) 408-8084 cell
djudy@kleinfelder.com

Michael O'Mahony
Normandeau Associates
400 Old Reading Pike
Building A, Suite 101
Stowe, PA 19464
(610) 705-5733
momahony@normandeau.com

Steve Pernick*
Skelly and Loy, Inc.
3280 William Pitt Way
Pittsburg, PA 15238
(412) 828-1412
(412) 463-2149 cell
spernick@skellyloy.com
*Only approved for IBAT surveys

Sanders Environmental
322 Borealis Way
Bellefonte, PA 16823
(814) 659-8257
sanders@batgate.com
Christopher Sanders
Keith Christenson
Matthew Hopkins

Stantec Consulting Services
(2 Locations)
11687 Lebanon Road
Cincinnati, OH 45241-2012
Jeff Brown
(513) 842-8200
jeff.brown@stantec.com
James Kiser
(502) 396-3199
Kim Carter
(614) 643-4357 ext. 4357
Tony Evans
(502) 212-5000
Lindsey Wright
(802) 497-6426
1011 Boulder Springs Drive, Suite 225
Richmond, VA 23225
Sean Wender**
(804) 267-3474
sean.wender@stantec.com
Trevor Peterson**
(804) 267-3474
trevor.peterson@stantec.com

Bradley J. Steffen
Bat Program Director
TRC Environmental
11231 Cornell Park Drive
Cincinnati, OH 45242
(513) 489-2255
(513) 309-6453
bsteffen@trcsolutions.com

Quinten D. Tolliver
Wise, Virginia
(276) 328-2027
qdtolliver@hotmail.com

VA Division of Natural Heritage
217 Governor Street, 3rd Floor
Richmond, VA 23219
Anne Chazal
(804) 786-9014
anne.chazal@dcr.virginia.gov
Chris Hobson
(804) 371-6202
chris.hobson@dcr.virginia.gov
Steve Roble
(804) 786-7951
steve.roble@dcr.virginia.gov

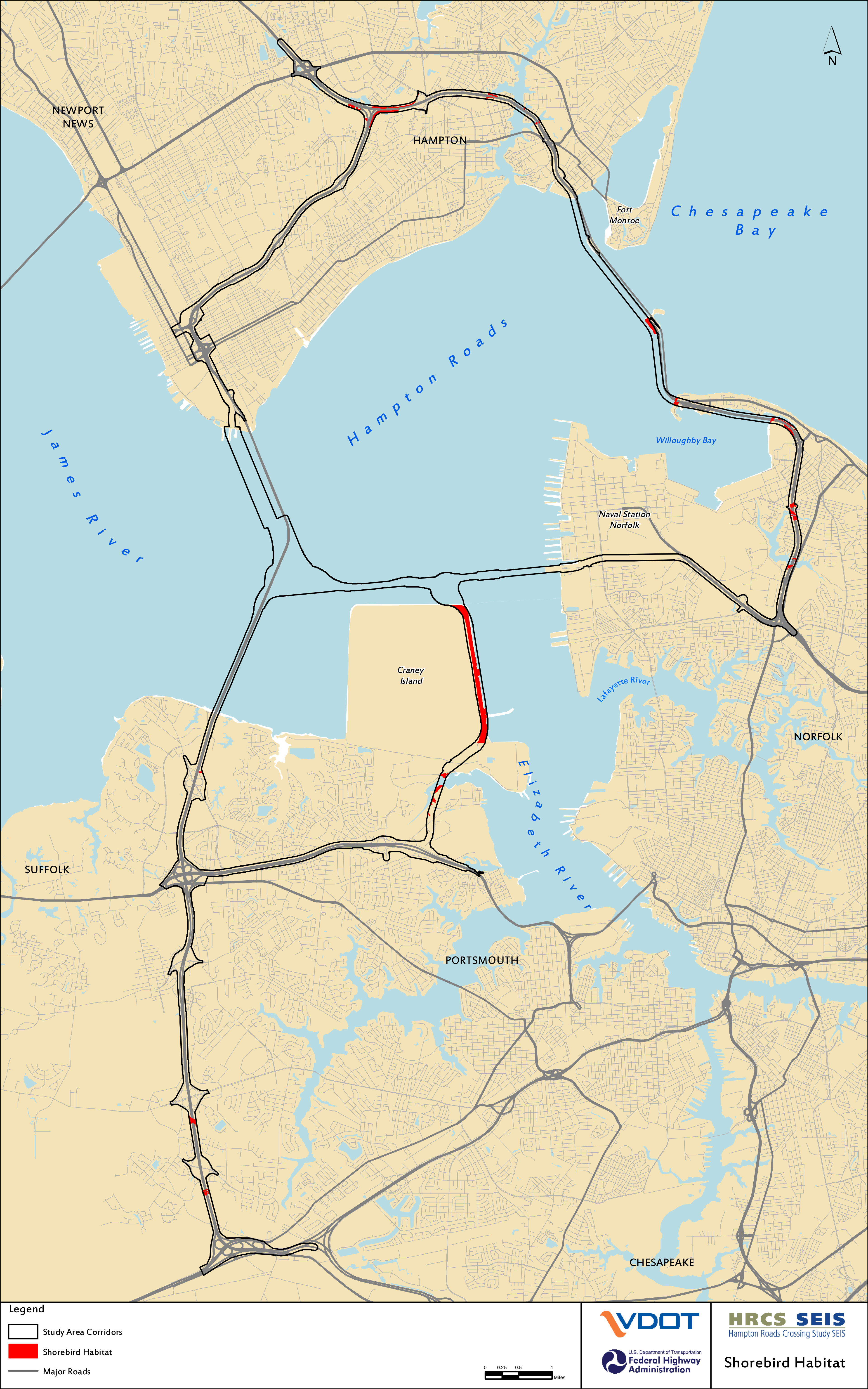
VA Tech – Conservation Mgmt. Inst.
1900 Kraft Drive, Suite 250
Moss Bldg. CRC
Blacksburg, VA 24060
Michael St. Germain
(540) 231-9176
mstgerma@vt.edu
Eric Wolfe
(540) 808-8308
ewolf6@vt.edu

