## 3.8 NATURAL RESOURCES

### 3.8.1 Water Resources

#### 3.8.1.1 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 flow of tides are considered tidal 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 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 considered subaqueous bottoms, which 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.

*Methodology*

Tidal waterbodies and non-tidal streams were identified within the Study Area Corridors using the National Hydrography Dataset (NHD) from the US 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 US 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 LOD.

### *Affected Environment*

The central waterbody within the Study Area Corridors is Hampton Roads, which is the confluence of the James River, Elizabeth 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. Seventeen different tidal waterbodies are located within the Study Area Corridors (**Figure 3-10**).

The following resources were evaluated and were not present in the Study Area Corridors: Wild or Scenic Rivers; waterbodies listed on the Nationwide Rivers Inventory; National Marine Sanctuaries; State Scenic Rivers (however, the VDCR has identified the James River, including Hampton Roads, as a potential State Scenic River segment for future study (VDCR, 2016b)); and Exceptional State Waters.

**Table 3-29** shows the area of tidal or navigable waterbodies present within the Study Area Corridors, as well as shallow water habitat included in those totals. Shallow water habitat provides forage, refuge, spawning, and rearing habitat for fish, their prey, and other aquatic organisms such as shellfish and benthos.

**Table 3-29: Tidal or Navigable Waterbodies within Study Area Corridors (acres)**

| Waterbody | Alternative A | Alternative B | Alternative C | Alternative D |
|---|---|---|---|---|
| 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 |
| Hampton Roads/James River | 0 | 0 | 13 | 13 |
| Johns Creek[1] | 0.7 | 0.7 | 0 | 0.7 |
| Mason Creek | 5 | 5 | 0 | 5 |

| Waterbody | Alternative A | Alternative B | Alternative C | Alternative D |
|---|---|---|---|---|
| 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 | 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.*

Non-tidal streams (R3 and R4) were assessed using Unified Steam Methodology (USM) and are shown in *Appendix B* of the *HRCS Natural Resources Technical Report*. A total of 183 linear feet of R3 streams are crossed by the Study Area Corridor of Alternative B, and no R4 streams are crossed. A total of 2,890 linear feet of R3 streams and 169 linear feet of R4 streams are crossed by 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. 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

- ***Environmental Consequences***

The **No-Build Alternative** would not result in any project-related construction and would therefore not directly impact the natural environment. As a result, environmental effects to tidal waterways, shallow water habitat, and non-tidal streams are not anticipated. **Table 3-30** provides a summary of the tidal and non-tidal waterbodies that would be impacted by the **Build Alternatives**, as well as the total area of shallow water habitat within the tidal waters. Impacts have been quantitatively identified by using a GIS to determine the total area of water resource within the LOD for each alternative. As described in **Section 3.0**, the LOD is based on the full area which surrounds potential improvements associated with each

**Figure 3-10: Named Waterbodies**

alternative, including all potential areas of bridges, tunnels, and roadways, as well as areas where dredging may occur. Therefore, the estimated impact is conservative. The actual area of permanent impact would be limited to actual areas of dredging, which would be determined during project design; permanent placement of tunnels, piers, or pilings; and the area directly impacted from bridge approaches (causeways), 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.

**Table 3-30: Potential Impacts to Tidal and Non-Tidal Waters**

| Stream Type | Alternative A | Alternative B | Alternative C | Alternative D |
|---|---|---|---|---|
| Tidal (acres) | 147 | 216 | 369 | 461 |
| Shallow Water Habitat (acres) | 43 | 59 | 29 | 73 |
| Non-Tidal (linear feet) | 0 | 0 | 548 | 548 |

*Note: Tidal and non-tidal waters were identified using the same photo interpretation methods used for wetlands in combination with National Hydrography Dataset information.*

**Alternative A** would impact 147 acres of tidal waters, including 43 acres of shallow water habitat along I-64 (predominantly Hampton Roads and Willoughby Bay). **Alternative B** would impact 216 acres of tidal waters, including 59 acres of shallow water habitat along I-64, the I-564 Connector over the Elizabeth River (Hampton Roads and Willoughby Bay) and the VA 164 Connector (Craney Island Creek). **Alternative C** would impact the second highest area of tidal waters (352 acres) including shallow water habitat (29 acres) along I-664, the I-564 Connector (predominantly Hampton Roads) and the VA 164 Connector (Craney Island Creek). **Alternative D** would impact the most area of tidal waters (461 acres) including shallow water habitat (73 acres) along I-64, the I-564 Connector, and I-664 (predominantly Hampton Roads and Willoughby Bay).

The non-tidal impacts would be the result of culvert extensions and/or roadway fill occur along I-664 in Suffolk and Chesapeake. These would occur to the unnamed tributary to Streeter Creek (Suffolk), the unnamed tributary to Goose Creek (Chesapeake), and Drum Point Creek (Chesapeake).

#### *Mitigation*

VDOT is exempt from VMRC royalties for use of subaqueous bottom. 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.

### 3.8.1.2 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).

### *Methodology*

National Oceanic and Atmospheric Administration (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. Civil Works Projects noted this on the USACE Norfolk District webpage in addition to previous correspondence with the USACE on previous studies, and these 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.

### *Affected Environment*

Navigational channels are maintained by the USACE within Hampton Roads to provide transit to the many ports in the region. Two of the channels are maintained at -50 feet mean lowest low water (MLLW), although the channels are authorized to be deepened 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. There are 42 acres of maintained navigable channels within the Study Area Corridors.

The USACE Norfolk District Civil Works program also maintains a 2,500-acre dredged material management area (CIDMMA). This site receives dredged material from numerous federal and private dredging projects within the Hampton Roads area. Per the USACE Norfolk District Commander's Policy Memorandum WRD-01, the CIDMMA facility is for the use of all private interest accomplishing dredging to support navigation in Norfolk Harbor and adjacent waters. Material dredged for non-navigation related transportation projects (i.e., bridges and tunnels) would not be accepted at CIDMMA unless the material is clean and of the quality needed for dike construction.

### *Environmental Consequences*

The **No-Build Alternative** would not result in any project-related construction and would therefore not directly impact any navigational channels maintained by the USACE or CIDMMA, including the eastern 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 3-31** 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. Greater impacts to CIDMMA may occur 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. The estimate is conservative given that the actual area of permanent impact would be limited to areas of dredging, which would be determined during project design; permanent placement of tunnels, piers, or pilings; and the area directly impacted from bridge approaches (causeways), scour protection measures, and culverts.

**Table 3-31: Potential Impacts to Maintained Navigable Channels and the CIDMMA (acres)**

| Name of Channel | Alternative A | Alternative B | Alternative C | Alternative D |
|---|---|---|---|---|
| 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 Channel | 0 | 0 | 0 | 0 |
| CIDMMA | 0 | 89 | 89 | 89 |
| **Total** | **12** | **113** | **146** | **151** |

*Source and notes: NOAA, 2016c, 2016d. USACE, 2010a. CIDMMA impacts do not include the eastward expansion.*

**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 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 in 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 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 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 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. As with Alternatives 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.

#### *Mitigation*

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.

### 3.8.1.3 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, 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.

#### *Methodology*

Wetlands within the Study Area Corridors were mapped using a photo interpretation and groundtruthing process, detailed in Appendix B of the *HRCS Natural Resources Technical Report*. 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. Historical imagery and other ancillary data were used to assist with wetland location efforts. More detailed discussion of the FGDC photo interpretive method is provided in the *HRCS Natural Resources Technical Report*.

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 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.

*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 are 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 eight 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 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.

### *Affected Environment*

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* of the *HRCS Natural Resources Technical Report*.

