3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

Substantive edits that have been made to this Final SEIS since the publication of the Draft SEIS are indicated with underlined text.

This chapter presents the existing environmental conditions (affected environment) of the resources in the Study Area Corridors and potential impacts (environmental consequences) of the No-Build and Build Alternatives. The discussion in this chapter is limited to the data, information, and issues that would have a bearing on possible impacts and mitigation measures and on the identification of a preferred alternative. The human and natural environmental resources were first identified to analyze how the proposed alternatives could potentially affect the environment. Issues were identified from input received from the agencies and the public through the scoping process, review of aerial photos and other mapping, desktop research, and field reconnaissance. Potential impacts of the alternatives are provided under each resource heading. Possible mitigation measures for unavoidable adverse impacts are introduced, where applicable.

The Study Area Corridors for detailed evaluation are generally defined as 250 feet on either side of the centerline of I-64, I-564, I-664, VA 164 and proposed new alignments (**Figure 3-1**). Areas around the interchanges included in the Study Area Corridors vary based on the footprint of proposed modifications. For example, where proposed modifications would mainly consist of tying into existing ramps, the footprint of the interchange is smaller; therefore, the area surrounding the interchange included for study is smaller. The area included for study is larger around the footprints of more extensively modified or newly proposed interchanges. For the purposes of this Final SEIS, the existing conditions information provided under "Affected Environment" for each resource in the Draft SEIS has not changed because the Study Area Corridor for the Preferred Alternative is the same as Alternative A. However, for this Final SEIS an Inventory Corridor was developed along the length of the existing HRBT and approaches, extending from the eastern edge of the existing bridge-tunnels to 30 feet beyond the western edge of the proposed bridge-tunnel for the Preferred Alternative. During final design and construction the improvements would fit within the limits of the Inventory Corridor, allowing for flexibility in design to avoid permanent impacts to Hampton University property (see **Section 2.7** for more information). The Inventory Corridor is shown on Figures 4-6 in **Appendix B**. **Table 3-1** provides the results of the inventory of resources within the Inventory Corridor.

Table 3-1: Inventory Corridor Summary

Resource	Inventory Corridor
Total Acres	277.6
Section 4(f) Properties *Battle of Hampton Roads* *Battle of Sewell's Point*	 *267.1* *217.1*
Stream Impacts (Linear feet)	0.0
Navigable Waters (acres) *Hampton Roads*	*240.4*
Maintained Navigable Channels (acres) *Norfolk Harbor Entrance Reach*	*18.1*
Wetlands (Less open water)	0.0

Resource	Inventory Corridor
Wetlands (acres) *E1UB (open water)*	*240.4*
Shallow Water Area (acres)	50.0
Resource Protection Areas (acres)	0.1
Floodplains (acres) *James River/Hampton Roads* *Willoughby Bay*	179.2 *178.7* *0.5*
Aquatic Habitat (acres, Hampton Roads)	239.9
Benthic Communities (acres) *Oyster Habitat* *Clam Habitat* *Baylor Habitat*	 *0.0* *240.9* *0.0*
Essential Fish Habitat, Habitat Areas of Particular Concern, and Anadromous Fish Use Areas (acres)	260.6
Threatened and Endangered Species Habitat (acres)	0.0
Submerged Aquatic Vegetation (acres) *Existing SAV (acres)* *Historic SAV (acres)*	 *0.2* *0.2*
Impaired Waters (acres)	274.1
Water Bird Nests (acres)	81.8
Blue Crab Habitat (acres)	0
Historic Architecture Resources	2
Known Archaeological Resources (number of sites)	0

Potential impacts have been calculated using the limit of disturbance (LOD) for the proposed alternatives. The LOD was developed using the proposed pavement width of the mainline alternatives and the selected roadside design option (open section, guardrail section, retaining wall, or sound wall) based on the existing roadside conditions and constraints. The LOD is conservative and throughout the majority of the proposed widening accounts for an additional 30 feet beyond the improvements to accommodate drainage, utilities, erosion and sediment control, and construction easements. Should a managed lane strategy be selected, the final design would accommodate additional roadway elements related to the specific strategy, such as a four-foot wide buffer between the general purpose and managed lanes and lane entrances and exits. The four-foot wide buffer can be accommodated in the LOD assumed in this Final SEIS; however, future design decisions related to a managed lane concept could modify the roadway typical section and/or result in minor shifts to the LOD.

Stormwater management facilities have not been included within the LOD to determine the associated environmental impacts or the specific parcels that would be impacted. Additional signage and maintenance of traffic activities are anticipated to occur beyond the study area LOD.

Noise barrier activities are anticipated to occur beyond the study area LOD and were not included in the calculation of right-of-way and environmental impacts. The noise analysis contained in this SEIS was conducted in accordance with 23 CFR 772 using planning level design data. Final design traffic data would inform more detailed noise analyses during the final design and permitting phases of the study, after the issuance of the ROD. Final noise analysis would dictate the final selection and placement of noise barriers

that may fall outside the NEPA LOD. During final design, noise barriers may not be included beyond of the area of proposed roadway improvements.

More detailed information on the LOD and the roadside design options are included in the *HRCS Alternatives Technical Report*. Potential impacts were calculated using the LOD and are provided by alternative in this chapter. More detailed impacts are provided by alignment segment in **Appendix A**. Recommendations for potential minimization and mitigation measures for unavoidable adverse impacts are provided for each resource.