Wetland Studies and Solutions, Inc.
5300 Wellington Branch Drive
Suite 100
Gainesville, VA 20155
Jessica M. Campo**
(703) 679-5621
jcampo@wetlandstudies.com
Neil Gutherman**
(703) 679-5600

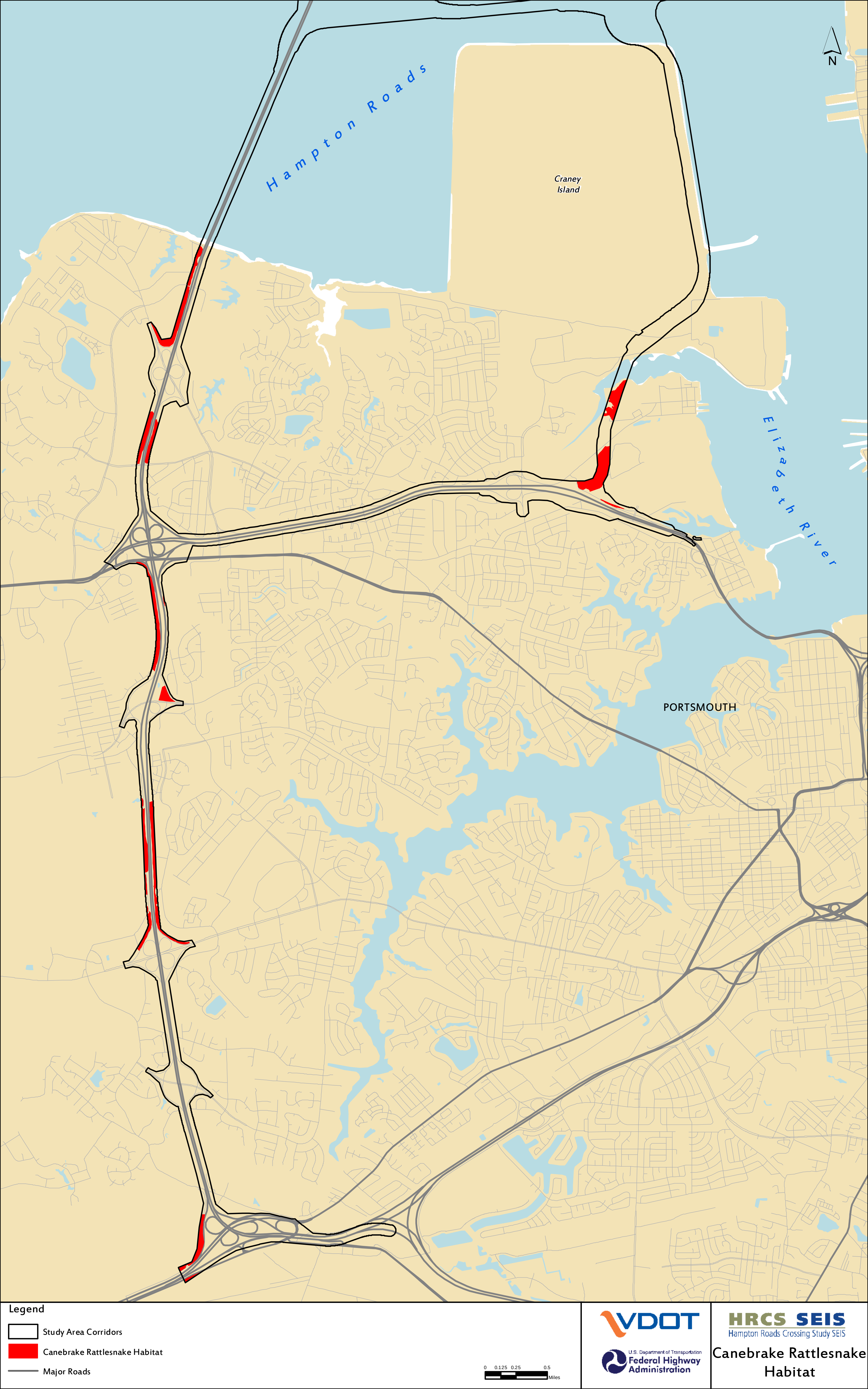
Julie Zeyzus
P.O. Box 314
Fayetteville, PA 17222
(724) 387-8201
jzeyzus@gmail.com

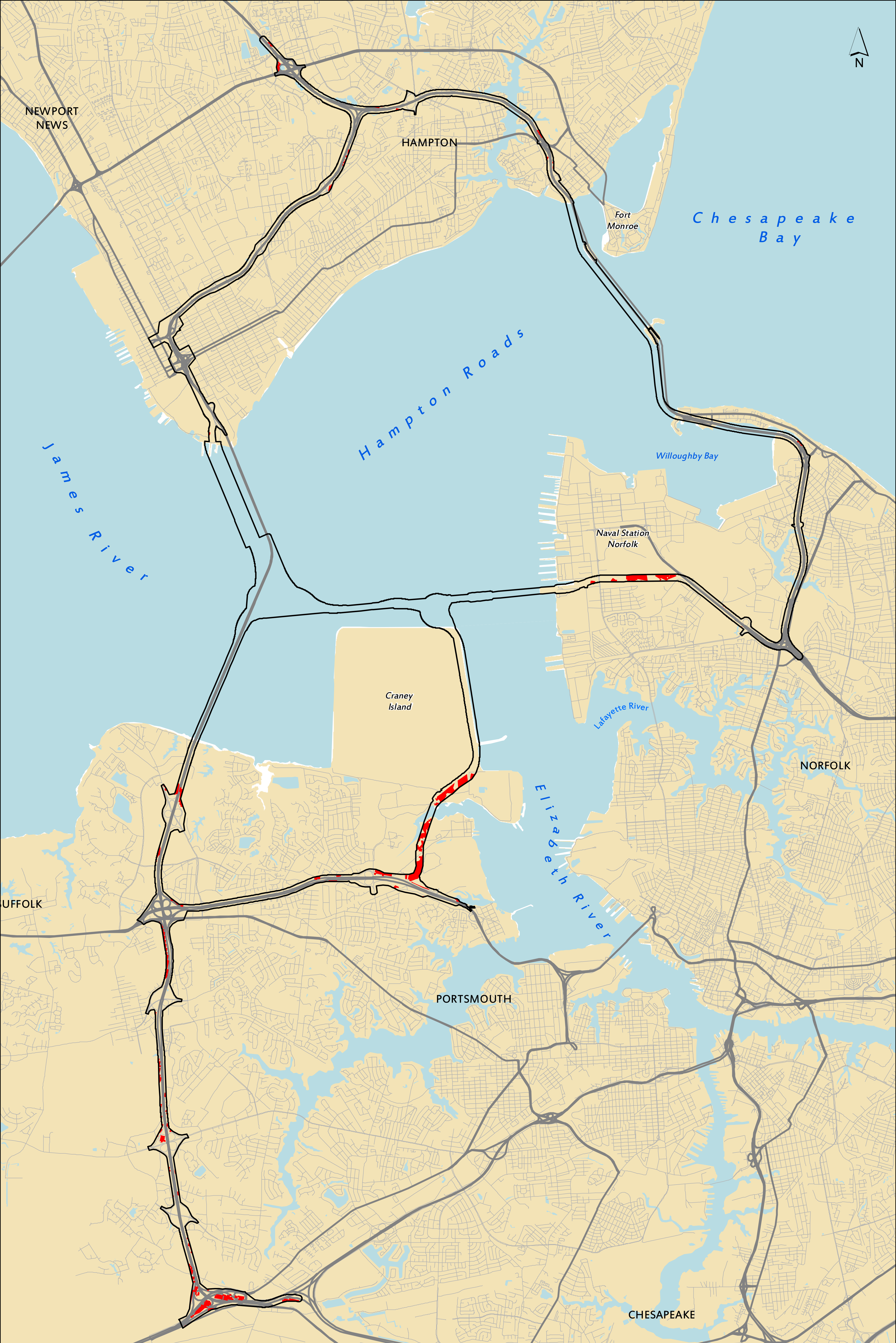
APPENDIX G:

THREATENED & ENDANGERED SPECIES HABITAT MAPS AND PHOTOS



Shorebird Habitat


N
Hampton Roads
Craney Island
Elizabeth River
PORTSMOUTH
Legend
Study Area Corridors
Canebrake Rattlesnake Habitat
Major Roads
0 0.125 0.25 0.5
Miles
VDOT
U.S. Department of Transportation
Federal Highway Administration
HRCS SEIS
Hampton Roads Crossing Study SEIS
Canebrake Rattlesnake Habitat



Legend

Study Area Corridors

Bat Habitat

Major Roads

Note:
1. Bat Habitat represented using 2011 NLCD data provided by MRLC http://www.mrlc.gov/

VDOT

U.S. Department of Transportation
Federal Highway Administration

HRCS SEIS
Hampton Roads Crossing Study SEIS

Bat Habitat

I-664 Suffolk (Alts C & D)
(Forested habitat suitable for NLEB)

I-664 Suffolk (Alts C & D)
(Forested habitat suitable for NLEB, Canebrake rattlesnake, & Dismal Swamp southeastern shrew)

I-664 & Rt. 460 (Alts C & D)
(Forested habitat suitable for NLEB, Canebrake rattlesnake)

I-664 Suffolk (Alts C & D)
(PFO habitat suitable for Mabee's salamander, NLEB, Canebrake rattlesnake, & Dismal Swamp southeastern shrew)

North of VA 164 (Alts B, C, & D)
(Forested habitat suitable for NLEB, Canebrake rattlesnake, & Dismal Swamp southeastern shrew)

Craney Island (Alts B, C, & D)
(Foraging habitat suitable for Gull-billed Tern, Piping & Wilson's Plovers, & Red Knot)

I-64 Norfolk (Alts A, B, & D)
(Foraging habitat for Gull-billed Tern, Piping & Wilson's Plovers, & Red Knot)

Craney Island (Alts B, C, & D)
(Non-suitable habitat due to disturbance)

I-64 Norfolk (Alts A, B, & D)
(Foraging habitat for Gull-billed Tern, Piping & Wilson's Plovers, & Red Knot)

I-64 Hampton (Alts A, B, & D)
(Foraging habitat for Gull-billed Tern, Piping & Wilson's Plovers, & Red Knot)