**Table 3-32** provides a description of the wetland types and total acreage identified within the Study Area Corridors. A large portion of the wetlands within each alternative are composed of tidal open waters (E1UB): 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.

**Table 3-32: Wetland Types within Study Area Corridors (acres)**

| Cowardin Abbreviation | Cowardin Classification | Alternative A | Alternative B | Alternative C | Alternative D |
|---|---|---|---|---|---|
| E1UB | estuarine, unconsolidated bottom | 287 | 531 | 926 | 1,224 |
| 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 |
| 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. Altered wetlands are those that were identified through the photointerpretation as being excavated, indicating recent or historic disturbances, or the result of water backing up from a manmade feature.

**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.

The majority of estuarine wetlands within the Study Area Corridors are designated as unaltered within all Alternatives. 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 a manmade feature. 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 3-32**. 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 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 stormwaves), 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, 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).

*Functional Assessment*

Palustrine and tidal wetland functions/conditions are classified by attributes defined in the selected functional assessment methodologies. **Tables 3-33** and **3-34** 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* of the *HRCS Natural Resources Technical Report***.**

The Hydrogeomorphic (HGM) Regional Guidebook was used to assess function of forested palustrine wetlands. **Table 3-34** provides the results of the assessment of four functions utilized in this method: habitat, plant community, water level regime, and carbon cycling processes. The values for functions range from 0.0 to 1.0 with 1.0 being the highest.

**Table 3-33: Palustrine Wetland Functional 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 3-34** provides the results of the assessment.

**Table 3-34: Tidal Wetland Functional 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 functional 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 result in any project-related construction and would therefore not directly impact any wetlands.

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 3-35, 3-36, and 3-37**. 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 3-35** are listed by Cowardin classification per alternative. Wetland impacts per alternative on **Table 3-36** 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**

**3-37**, which compares the extent of wetland types that are altered (excavated or manmade) to those that are relatively unaltered per alignment.

**Table 3-35: Potential Wetland Impacts by Cowardin Classification (acres)**

| Impact Type | Alternative A | Alternative B | Alternative C | Alternative D |
|---|---|---|---|---|
| E2EM | 4.6 | 8.5 | 6.2 | 10.8 |
| E2EMx | 0.1 | 0.1 | 0.0 | 0.1 |
| E2US | 0.5 | 0.5 | 0.0 | 0.5 |
| PEM | 0.0 | 10.6 | 11.4 | 10.7 |
| PEMF | 0.0 | 0.0 | 0.0 | 0.0 |
| PEMFx | 0.0 | 0.0 | 0.2 | 0.2 |
| PEMx | 0.2 | 6.1 | 6.4 | 8.8 |
| PFO | 0.3 | 36.6 | 55.4 | 55.6 |
| PFOF | 0.0 | 0.0 | 0.0 | 0.0 |
| PFOFx | 0.0 | 0.0 | 6.7 | 6.7 |
| PFOx | 2.0 | 3.2 | 18.0 | 19.2 |
| PSS | 0.0 | 0.3 | 0.3 | 0.3 |
| PSSx | 0.0 | 0.2 | 0.2 | 0.2 |
| PUB | 0.0 | 0.0 | 0.0 | 0.0 |
| PUBF | 0.0 | 0.0 | 0.0 | 0.0 |
| PUBFx | 0.0 | 0.2 | 0.3 | 0.2 |
| PUBx | 0.0 | 6.2 | 6.3 | 6.3 |
| **Total** | **7.8** | **72.6** | **111.5** | **119.9** |

*Notes: Photo Interpretation Maps in Appendix B of the HRCS Natural Resources Technical Report.*

**Table 3-36: Potential Wetland Impact Totals (acres)**

| Impact Type | Alternative A | Alternative B | Alternative C | Alternative D |
|---|---|---|---|---|
| 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** |

*Notes: Photo Interpretation Maps in Appendix B of the HRCS Natural Resources Technical Report.*

**Table 3-37: Potential Impacts Comparison of Altered vs. Unaltered Wetlands (acres)**

| Impact Type | Alternative A | Alternative B | Alternative C | Alternative D |
|---|---|---|---|---|
| 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** |

*Notes: Photo Interpretation Maps in Appendix B of the HRCS Natural Resources Technical Report.*

**Alternative A** would potentially impact a total of five 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 two 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. As identified in the assessment, tidal wetland areas with bridges and overpasses have lower condition ratings than those without, due to shading and disturbance from piers within the wetlands, among other factors. Therefore, impacts from constructing piers and additional shading from expansion of bridges or overpasses could cause some reduction in wetland condition. Additional point sources and tidal restrictions would also reduce condition.

**Alternative B** would potentially impact a total of ten 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. 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 US. 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 US 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 six 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 condition ratings than those without, due to shading and disturbance from piers within the wetlands, among other factors. 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. More detailed impacts are provided by alignment segment in **Appendix A**.

#### *Mitigation*

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 as discussed in the Water Quality section. Impacts to hydrology would be minimized through the incorporation of culverts, where appropriate, to maintain hydrologic connections between wetlands.

Individual permits from the USACE and VDEQ are expected to be required for all Build Alternatives. The USACE and VDEQ can only permit the Least Environmentally Damaging Practicable Alternative (LEDPA). Compensatory mitigation would be required for all unavoidable impacts to vegetated wetlands.

#### 3.8.1.4 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 that 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 ten percent and 20 percent 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 Executive Order (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.

### *Methodology*

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 are 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 this 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 polychlorinated biphenyls (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 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.