VDOT is committed to avoiding permanent impacts at Hampton University. Since publication of the Draft SEIS, modifications to the design have shifted the LOD off Hampton University property and widened the LOD over Hampton Roads to accommodate reconstruction of the HRBT northern approach bridges.

This NEPA study evaluated a range of reasonable alternatives and presents the worst-case impact for the area within the determined LOD. The impacts provided in the SEIS are preliminary estimates based on the current planning-level engineering which is appropriate for the NEPA analysis. Final impacts would be determined during the final design and permitting process, after a ROD is issued. For example, as described in **Section 3.8.1**, the FHWA, US Army Corps of Engineers (USACE), US Environmental Protection Agency (EPA), and VDOT agreed to use aerial photo-interpretation to evaluate and quantify preliminary wetland impacts for this SEIS. Final wetland impacts would be determined based on the Jurisdictional Determination, post NEPA.

Impacts are calculated based on environmental conditions as they exist at the time of this study. Separate projects within the HRCS Study Area Corridors (such as the I-564 Intermodal Connector) that are not yet complete or open to traffic are not considered part of the existing environment. Therefore, impacts quantified in this chapter do not take into account the impacts from these separate projects.

Additional detail, data, and information may be found in the following HRCS technical reports and memoranda:

- *Air Quality Technical Report*
- *Archaeological Assessment*
- *Architectural Survey: Management Summary*
- *Hazardous Materials Technical Memorandum*
- *Indirect and Cumulative Effects Technical Report*
- *Natural Resources Technical Report*
- *Noise Analysis Technical Report*
- *Right-of-Way and Relocation Technical Memorandum*
- *Socioeconomic and Land Use Technical Report*
- *Traffic and Transportation Technical Report*
- *Virginia Institute of Marine Science Technical Report*
- *Visual Resources Technical Memorandum*

Figure 3-1: Study Area Corridors

3.1 LAND USE

Methodology

Existing and potential future land uses within the Study Area Corridors were identified to provide a baseline for analysis of the potential impacts of the alternatives. The most recent available regional land use data compiled by the Hampton Roads Transportation Planning Organization (HRTPO) in 2011 is used in this analysis (HRTPO, 2011). Information on land use was also gathered from local comprehensive and land use plans, aerial photos, input from local and regional planning officials, and field reconnaissance. Area within the existing VDOT right-of-way in the vicinity of NAVSTA Norfolk is currently classified as military use; however, field reconnaissance has determined this land is used for the I-64 right-of-way.

Affected Environment

Hampton Roads is, for the most part, comprised of highly developed, well-established communities and commercial and industrial areas. The comprehensive plans of the six cities traversed by the Study Area Corridors indicate the cities of Hampton, Newport News, Norfolk, and Portsmouth are largely built-out, while the cities of Chesapeake and Suffolk have more undeveloped land. Regardless of the locality, the land in the Study Area Corridors is mostly developed.

As shown in **Table 3-2** and **Figures 3-2a through 3-2f**, current land use in the Study Area Corridors is primarily mixed-use, followed by open space, institutional, industrial, military, residential, and commercial. Transportation facilities are included in the institutional land use category and since this study focuses on highway corridors, the predominance of institutional land use is expected. Land use in the Study Area Corridors is likely more industrial and commercial than the Hampton Roads region as a whole, due to development located near key transportation access nodes (i.e., interstate interchanges) that provide for the efficient movement of goods, and easier access to services by the traveling public.

Table 3-2: Study Area Corridors Land Use (2011)

Land Use Class	Acres	Percent
Residential	160.3	7%
Commercial	68.6	3%
Mixed-Use	1,183.6	50%
Industrial	215.5	9%
Institutional	265.7	11%
Military	180.0	8%
Open Space	292.0	12%

Source: HRTPO (2011).

Environmental Consequences

The **No-Build Alternative** would not result in any project-related construction and would therefore not directly require any right-of-way acquisition. This alternative requires no land use conversion and would have no direct impact on land use. It is assumed that any locality-approved projects and land uses would continue to develop, as planned.