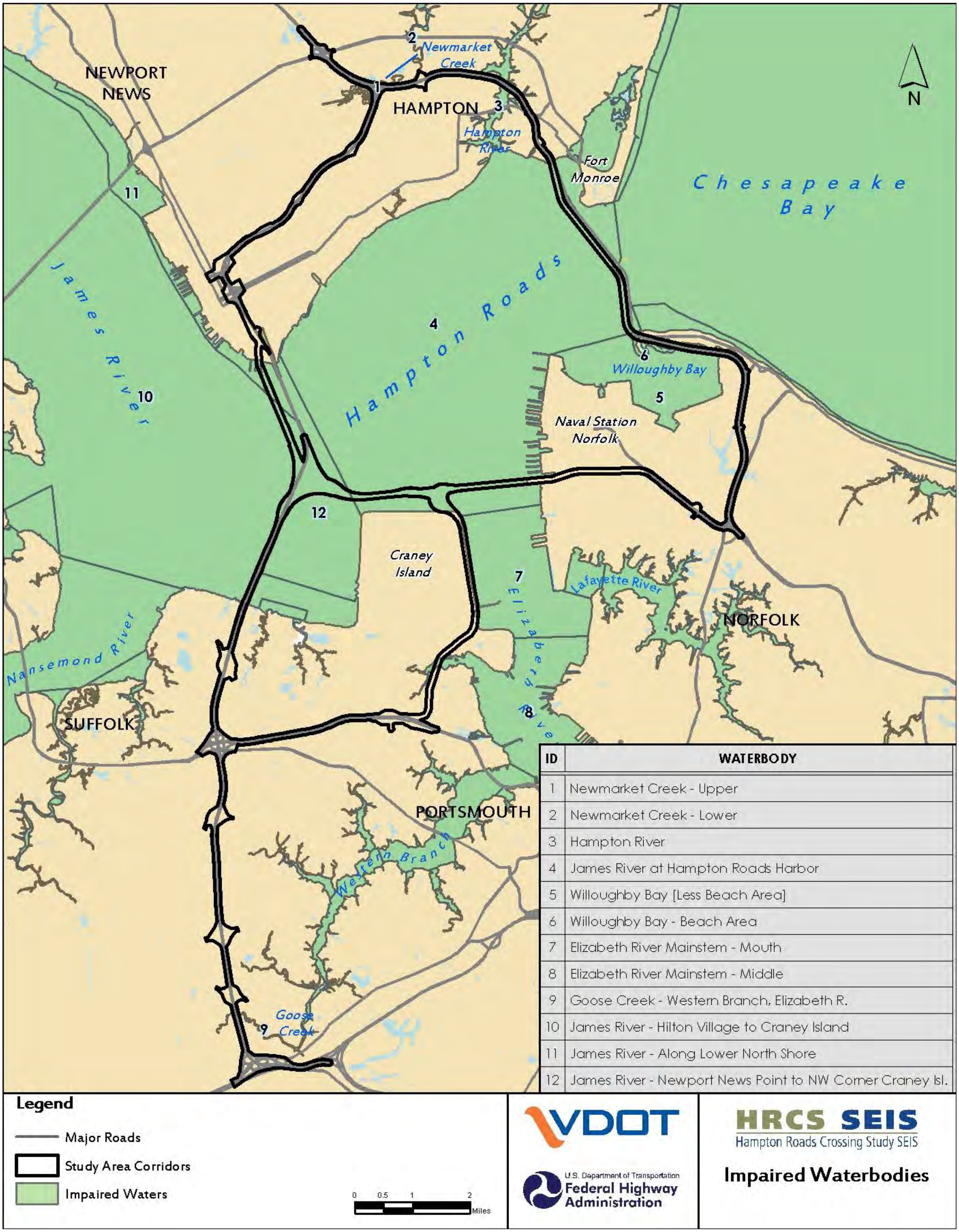
### *Affected Environment*

Impaired waterways exist throughout the Hampton Roads region. 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. As shown on **Figure 3-11**, all of the Study Area Corridors are located within impaired waters. Impaired waters, by waterbody are summarized in **Table 3-38**.

### *Environmental Consequences*

The **No-Build Alternative** would not involve 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.

**Figure 3-11: 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 3-38: Impaired Waters**

| Waterbody | Designated Use | Impairment |
|---|---|---|
| Newmarket Creek - Upper | Aquatic Life | Dissolved Oxygen<br>Aquatic Plants (Macrophytes) |
| | Fish Consumption | PCB in Fish Tissue |
| | Recreation | *Enterococcus* |
| | Shellfishing | Fecal Coliform |
| Newmarket Creek Lower | Aquatic Life | Dissolved Oxygen<br>Aquatic Plants (Macrophytes) |
| | Fish Consumption | PCB in Fish Tissue |
| | Recreation | *Enterococcus* |
| | Shellfishing | Fecal Coliform |
| Hampton River | Aquatic Life | Dissolved Oxygen |
| | Fish Consumption | PCB in Fish Tissue |
| | Recreation | *Enterococcus* |
| James River – Hampton Roads | Aquatic Life | Chlorophyll-a, Nutrient/Eutrophication Biological Indicators |
| | Fish Consumption | PCB in Fish Tissue |
| Willoughby Bay (Less Beach Area) | Fish Consumption | PCB in Fish Tissue |
| Willoughby Bay (Beach Area) | Recreation | PCB in Fish Tissue |
| Elizabeth River Mainstem – Mouth | Aquatic Life | Estuarine Bioassessments (Benthics)<br>Dissolved Oxygen |
| | Fish Consumption | PCB in Fish Tissue |
| Elizabeth River Mainstem – Middle | Aquatic Life | Estuarine Bioassessments (Benthics)<br>Dissolved Oxygen |
| | Fish Consumption | PCB in Fish Tissue |
| Goose Creek – Western Branch, Elizabeth River | Aquatic Life | Dissolved Oxygen |
| | Fish Consumption | PCB in Fish Tissue |
| James River – Hilton Village to CIDMMA | Aquatic Life | Chlorophyll-a<br>Dissolved Oxygen |
| | Fish Consumption | PCB in Fish Tissue |
| James River – Along Lower North Shore | Aquatic Life | Chlorophyll-a<br>Dissolved Oxygen |
| | Fish Consumption | PCB in Fish Tissue |
| James River – Newport News Point to NW Corner CIDMMA | Aquatic Life | Chlorophyll-a<br>Dissolved Oxygen |
| | Fish Consumption | 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.*

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 traffic volume. 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, 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, roadside herbicides, and nutrients. Vehicle-related particulates in highway runoff come mostly from tire and pavement wear (≈⅓ each), from engine and brake wear (≈20 percent), and from settleable exhaust (≈8 percent) (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 would 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 percent 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 best management practices (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. 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 3-38**. 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 3-39** 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 3-38** add estuarine bioassessments (benthics). Further impacts to impaired waters would be negligible 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 additional new tunnel across the Elizabeth River for the I-564 Connector (see **Table 3-39** 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 3-39** 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 added adjacent to the MMMBT and one tunnel constructed 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.

### *Mitigation*

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 stormwater management 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 percent, 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.

#### 3.8.1.5 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 US 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. 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.

***Methodology***

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.

*Affected Environment*

According to the Flood Insurance Rate maps (FIRMs), large portions of the area surrounding the Study Area Corridors consist of 100-year floodplain (**Figure 3-12**). The approximate total of 100-year floodplain limits in the Study Area Corridors is 933 acres. Within the Study Area Corridors, floodplains are associated with Hampton Roads, the James River, several tidal creeks, and various areas of low-lying ponding.

The following floodplains are located within the Alternative A Study Area Corridor: Hampton River, James River/Hampton Roads, Johns Creek, Mason Creek, Newmarket Creek, and Willoughby Bay. The Alternative A Study Area Corridor includes 463 acres of 100-Year Floodplain. Alternative B includes the same floodplain areas as Alternative A plus Craney Island Creek, Elizabeth River, Knotts Creek, and ponding. The Alternative B Study Area Corridor includes 777 acres of 100-Year Floodplain. The following floodplains are located within the Alternative C Study Area Corridor: Craney Island Creek, Drum Point Creek, Elizabeth River, Elizabeth River Western Branch, James River/Hampton Roads, Knotts Creek, Newmarket Creek, and Streeter Creek. The Alternative C Study Area Corridor includes 520 acres of 100-Year Floodplain. Alternative D includes the same floodplain areas as Alternative C plus Hampton River, Johns Creek, Mason Creek, a larger area of Newmarket Creek, and Willoughby Bay. The Alternative D Study Area Corridor includes 989 acres of 100-Year Floodplain.

*Environmental Consequences*

The **No-Build Alternative** would not result in any project-related construction and would therefore not directly impact any floodplains.

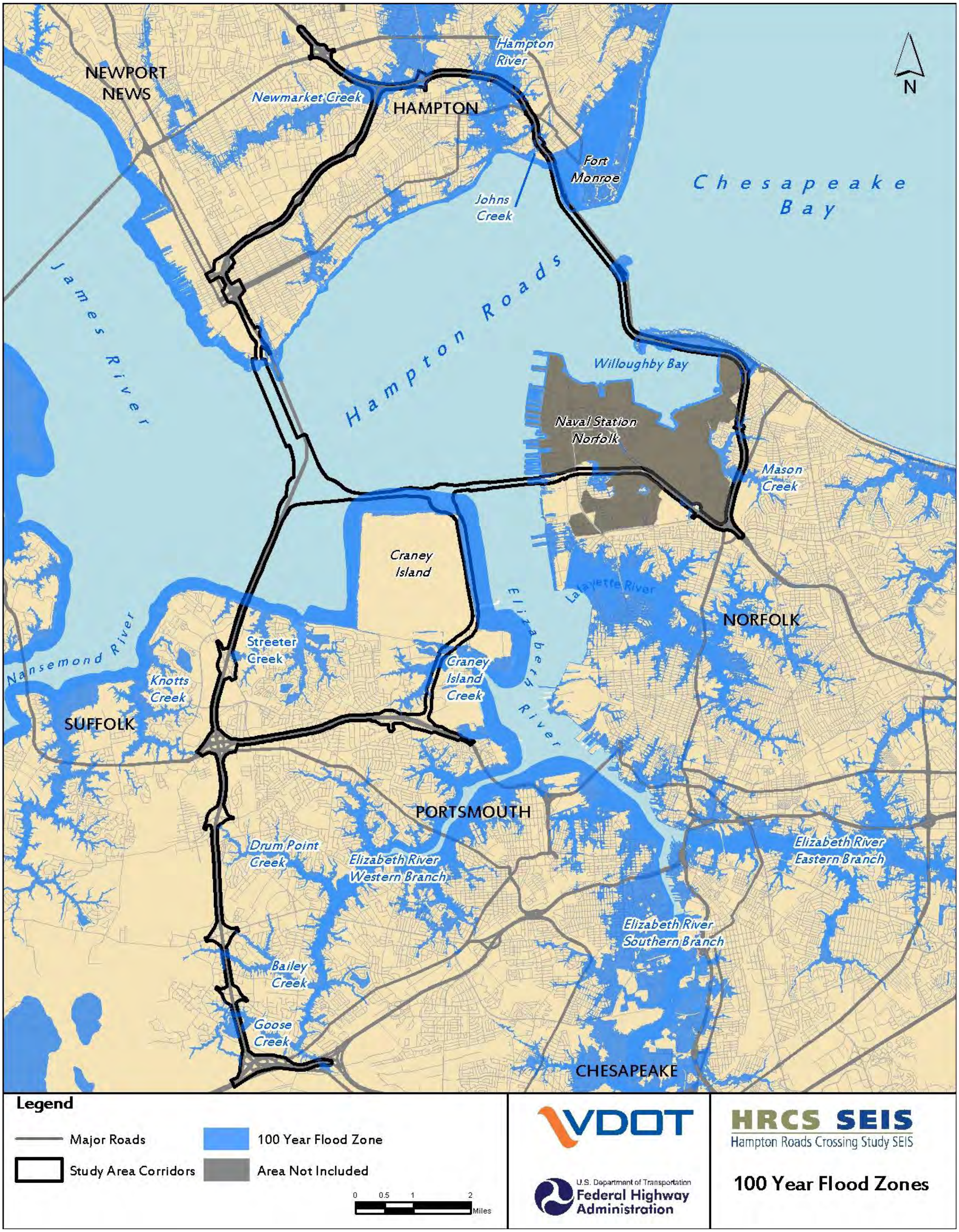
All of the **Build Alternatives** would involve encroachment within regulatory floodplains. The Build Alternatives would not pose a significant flooding risk. They would be designed to be consistent with procedures for the location and hydraulic design of highway encroachments on floodplains contained 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. **Alternative A** would impact 113 acres of floodplain, **Alternative B** would impact 213 acres, **Alternative C** would impact 213 acres, and **Alternative D** would impact 313 acres. The actual encroachment may be

**Figure 3-12: 100 Year Flood Zones**



different based upon the total extent of fill required for construction and the use of bridges at the major waterways. Causeways may be used to support tunnel construction. More detailed impacts are provided by alignment segment in **Appendix A**.

*Mitigation*

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, and VDOT criteria. Sections 107 and 303 of VDOT's specifications would be met through final design.

3.8.1.6 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.

*Methodology*

The Virginia Institute of Marine Science (VIMS) is evaluating the potential impact on flow, estuarine circulation, and sediment transport. Their study improves 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 future Build 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 three 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 being 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 Build Alternatives analyzed in this 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 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*

VIMS will provide a complete assessment of sediment transport, bank erosion, shoaling, and hydrodynamics associated with the HRCS study once a Preferred Alternative has been identified. The following interim findings have been made:

- **Alternative A** - Would result in a small increase of averaged surface and bottom salinity on the order of ~0.3 practical salinity units (PSU) in the vicinity of the HRBT, due to the decreased flushing there. The salt intrusion along the main channels of James and Elizabeth Rivers is not substantially affected.
- **Alternative B** - The changes associated with Alternative A would also apply to Alternative B. In addition, there would be a modest increase in surface salinity near CIDMMA, likely due to increased turbulence mixing. The intrusion along the main channels of James and Elizabeth Rivers would not be substantially affected.
- **Alternative C** - The impact on bathymetry would be larger and more wide-spread compared to Alternatives A and B, especially in the Hampton Roads shallows. As a result, the increase in the turbulence mixing and retention time would lead to a larger increase in the surface salinity (up to 1PSU) near the alternative alignments. However, the increase in the bottom salinity is less as the bottom salt intrusion is more channelized.
- **Alternative D** - This scenario would combine all of the alterations in the other three Build Alternatives, and therefore the changes in the surface and bottom salinity would resemble the combination of those from the other three Alternatives. That is, there would be increases in the salinity near the I-64, I-664, and Elizabeth River pilings, with the bottom salinity being less affected.

***Mitigation***

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 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 used during the design and construction phases to reduce potential effects.

#### 3.8.1.7 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 the environmental acceptability (USEPA, 1991).

### *Methodology*

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.