Figure 3-2a: Land Use in the Study Area Corridors

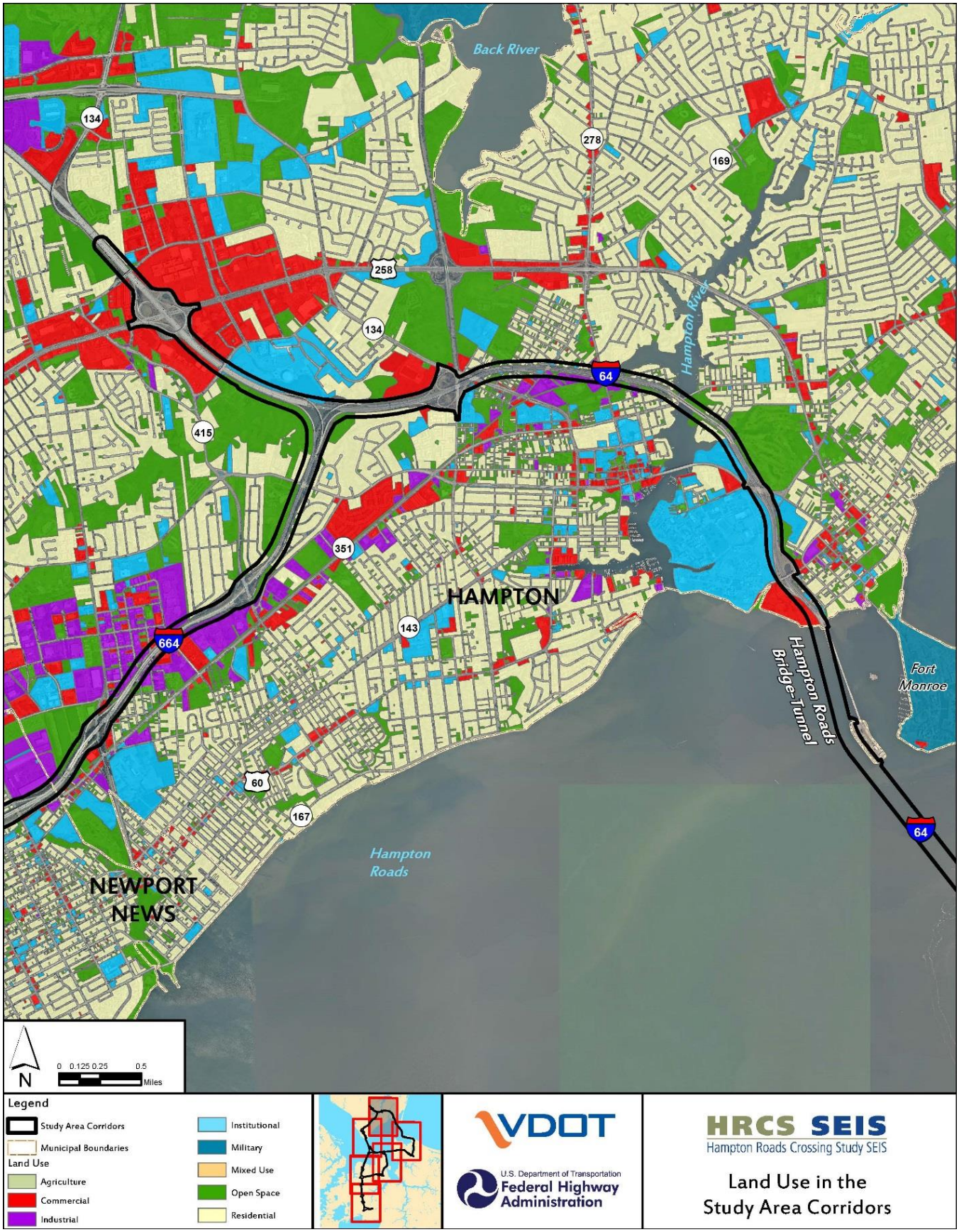


Figure 3-2b: Land Use in the Study Area Corridors