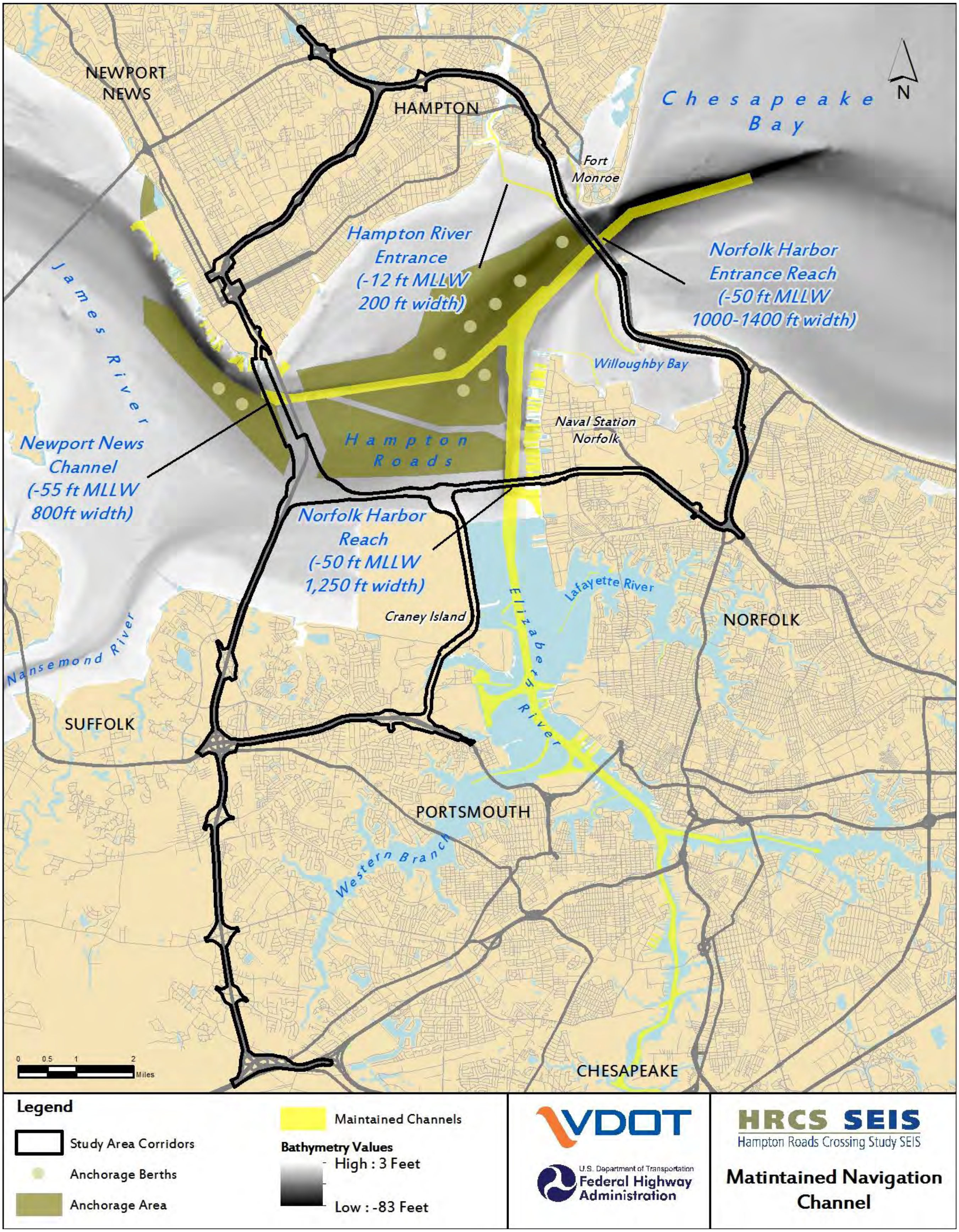
### *Affected Environment*

The Norfolk Harbor Entrance Reach in the vicinity of the HRBT (**Figure 3-13**), as well as the Norfolk Harbor Reach at the mouth of the Elizabeth River, are maintained at 50 feet MLLW, although the channels are authorized to be deepened to -55 feet MLLW. The Newport News Channel in the vicinity of the MMMBT is maintained at -55 feet MLLW. Field surveys conducted by the USACE showed depths to be between -50 and -60 feet within the Study Area Corridors.

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 the Benthic Species section. 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, 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 below but represent only

**Figure 3-13: Maintained Navigation Channel**



those known to exist at the present time and could vary over the course of the phased implementation of the selected alternative.

### *Environmental Consequences*

The **No-Build Alternative** would not result in any project-related construction and would therefore not have any direct effects to dredging.

All of the **Build Alternatives** would involve dredging activities associated with bridge and 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.

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 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 do not occur or are mitigated appropriately.

The estimated dredge quantities associated with each alternative is provided in **Table 3-39**. 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. 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 to accommodate two transit-only lanes.

**Table 3-39: Estimated Dredge Quantities (cubic yards)**

| Structure | Alternative A | Alternative B | Alternative C | Alternative D |
|---|---|---|---|---|
| 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** |

**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, resulting in the largest estimated dredge material quantity compared to the other Build Alternatives. 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 3-39** 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, 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 selected 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.

Disposal alternatives include beneficial use, upland Confined Disposal Facilities (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. Furthermore, 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. 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", 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 a significant consideration in identifying suitable disposal options.

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." The material would need to meet certain physical and chemical properties; however, since implementation of any Build Alternative would take many years, it is unknown if CIDMMA would be able to accept the dredged material at this time.

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 the site and move material there without excessive cost. If it is deemed necessary that a project-specific disposal site is 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 five 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, use of this site has been limited due to the 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 and the amount requiring disposal at any given point in time. The dredge disposal options discussed herein 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 expand disposal options. Likewise, the capacity of the options would also, as the current options presumably get used up or expand.

#### *Mitigation*

Regardless of the method of dredging, a number of operational BMPs can be employed to reduce impact to water quality. The time of year and length of dredging operations will be considered as prolonged dredging would result in disturbance to the natural resources and adjacent water column over a longer period of time.

Regardless of the method of dredging, a number of operational BMPs can be employed to reduce impact to water quality, including: 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. Other examples include cofferdams, removable dams (e.g., geotubes), sheet-pile enclosures, silt or turbidity curtains, and pneumatic (bubble) curtains (ERDC, 2008). The time of year and length of dredging operations will 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. 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.

### 3.8.1.8 Aquifers/Water Supply

#### *Regulatory Context*

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 US 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.

#### *Methodology*

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 Study Area Corridors at the I-664 interchange with Route 460; there are no public surface water intakes, or public springs within the Study Area Corridors. 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 I-95. **Table 3-40** summarizes public water supplies.

**Table 3-40: Public Water Supplies**

| Item | Results |
|---|---|
| Public Ground Water Wells [1] | Sunray Artesian Water Supply (PWS ID# 3550775) located in Chesapeake, is within one mile but greater than 1,000 feet from the Study Area Corridors. |
| Public Surface Water Intakes [1] | None 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 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 result in any project-related construction and would therefore not directly impact any aquifers or water supply. 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.

#### *Mitigation*

The study would have no effect to aquifers or water supply; therefore, minimization and mitigation are not warranted.

### 3.8.2 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). When the USACE reviews a Joint Permit Application for impacts to waters of the US, it is required that the applicant demonstrate consistency with the enforceable regulatory programs of the CZMP listed in **Table 3-41**.

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

### *Methodology*

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 whether more information is needed, whether it is not required, and/or whether 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 OISs advance from the study, VDOT would work with VDEQ to complete this Coastal Zone Management process.

**Table 3-41: 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<br>29.1-100 to 29.1-570 | VMRC<br>VDGIF | N/A |
| Subaqueous Lands Management | Establishes conditions for granting or denying permits to use State-owned bottomlands | 28.2-1200 to 28.2-1213 | VMRC | N/A |
| Wetlands Management | Preserve wetlands and prevent their despoliation | 62.1-44.15:5<br>28.2-1301 to 28.2-1320 | VDEQ<br>VMRC<br>Wetlands Boards | Non-tidal<br>Tidal |
| Dunes Management | Prevent destruction or alteration of primary dunes | 28.2-1400 to 28.2-1420 | VMRC<br>Wetlands Boards | N/A |
| Non-point Source Pollution | Reduce soil erosion and decrease inputs of chemical nutrients and sediments | 62.1-44.15:51 *et seq.* | VDEQ<br>Local Governments | N/A |
| Point Source Pollution Control | Regulates discharges into State waters through VA Pollutant Discharge Elimination System and VA Pollution Abatement permits | 62.1-44.15 | VDEQ | N/A |
| 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 | N/A |
| Coastal Lands Management | Regulates activities within RMAs and RPAs | 62.1-44.15:67 to 62.1-44.15:79<br>9 VAC 25-830-10 *et seq*. | VDEQ<br>Local Governments | N/A |

### *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.

### 3.8.3 Wildlife Habitat

#### 3.8.3.1 Terrestrial Wildlife / Habitat

*Regulatory Context*

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 US Fish and Wildlife Service (USFWS) and the VDGIF act as consulting agencies under the US 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).

*Methodology*

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 assessments, 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 obtained from the 2011 National Land Cover Database (Homer, et.al, 2015). Potential impacts to land cover types was calculated by performing GIS overlays of the LOD.

### *Affected Environment*

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.

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 (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 and Craney Island Conservation Sites contain waterbirds as their natural heritage resources. 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 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.