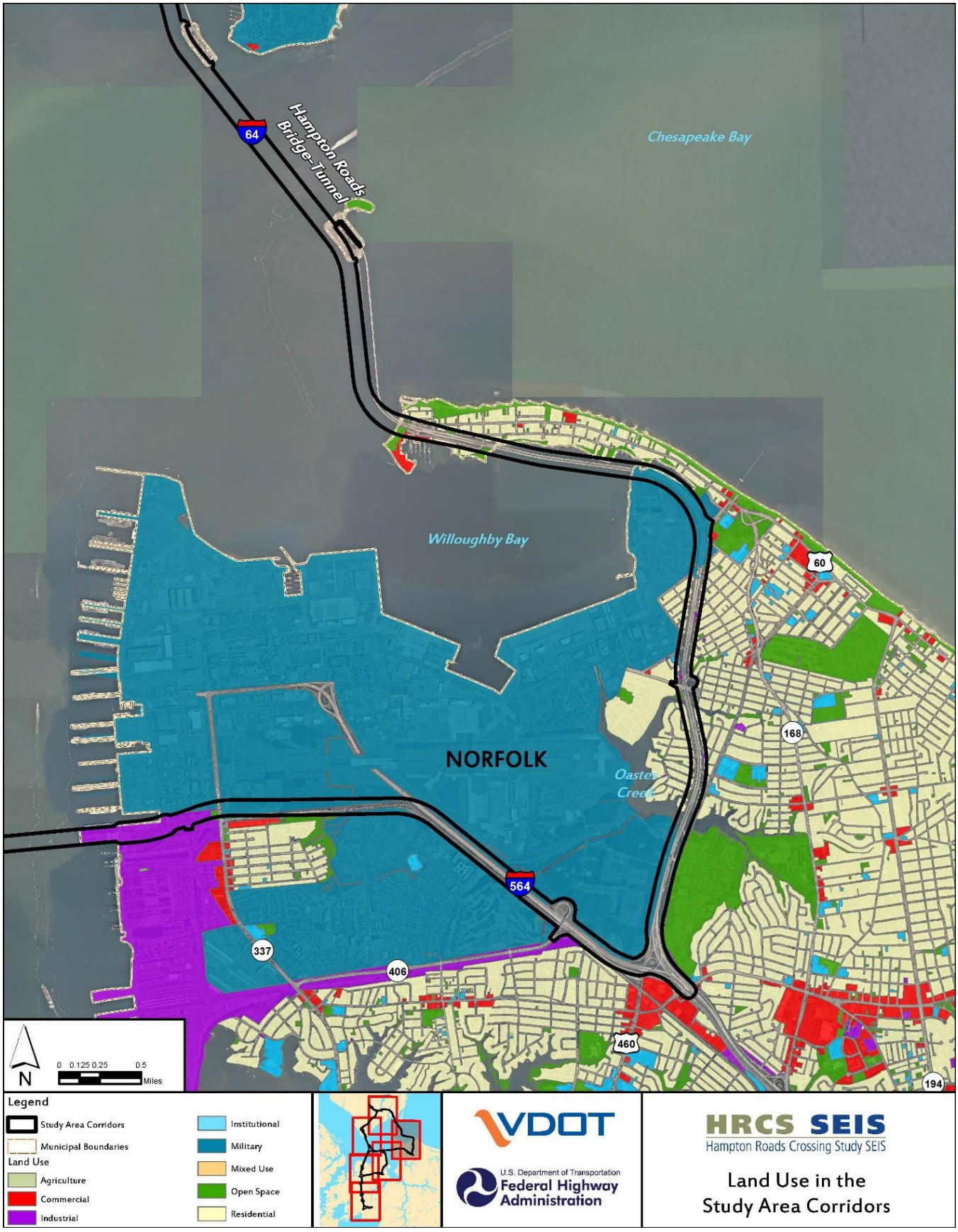


Figure 3-2c: Land Use in the Study Area Corridors

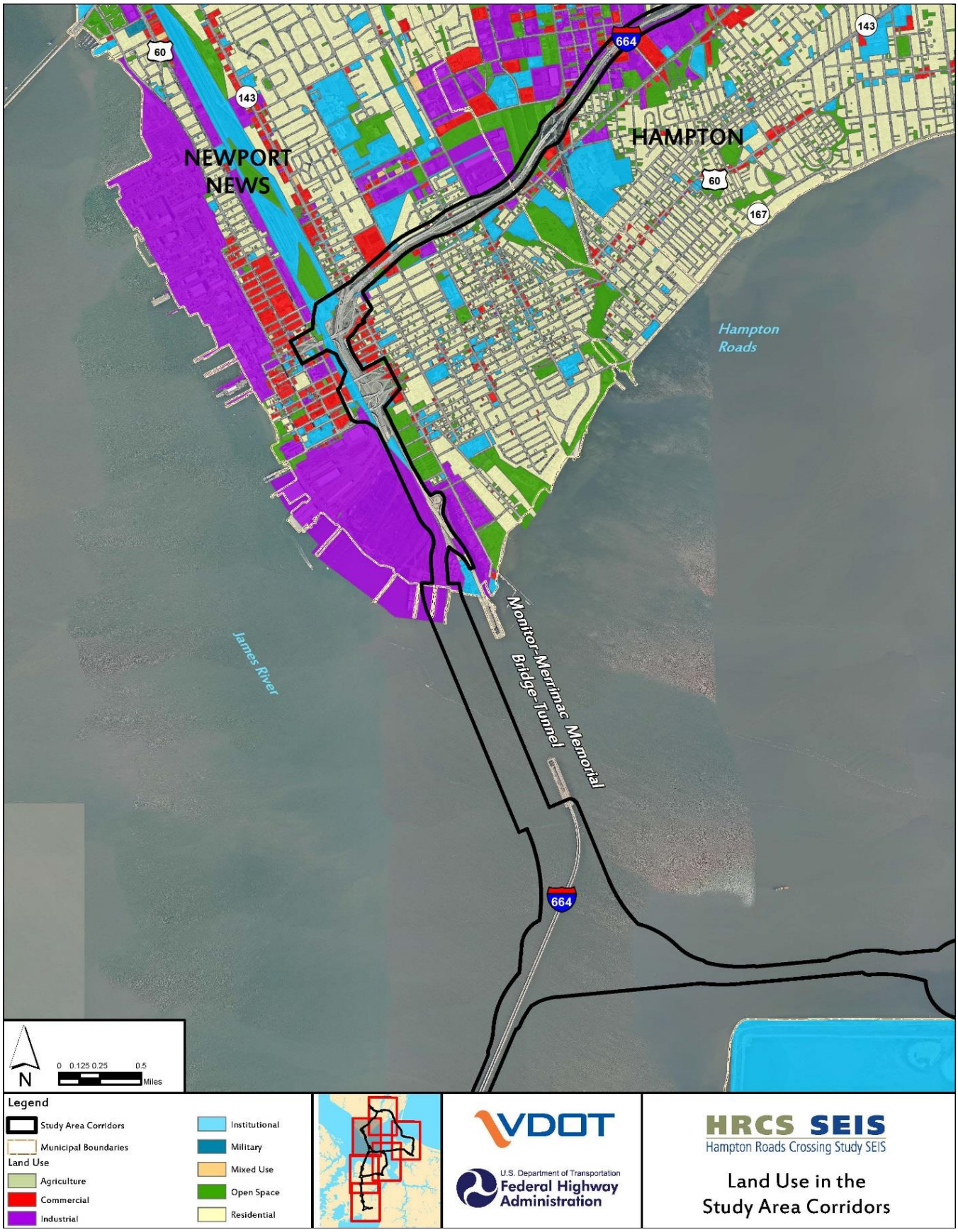
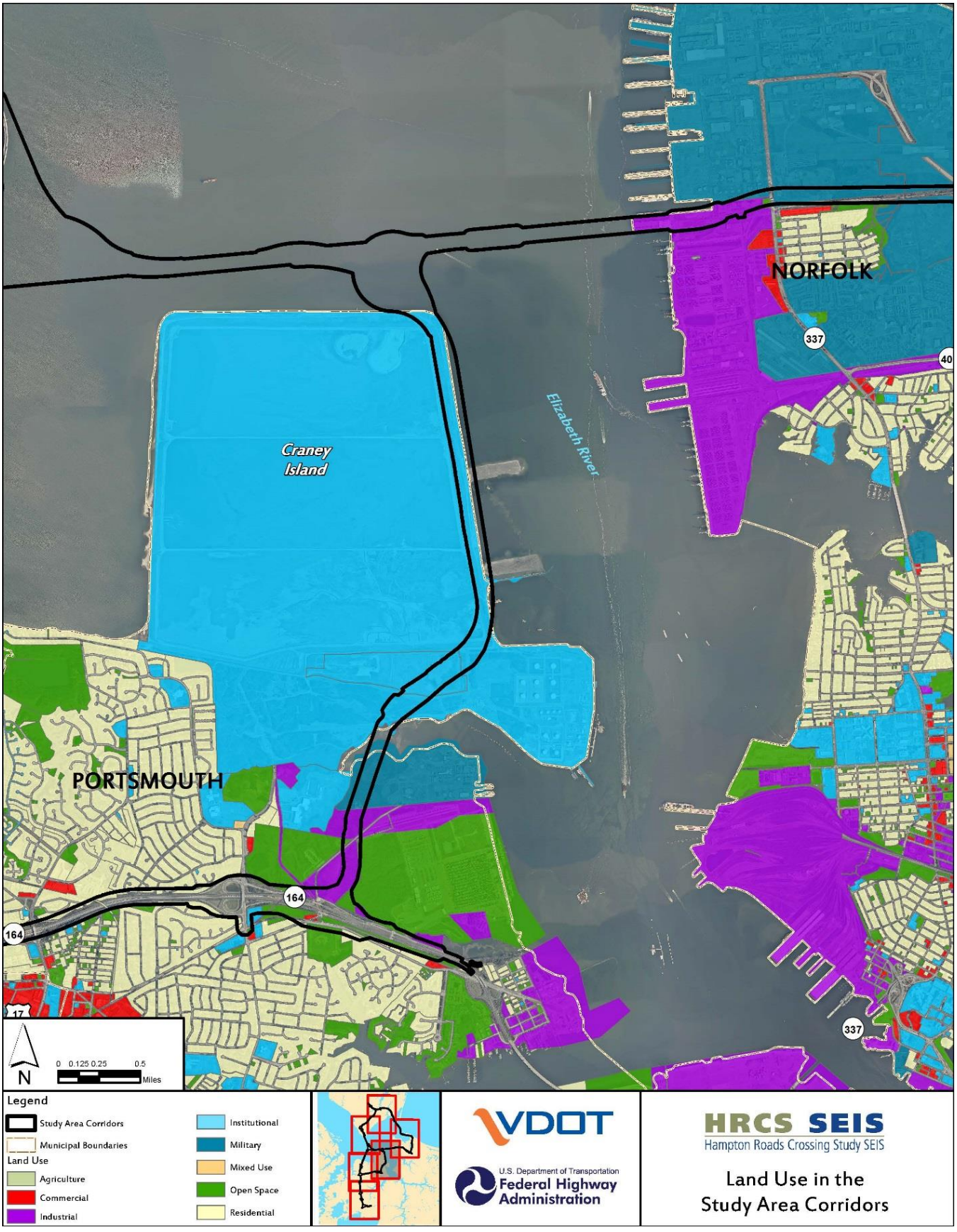


Figure 3-2d: Land Use in the Study Area Corridors

Figure 3-2e: Land Use in the Study Area Corridors

Figure 3-2f: Land Use in the Study Area Corridors



The **Build Alternatives** would each impact many different types of land use (**Table 3-2**). The conversion of land from its present use to transportation use would be a direct impact of construction of the Build Alternatives. Under **Alternative A**, the conversion of land use would be an expansion of adjacent transportation land use, as the improvements primarily expand existing roadways. Alternative A would require the conversion of 27.8 acres of land, the majority of which is designated as military land; however, much of this area is already in a transportation use (see **Figure 3-2b**). Most of the land use conversions under **Alternatives B, C, and D** would occur where new roadway would be constructed (along the eastern side of Craney Island Dredged Material Management (CIDMMA) connecting to VA 164). The remainder of the land use conversion consists of sliver takes along existing roadways and interchanges. **Alternative B** would require the conversion of 260.4 acres of land, the majority of which is institutional. **Alternative C** would require the conversion of 333.0 acres of land, the majority of which is industrial. **Alternative D** would require the conversion of 335.9 acres of land, the majority of which is institutional.

The **Preferred Alternative** would require the conversion of 3.3 acres of land, the majority of which is institutional (VDOT-owned land east of I-64 in Hampton). Since publication of the Draft SEIS, more detailed research has been conducted to refine the existing right-of-way files using as-built plans. The property boundaries between the interstate and US Navy properties, however, are too complex to be delineated at this planning level and require land survey that is to be completed following the publication of this Final SEIS. Through this effort, and coordination with the US Navy, VDOT is committed to avoiding permanent impacts to the US Navy properties under the Preferred Alternative. This updated information is reflected in **Table 3-3**. Note that the military land use shown on **Figure 3-2b** does not reflect this refined land use and right-of-way information. See **Section 3.2.1** and for more detailed information.

Table 3-3: Land Use Conversion by Build Alternative (acres)

Land Use Class	Alternative A	Alternative B	Alternative C	Alternative D	Preferred Alternative
Residential	0.5	0.6	2.6	2.7	0.5
Commercial	1.8	3.1	6.3	7.5	<0.1
Mixed Use	0	0	0	0	0
Industrial	0.7	72.1	119.9	112.1	0.7
Institutional	2.8	113.3	117.4	119.8	1.1
Military	20.8	47.4	40.4	47.4	0
Open Space	1.2	23.9	46.4	46.4	0.9
TOTAL	**27.8**	**260.4**	**333.0**	**335.9**	**3.3**

Note: Land use coverage does not include water.