*Environmental Consequences*

The **No-Build Alternative** would not result in any project-related construction and would therefore not directly impact wildlife or terrestrial habitat.

The **Build Alternatives** could potentially impact both terrestrial wildlife and habitat. However, the existing roadway corridors that comprise the four Build Alternatives 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.

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 VA 164 Widening 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. The impacts along this corridor within existing interchanges, existing right-of-way, and immediately adjacent to them 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 direct impacts to the Wildlife Refuge. The I-664 and US 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.

**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. More detailed impacts are provided by alignment segment in **Appendix A**.

#### *Mitigation*

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 include the implementation and maintenance of strict erosion and sediment control measures and stormwater management BMPs 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.

### 3.8.3.2 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 US 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.

### *Methodology*

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.

### *Affected Environment*

There are 13 waterbird colonies within a two-mile radius of the Study Area Corridors; however, only two colonies are located within the Study Area Corridors. One colony is a component of the HRBT Conservation Site and, and the other is a component of the Craney Island Conservation Site.

All of the natural heritage resources of concern found at the HRBT Island Conservation Site are 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, its proximity to disturbances from cars, boats, and airplanes is constantly present. Constant shipping traffic as well as coastal storms could also present disturbances.

One of the natural heritage resources of concern found at the Craney Island Conservation Site is the Least tern (*Sterna antillarum*), a colonial waterbird. 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 on 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).

### *Environmental Consequences*

The **No-Build Alternative** would not result in any project-related construction and would therefore not directly impact colonial waterbirds.

All of the **Build Alternatives** have the potential to impact one or both of the waterbird colonies located in the study corridors. The colonies potentially impacted by construction of the Build Alternatives are shown in **Table 3-42. Alternatives A, B,** and **D** would impact the HRBT Conservation Site (I-64) and Alternatives B, **C**, and D would impact the Craney Island Conservation Site (VA 164 Connector).

**Table 3-42: Potential Waterbird Colony Impacts**

| Colonies | Alternative A | Alternative B | Alternative C | Alternative D |
|---|---|---|---|---|
| HRBT Conservation Site | x | x | | x |
| Craney Island Conservation Site | | x | x | x |

Any construction activity on the HRBT islands 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. That being said, the alternatives that will pass over/adjacent to Craney Island will introduce far greater noise and general disturbance, such as from trash and roadway debris, than is currently experienced. At the Craney Island Conservation Site colony locations vary from year to year and can be dependent upon where active dredge disposal is occurring. It is difficult to predict the potential effects to waterbird colonies at this site. The birds would be expected to avoid areas of active construction, which would be immediately adjacent to or over the eastern edge of the island, and they may or may not return to the island following construction. 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 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.

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.

#### *Mitigation*

Close coordination with the VDCR, VDGIF, and USACE will be required to minimize impacts to waterbird colonies to the maximum extent practicable, as well as the strict adherence to time-of-year restrictions and erosion and sediment control measures. Surveys to locate existing waterbird colonies would be required, in addition to evaluations to shift alignments away from the resource to reduce the impacts of the construction to the colony. While beach disturbance during construction may temporarily or permanently make areas unacceptable for nesting waterbirds, all four Build Alternatives could ultimately augment the existing beach habitat, providing an opportunity for increased suitable nesting habitat along the corridors.

### 3.8.3.3 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.

*Methodology*

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, SAV habitat (crab habitat), and oyster sanctuaries. The data are 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, 2016). 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, 2016). 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).

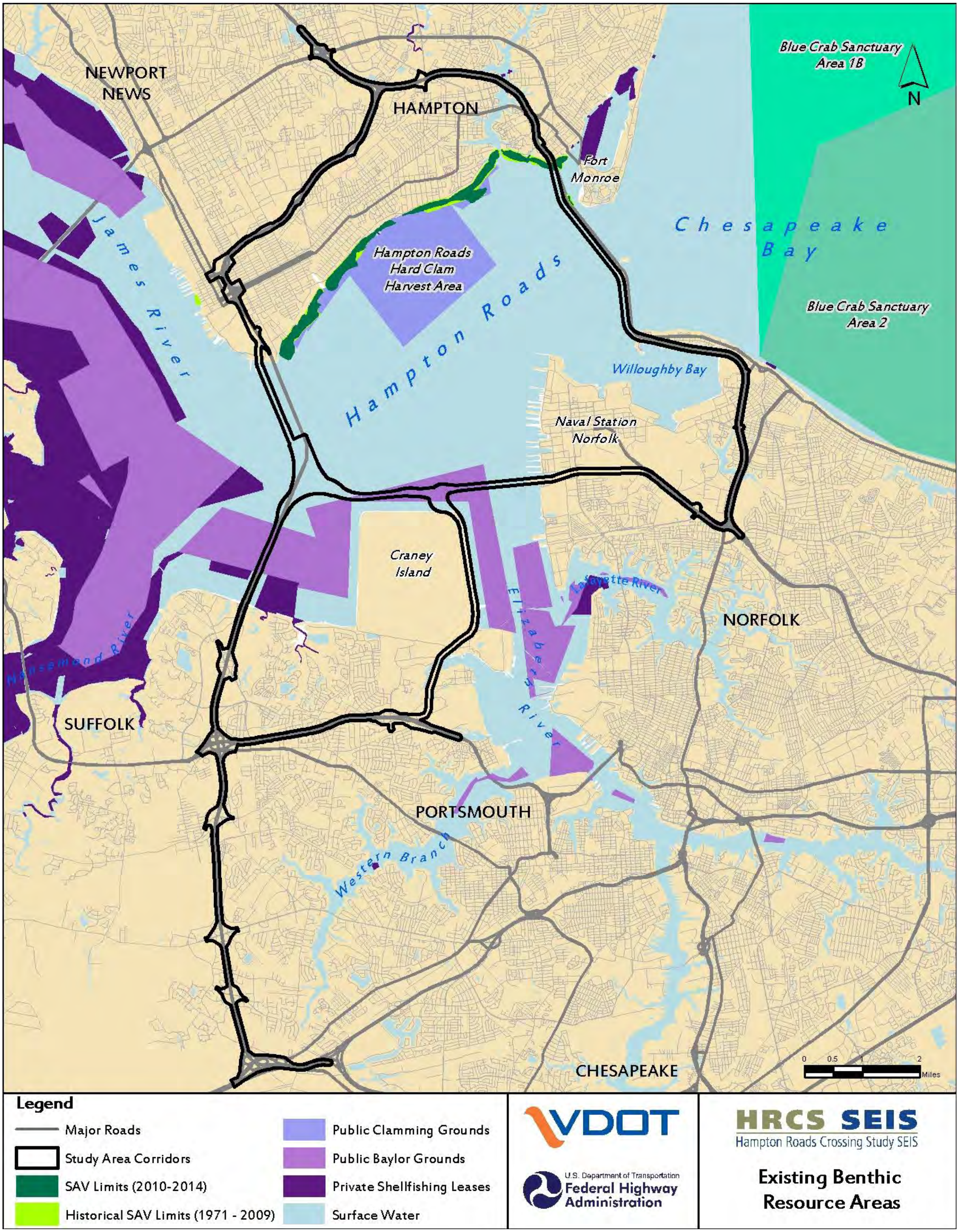
The benthic environment present within the Study Area Corridors was determined by performing a GIS overlay of the Study Area Corridors on top of the GIS data obtained from VIMS, VMRC, NOAA, and VDH. Potential impacts to the hard clam, blue crab, and oyster, were calculated by performing GIS overlays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

*Affected Environment*

Benthics in the vicinity of the Study Area Corridors include commercially important shellfish, such as the hard clam, blue crab, and oysters (**Figure 3-14**). 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 entire over water areas of the Study Area Corridors is considered potential clam habitat because throughout Hampton Roads the bottom is composed of sand, mud, or a combination suitable for clams.

**Figure 3-14: Existing Benthic Resource Areas**



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.

The blue crab is an important part of the trophic web using underwater grass beds or SAV as nursery areas and foraging grounds for feeding. No SAV beds exist within the Study Area Corridor of Alternative C; however, there are approximately five acres of existing SAV beds and five acres of historic beds located within the Study Area Corridor for Alternatives A, B, and D (**Figure 3-14**).

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. 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 3-14**).

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. Harvesting activity is virtually non-existent within the condemnation zone (Wesson, 2016).

Benthic infaunal organisms live in marine and coastal sediments and some are used as indicator species to determine overall sediment and water quality conditions. The most abundant taxa in the vicinity of the Study Area Corridors are opportunistic, early successional stage (Stage I) colonizers of disturbed marine habitats. They can tolerate hypoxic conditions and are frequently found in high abundances in silty, organically-enriched habitats and will rapidly recolonize disturbed areas. Later successional species represented by larger, longer-lived, deeper burrowing, and predatory organisms that cannot tolerate hypoxic sediment conditions are preset but in low abundances, mainly with two or fewer individuals per taxa. These are secondary successional stage species (Stage II) such as bivalves and ampeliscid tube-building amphipods along tertiary, end-stage successional taxa (Stage III). Though 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 an end-stage successional community (Stage III) but will continue to remain in Stage I and Stage II (secondary successional stage) with few Stage III organisms present, characteristic of urban coastal waterways.

More detail on benthic species may be found in the *HRCS Natural Resources Technical Report*.

### *Environmental Consequences*

The **No-Build Alternative** would not result in any project-related construction and would therefore not directly impact benthic species.

All 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. Temporary impacts could result from cofferdams, causeways or temporary roads, work bridges or barges, dredge material dewatering and disposal, and construction staging areas.

Potential impacts within the LOD of each Build Alternative is presented in **Table 3-43**. 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 directly impacted by all alternatives except **Alternative A**, and which would require legislation to convert use prior to permitting construction.

**Table 3-43: Potential Impacts to Benthic Resources (acres)**

| Resource | Alternative A | Alternative B | Alternative C | Alternative D |
|---|---|---|---|---|
| Hard Clam Habitat | 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. 5) VMRC, 2016a.4 Low density oysters may be present; however, no high quality oyster habitat, sanctuary, or reefs are present (CCRM, 2016 and VIMS, 2015).*

### *Mitigation*

Construction BMPs, including conforming to the guidelines contained in the VESCH, would be employed to reduce turbidity and sediment disturbance. Examples may include eliminating overflow from barges during dredging or transport; changing the method of operating the dredge based on changing site conditions such as tides, waves, currents, and wind, reducing the speed of loaded buckets or cutterheads, filtration of discharge water from barges/scows, sheet-pile enclosures, 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. 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 will 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 but would also provide structural habitat for oysters and other marine organisms. Once the tunnel construction is complete, the substrate above it would then be available for benthic organisms to recolonize. The Affected Environment section of this section 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.

#### 3.8.3.4 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).

### *Methodology*

NOAA's online mapping system (EFH Mapper v3.0) 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). The Study Area Corridors for the HRCS lie within four ten by ten longitudinal by ten-minute latitudinal squares. These four squares span an area from approximately five miles west of the I-664 MMMBT to ten miles east of the I-64 HRBT.

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.

### *Affected Environment*

EFH for fourteen species occur within Study Area Corridors including nine fish species, two shark species, and three skate species (**Table 3-44**). The Study Area Corridors contain approximately 1,382 acres of EFH. None of the EFH species are listed as Threatened or Endangered by NOAA Fisheries. Habitat Area of Particular Concern (HAPC) is considered high priority areas for conservation, management, or research because they are rare, sensitive, stressed by development, or important to ecosystem function. One HAPC for the Sandbar Shark is located within the Study Area Corridors that spans across all of the alternatives and comprises the same area as the EFH for all 14 species.

**Table 3-44: 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 |
| 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*) | Larvae, Juveniles, Adults |
| Clearnose skate (*Raja eglanteria*) | Juveniles, Adults |
| Little skate (*Leucoraja erinacea*) | Juveniles, Adults |
| Winter skate (*Leucoraja ocellata*) | Juveniles, Adults |

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

### *Environmental Consequences*

The **No-Build Alternative** would not result in any project-related construction and would therefore not directly impact EFH or HAPC.

All four of the **Build Alternatives** would impact EFH and HAPC. **Alternative A** would impact 138 acres of EFH and HAPC, **Alternative B** would impact 214 acres, **Alternative C** would impact 565 acres, and **Alternative D** would impact 636 acres. 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.

*Mitigation*

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 possible 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.

3.8.3.5 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.

*Methodology*

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.

### *Affected Environment*

The Study Area Corridors intersect the James River (including Hampton Roads) and the Elizabeth River, which are identified as Confirmed Anadromous Fish Use Areas, with six anadromous fish species using these areas to complete their life cycles (**Table 3-45**). 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 3-45: 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)<br>Elizabeth River (C20) |

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

### *Environmental Consequences*

The **No-Build Alternative** would not result in any project-related construction and would therefore not directly impact anadromous fish.

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. Permanent filling for cofferdams, piers or pilings, and causeways could also disrupt these food sources. **Alternative A** would impact 138 acres, **Alternative B** would impact 214 acres, **Alternative C** would impact 5465 acres, and **Alternative D** would impact 636 acres of Potential Anadromous Fish Use Areas. More detailed impacts are provided by alignment segment in **Appendix A**.

### *Mitigation*

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 3-10** and **Table 3-29**): 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. 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. 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.

#### 3.8.3.6 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 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. 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).

##### *Methodology*

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 annually documenting the extent of SAV beds. VIMS also maintains an on-line interactive mapper and GIS data that depict SAV beds in the Chesapeake Bay region dating back to 1971, that were 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.

##### *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). 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. According to mapping provided by VIMS, there are approximately five acres of existing SAV beds and five acres of historic beds located within the Study Area Corridors (**Figure 3-14**).

*Environmental Consequences*

The **No-Build Alternative** would not result in any project-related construction and would therefore not directly impact SAV.

**Alternatives A, B and D** would each impact 2 acres of SAV. **Alternative C** would not impact SAV, because beds within the LOD only occur along the north shore of Hampton Roads in the vicinity of I-64. Permanent loss of SAV would be limited to the footprint of the bridge piers and approaches, and potentially the area beneath the bridge. Adjacent areas could be directly 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.

*Mitigation*

Implementation of strict erosion and sediment control measures in compliance with VESCH, to include the use of cofferdams, turbidity curtains, silt fence, storm drain inlet protection, diversion dikes, and temporary and permanent seeding would 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. 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.

3.8.3.7 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, control, and eradicate invasive species.

### *Methodology*

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.

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 are presented through a discussion of construction and seeding practices that could encourage their spread or establishment.

### *Affected Environment*

The following highly invasive plant 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

### *Environmental Consequences*

The **No-Build Alternative** would not result in any project-related construction and would therefore not directly impact invasive species. Invasive species would continue to grow, spread, and be treated using current roadside management strategies.