Mitigation

No adverse impacts to land use are anticipated; therefore, no mitigation is suggested.

3.2 SOCIOECONOMICS

3.2.1 Communities, Community Facilities, and Military Facilities

Methodology

Data on communities, community facilities, and military facilities was gathered using multiple sources. GIS data was compiled using: the VDOT Comprehensive Environmental Data and Reporting System (CEDAR) database (which is continually updated); data from Chesapeake, Hampton, Newport News, Norfolk, Portsmouth, and Suffolk (2015 and 2016); and information from previous studies including the 2001 HRCS FEIS and ROD; the 2012 HRBT Draft EIS; and the 2003, 2011, and 2013 Re-evaluations of the 2001 FEIS. Online mapping tools were used, where possible, to verify community facilities such as parks and recreation areas. Published planning documents were used to define neighborhood and community boundaries. Finally, the features and facilities were verified in the field, where possible.

Communities, community facilities, and military facilities within the Study Area Corridors are identified in this section, and the potential impacts of the alternatives are assessed. Community facilities include cemeteries, medical facilities, police stations, religious institutions, schools/universities, and park or recreation areas that are open to the public. Potential effects are quantified in terms of the number of potential community facility displacements and qualitatively assessed based on changes to access or use.

Affected Environment

Communities

The Study Area Corridors span six cities on either side of Hampton Roads including: Chesapeake; Hampton; Newport News; Norfolk; Portsmouth; and Suffolk. Chesapeake is in a historically rural and agricultural area that experienced a large population boom at the turn of the century, and continues to be one of the fastest growing cities in the Hampton Roads region.

Hampton is located at the southern tip of the Peninsula and is divided into several planning districts, within which smaller communities and neighborhoods are located. Three large districts (Coliseum Central, Downtown, and Phoebus) and several smaller neighborhoods fall within the limits of the I-64 and I-664 Study Area Corridors.

Similar to Hampton, Newport News is located at the tip of the Peninsula and is divided into different planning districts. Newport News and is largely urban and industrial, with the exception of portions of the Southeast Community, which is largely residential.

Norfolk is characterized by its many distinct communities and neighborhoods as there are more than 125 active neighborhood civic leagues. Norfolk has a strong military presence and is home to the world's largest naval base, Naval Station Norfolk (NAVSTA Norfolk).

Portsmouth is an older, largely built-out city with established neighborhoods and a mature housing stock. The Study Area Corridor within the City's boundaries is limited to properties surrounding VA 164, also known as the "Western Freeway," and the area around CIDMMA and the Virginia International Gateway (VIG) Terminals.

Like Chesapeake, Suffolk is historically a rural and agricultural city that has experienced rapid suburban growth over the past fifty years due to a burgeoning population, greater accessibility, and suburban

sprawl. Suffolk is still a predominantly rural area with two major centers of development: the historic downtown core located in central Suffolk and the more recently developed northern core.

Community Facilities

Locations of community facilities discussed in this section are listed in **Table 3-4**. These community resources provide services to communities and neighborhoods in and around the Study Area Corridors. A total of 42 community facilities are located in the Study Area Corridors. The majority are either religious facilities or schools/universities. There are no libraries, fire stations, or post offices within the Study Area Corridors.

Table 3-4: Community Facilities in the Study Area Corridors

Facility	Address	Locality
Cemeteries		
Hampton National Cemetery Phoebus Addition	West County Street	Hampton
Forest Lawn Cemetery	8100 Granby Street	Norfolk
Pentecostal Holiness Church Cemetery	6000 Arthur Avenue	Portsmouth
New Hope Baptist Church Cemetery	5000 Pughsville Road	Chesapeake
Medical Facilities		
Hampton Veterans Affairs Medical Center	100 Emancipation Drive	Hampton
Police Stations		
Chesapeake 4th Precinct – Western Branch	4764 Station House Road	Chesapeake
Newport News South Precinct	3303 Jefferson Ave	Newport News
Religious Facilities		
Kingdom Hall Jehovah's Witness	804 41st Street	Newport News
Alpha and Omega Christian Worship Center	1110 39th Street	Newport News
House of Judah Deliverance Center	3806 Roanoke Avenue	Newport News
Zion Baptist Church	125 West County Street	Hampton
First View Baptist Church	9124 1st View Street	Norfolk
Wesley Memorial United Methodist Church	288 East Little Creek Road	Norfolk
Churchland North Baptist Church	6201 Centenary Drive	Portsmouth
Pentecostal Holiness Church	6000 Arthur Avenue	Portsmouth
The Village Church of Portsmouth	3697 Pepperwood Court	Portsmouth
Alexander Baptist Church	4316 Pamela Court	Chesapeake
Living Waters Christian Fellowship Church	2700 Gum Road	Chesapeake
Believer's Church	4500 Peek Trail	Chesapeake
Schools/Universities		
Hampton High School	1491 West Queen Street	Hampton
Hampton University	100 East Queen Street	Hampton
Willoughby Elementary	9500 4th View Street	Norfolk
Old Dominion University Tri-Cities Higher Education Center	1070 University Boulevard	Portsmouth
Jolliff Middle School	1021 Jolliff Road	Chesapeake
Believer's Day School	4500 Peek Trail	Chesapeake
Old Dominion University Virginia Modeling, Analysis, and Simulation Center	1030 University Boulevard	Suffolk