The **Build Alternatives** could increase the spread of invasive species, particularly those known to exist in the Study Area Corridors. While most of the area within the LOD is comprised of open water and impervious surface, or is previously disturbed by a myriad of development activities, the disturbance of remaining natural areas and removal and transfer of fill from borrow sites could spread invasive species. **Alternative A** would have the least potential impact from spread of invasive species since it is a highly-developed corridor with few tracts of native vegetation that could be threatened. Improvements under **Alternative B** have the potential to increase invasive plant species establishment at CIDMMA. **Alternative C** would have similar impacts to CIDMMA as Alternative B, and would involve construction in the lesser-developed areas of Suffolk and Chesapeake creating opportunity for establishment of invasive species in those areas. **Alternative D** has the greatest potential to affect the spread of invasive species, given that it covers the largest area of potential ground disturbance for construction and other offsite activities.

*Mitigation*

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 reuired 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, BMPs would be followed, including conforming to the guidelines contained in the Virginia Erosion and Sediment Control Handbook. These BMPs 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.

### 3.8.4 Threatened and Endangered Species

*Regulatory Context & Methodology*

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:
    - Update the database searches to list current species;
    - Perform Informal consultation with the UFWS to determine if the species or critical habitat is potentially present;
    - Conduct habitat assessments for any new species and update habitat assessments for the species they've been previously conducted;
    - Determine what effect the project may have on the species or its habitat;

- o Conduct presence/absence surveys if necessary; and
- o Prepare the Biological Assessments for any species to support Section 7 formal consultation, if necessary.

The regulatory context and methodologies employed for analysis of threatened and endangered species in the Study Area Corridors is summarized in **Table 3-46**. More detail is provided in the *HRCS Natural Resources Technical Report*.

**Table 3-46: Threatened and Endangered Species Regulatory Context and Methodology**

| Resource | Regulatory Context | Methodology |
|---|---|---|
| Threatened and Endangered Species | • Endangered Species Act<br>• Virginia Department of Agriculture and Consumer Services<br>• Memorandum of Agreement between VDCR & VDACS | • Habitat Assessment<br>• GIS overlays |

As a result of agency coordination, **Table 3-47** 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. Agency coordination is provided in **Appendix D**. 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.

**Table 3-47: Threatened and Endangered Species Mapped within the Vicinity of Study Area Corridors**

| Species | Status |
|---|---|
| Piping Plover (*Charadrius melodus*) | FT/ST |
| Wilson's Plover (*Charadrius melodus*) | SE |
| Gull-billed Tern (*Sterna nilotica*) | ST |
| Red Knot (*Calidris canutus rufa*) | FT |
| Peregrine Falcon (*Falco peregrinus*) | ST |
| Northern Long-eared Bat (*Myotis septentrionalis*) | FT |
| Mabee's Salamander (*Ambystoma mabeei*) | ST |
| Canebrake Rattlesnake (*Crotalus horridus*) | SE |
| Atlantic Sturgeon (*Acipenser oxyrinchus*)* | FE/SE |
| Kemp's Ridley Sea Turtle (*Lepidochelys kempii*)* | FE/SE |
| Leatherback Sea Turtle (*Dermochelys coriacea*)* | FE/SE |
| Loggerhead Sea Turtle (*Caretta caretta*)* | FT/ST |
| Green Sea Turtle (*Chelonia mydas*)* | FT/ST |
| Little Brown Bat (*Myotis lucifigus lucifigus*) | SE** |
| Tri-colored Bat (*Perimyotis subflavus*) | SE** |

*Notes: *No habitat assessment performed. **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.*

### *Affected Environment*

Potential habitat was verified within the Study Area Corridors for all of the terrestrial Threatened and Endangered Species mapped within the vicinity (**Table 3-48**).

**Table 3-48: Terrestrial Threatened and Endangered Species Habitat within Study Area Corridors (acres)**

| Species | Alternative A | Alternative B | Alternative C | Alternative D |
|---|---|---|---|---|
| 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 | <1 | <1 |
| Bats (NLEB, Little Brown Bat, Tri-colored Bat) | 8 | 115 | 174 | 191 |
| **Total** | **10** | **250** | **407** | **426** |

Shorebirds

Habitat is present for the Gull-billed tern, Piping plover, Red knot, and Wilson's plover within the Study Area Corridors. 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*). Potential breeding habitat for the shorebirds was limited to known areas for current or historic nesting, at the HRBT Island (Gull-billed tern) and CIDMMA (Piping plover) within the Study Area Corridors.

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 VA 164. The majority of the habitat is located along I-664 south of the MMMBT and extends south to the interchange with Military Highway. Suitable habitat can generally be characterized as forested mineral flats and other hardwoods/palustrine wetland areas, 100 acres or greater.

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 VA 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.

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 the Study Area Corridors. Smaller fragmented areas of forest and individual trees may provide suitable roosting habitat, but in general would be considered suboptimal habitat. Forested areas, easements, road edges, and waterways can provide corridors for movement between habitat areas. Trees with suitable sized cavities, buildings and bridges may provide suitable habitat for maternity roosts.

*Environmental Consequences*

The **No-Build Alternative** would not result in any project-related construction and would therefore not directly impact any threatened and endangered species.

The **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. 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 3-49.**

**Table 3-49: Terrestrial Threatened and Endangered Species Habitat within the LOD (acres)**

| Species | Alternative A | Alternative B | Alternative C | Alternative D |
|---|---|---|---|---|
| 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 |
| **Total** | **1** | **112** | **164** | **154** |

**Alternative A** 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. It is anticipated that the majority of these estuarine areas will be bridged; therefore, the proposed activities would have minimal impact on the foraging habitat that is present. Due to the presence of higher quality foraging habitat within the vicinity of Alternative A, disruption during construction activities should 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. No habitat for the Canebrake rattlesnake, or Mabee's salamander is present within Alternative A and therefore it should have no effect on these species. In addition, there are no records of Peregrine falcons utilizing the Study Area Corridor of Alternative A for breeding, therefore construction activities should have no effect on the species (Watts, 2015; Watts, 2016).

**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 includes improvements to the eastern 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 no longer be suitable for nesting Piping plovers due to the presence of predators and human disturbance. However, future surveys may be required to determine 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. Construction activities should not disrupt foraging on CIDMMA due to the availability of suitable habitat west of the disturbance and would not likely induce an increase in the frequency of human activity and disturbance. 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 as described for the Piping plover. Potential effects to additional areas of foraging habitat along Alternative B would be 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 greater than 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 less than 100 acres, which is considered by biologists to be the minimal threshold for suitable Canebrake rattlesnake habitat. The highway would limit resident snake access to forested habitat, and could result in increased mortality of 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.

**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 additional 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 an impact to the aquatic habitat (pond) west of I-664. The VDGIF recommends maintaining undisturbed natural vegetated buffers at least 300m 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 current forested buffers 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, but there would be no direct impacts to the Wildlife Refuge. The I-664 and US 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.

**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 from the transit lanes along the I-564 Connector.

#### *Mitigation*

In order to reduce potential impacts to threatened and endangered species and their habitat, efforts to minimize the construction footprint can be considered. Construction practices would minimize the removal of existing vegetation and include the implementation of BMPs for erosion and sediment control as well as stormwater management to reduce potential impacts to adjacent habitats and properties. 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.

Prior to construction of a Build 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 appropriate. If presence of any species is confirmed the agencies may recommend a time of year restriction (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 3-50**.

**Table 3-50: 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 | *15 Apr – 15 Sep for tree removal activities. |
| Sea Turtles** | 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. *TOYR for avoidance of incidental take in summer roosting habitat. Source – USFWS IPaC Online Project Review Step 7b - Northern long-eared bats in Virginia. **July 2000 Biological Assessment, October 2000 NMFS letter, and March 2001 FEIS concluded not likely to adversely affect if TOYR is followed.*