Facility	Address	Locality
Booker T. Washington Middle School	3700 Chestnut Avenue	Newport News
Parks		
Riverwalk Street Park	River Street Park	Hampton
Park Place Playground	50th Street	Hampton
Fort Wool	I-64 HRBT	Hampton
Captains Quarters Nature Center and Park	800 Little Bay Avenue	Norfolk
Ebony Heights Park	Tyre Neck Road and Fawkes Street	Portsmouth
Recreation		
Hampton Coliseum	1000 Coliseum Drive	Hampton
Bluebird Gap Farm	60 Pine Chapel Road	Hampton
Y.H. Thomas Community Center	1300 Thomas St.	Hampton
The Woodlands Golf Course	9 Woodland Road	Hampton
Willoughby Boat Ramp	1275 Bayville Street	Norfolk
Naval Station Norfolk Baseball Fields	Patrol Road across from Forest Lawn Cemetery	Norfolk
Naval Station Norfolk Baseball Field	Patrol Road just west of I-64/I-564 interchange	Norfolk
Naval Station Norfolk Sewell's Point Golf Course	660 Ruthven Road	Norfolk
Captain Slade Cutter Athletic Park	100 Elementary Drive	Norfolk

Bike Facilities and Recreational Trails

Bike lanes (designated lanes for bicycles), sharrow lanes (roadways marked with street paint where bikes should preferably cycle when sharing a street), bike routes (recommended routes for the safest cycling from point A to point B), and bike and multi-use recreational trails exist within the Study Area Corridors on local streets, or that pass under or over restricted access highways. Chesapeake has one designated bike trail, Hampton has seven bike routes, Newport News has two bike routes, Norfolk has three bike lanes and a sharrow lane, and Portsmouth has one dedicated bike route in the Study Area Corridors. Suffolk does not currently have an existing bike lane or route in the I-664 and VA 164 Study Area Corridors (see the *HRCS Socioeconomic and Land Use Technical Report* for more detail).

Military Facilities

I-64, I-564, I-664, and VA 164 provide for the movement of military personnel and equipment within the region (US Army, 2015a). These roadways are part of the Strategic Highway Network (STRAHNET), which is designated by the US Department of Defense (DoD) in coordination with the Federal Highway Administration (FHWA). STRAHNET, a network of highways which are important to the United States' strategic defense policy, provide defense access, continuity, and emergency capabilities for defense purposes. Military installations accessible by STRAHNET and in the HRCS Supplemental Environmental Impact Statement (SEIS) Study Area Corridors are shown on **Figure 3-3**. They include:

- NAVSTA Norfolk: The world's largest Naval Base currently supporting 75 ships and 134 aircraft. Houses the largest concentration of US Navy forces and is the hub for Navy logistics for the European and Central command theaters of operations.

- Naval Support Activity (NSA) Hampton Roads: Provides logistical, maintenance and administrative support to a collection of Navy and Marine Corps facilities in Hampton Roads that lie outside the region's major bases.
- CIDMMA: Under the operation of the US Army Corps of Engineers (USACE), this is an active civil works project for the management and deposition of dredged material from the Hampton Roads navigation channels.
- US Coast Guard Station-Portsmouth: Part of the US Coast Guard's (USCG) 5th District, ensures the safety and security of the oceans, coastal areas, and marine transportation system within the US Mid-Atlantic region.
- Craney Island US Naval Supply Center: Part of the oldest and largest naval supply center in the world. Handles part of the supply activities and related functions located within the confines of NAVSTA Norfolk, specifically, naval fuel storage operations within the region.
- Joint Staff Suffolk Complex: Contains elements of Navy Cyber Forces, Navy Cyber Defense Operations Command, and Naval Network Warfare Command.

As shown on **Figure 3-3**, NAVSTA Norfolk and NSA Hampton Roads are presently served by I-564, identified as a STRAHNET Interstate Highway, and by STRAHNET connector roadways (VA 337 and VA 406). Portions of these roadways currently bisect the Navy properties.

Since publication of the Draft SEIS, more detailed research has been conducted to refine the existing right-of-way files using as-built plans acquired by VDOT. Through this effort, and coordination with the US NAVY, a commitment is made in this document that no military property takes would occur as a result of the Preferred Alternative. Note that the military land use shown on **Figure 3-2b** does not reflect this refined land use and right-of-way information.

Environmental Consequences

Communities

The **No-Build Alternative** would not result in any project-related construction and would therefore not directly impact any communities. Continued congestion within the Hampton Roads region would increasingly hamper community mobility.

Construction of the **Build Alternatives** would result in greater transportation mobility and improved congestion relief for the communities within the Hampton Roads region. **Alternative A** would provide congestion relief and increased mobility along I-64 in Hampton and Norfolk. **Alternative B** would provide congestion relief and increased mobility along I-64 in Hampton and Norfolk, I-564, and VA 164 in Suffolk. **Alternative C** would provide congestion relief and increased mobility along I-664 in Hampton and Suffolk, I-564, and the proposed VA 164 Connector. **Alternative D** would improve congestion and mobility for the largest area, along all the existing and proposed roadways in the Study Area Corridors. Residents would have greater range of choice and access to area communities. All of the Build Alternatives are either located along an existing corridor and would not create new physical barriers to inter-community interaction or are located along new alignment that is not within established residential or business communities, thus minimizing the potential for adverse impacts to community connectivity or cohesion. While there would be some relocations associated with the Build Alternatives, those relocations are located along the edges of communities and would not bisect residential areas or create new impediments to travel.

Figure 3-3: Military Facility Locations and the STRAHNET Roadways

The **Preferred Alternative** would provide congestion relief and increased mobility along I-64 in Hampton and Norfolk. The improvements are located along I-64 and would not create new physical barriers to inter-community interaction.

Community Facilities

The **No-Build Alternative** would not result in any project-related construction and would therefore not directly impact any community facilities. However, under this alternative, congestion would continue to worsen along the primary transportation corridors in the Hampton Roads region, resulting in deteriorated accessibility to community facilities.

Construction of any of the **Build Alternatives** would result in greater transportation mobility and improved congestion relief within the Hampton Roads region, to varying degrees. Under each Build Alternative, access to community facilities would be improved. **Alternative A** would improve congestion and access to community facilities along the I-64 corridor in Hampton and Norfolk. **Alternative B** would improve congestion and access to facilities along I-64, I-564, and VA 164 in Hampton, Norfolk, and Suffolk. **Alternative C** would improve congestion and access to community facilities along I-664 in Hampton, Suffolk, and Chesapeake, on I-564 in Norfolk, and along the proposed VA 164 Connector. **Alternative D** would improve congestion and access to community facilities throughout. The **Preferred Alternative** would improve congestion and access to community facilities along the I-64 corridor in Hampton and Norfolk, similar to Alternative A.

Each of the alternatives presented in the Draft SEIS would impact community facilities; however, the use and functionality of the resources would not be impacted. **Alternative A** would impact 1.4 acres of Hampton University and <0.1 acres of the Willoughby Boat Ramp. **Alternative B** would impact a total of 8.9 acres at three facilities (one school and two park and recreational facilities). **Alternative C** would impact a total of 10.0 acres at four facilities (one religious facility, one school, and two park and recreational facilities). **Alternative D** would have the largest impact to community facilities; 9.8 acres at five facilities (two schools and three park and recreational facilities). Since publication of the Draft SEIS, the Preferred Alternative has been modified to avoid impact to Hampton University and the Willoughby Boat Ramp. Through this effort, the commitment is made in this document that no community facilities would be impacted by the **Preferred Alternative**. Impacts to community facilities are summarized in **Table 3-5**.

Table 3-5: Impacts to Community Facilities (acres)

Facility	No-Build Alternative	Alternative A	Alternative B	Alternative C	Alternative D	Preferred Alternative
Religious Facilities						
Kingdom Hall Jehovah's Witness	0	0	0	0.1	0	0
Schools/Universities						
Hampton High School	0	0	0	0.7	0.7	0
Hampton University	0	1.4	1.1	0	1.1	0
Park and Recreational Facilities						
Park Place Playground	0	0	0	0.2	0.1	0

Facility	No-Build Alternative	Alternative A	Alternative B	Alternative C	Alternative D	Preferred Alternative
Willoughby Boat Ramp	0	<0.1	<0.1	0	<0.1	0
Fleet Park	0	0	7.8	9.0	7.8	0

Bike Facilities and Recreational Trails

The **No-Build Alternative** would not result in any project-related construction and would therefore not directly impact any existing recreational trails, bike paths, and bike lanes within the Study Area Corridors. Currently, no bicycle or recreational trails are associated with the use of I-64, I-664, I-564, or VA 164. There would be no long-term impact to any recreational trail, bike paths, or bike lanes under any of the **Build Alternatives**. All of the Build Alternatives cross over existing recreational trails or bike paths located on secondary roads (where no HRCS-related improvements are planned). Short-term impacts to recreational trail, bike paths, or bike lanes could include temporary closures and detours during construction.

Military Facilities

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

Alternative A would impact approximately 22 acres of NAVSTA Norfolk along both I-64 and I-564. However, as shown on **Figure 3-2b**, the land use layers used to calculate this impact show that a large portion of the land designated as "Military" property is located within existing I-64. Therefore, actual impacts to military right-of-way along I-64 is expected to be less. **Alternatives B and D** would result in the same impacts to military facilities: 37 acres of NAVSTA Norfolk, 27 acres of the Craney Island US Naval Supply Center, 87 acres of CIDMMA, and 12 acres of the US Coast Guard Station. **Table 3-6** summarizes the impacts to military facilities resulting from the alternatives. More information on the impacts by alignment segment is provided in **Appendix A**.

VDOT is committed to avoiding permanent impacts to the US Navy properties. Since publication of the Draft SEIS, more detailed research has been conducted to refine the existing right-of-way files using as-built plans. The property boundaries between the interstate and US Navy properties, however, are too complex to be delineated at this planning level and require land survey that is to be completed following the publication of this Final SEIS. Therefore, no engineering modifications or refinements were applied to the Preferred Alternative for the Final SEIS to avoid Navy property along eastbound I-64 south of Willoughby Bay. The need for modifications and refinements would be determined following the issuance of a ROD during more detailed design efforts; however, no military property would be impacted by the **Preferred Alternative**.

Table 3-6: Military Facilities Impacts (acres)

Facility	No-Build Alternative	Alternative A	Alternative B	Alternative C	Alternative D	Preferred Alternative
NAVSTA Norfolk*	0	22	37	42	37	0
Craney Island US Naval Supply Center	0	0	27	27	27	0
Craney Island Dredged Material Management Area (CIDMMA)	0	0	87	87	87	0
US Coast Guard Station-Portsmouth	0	0	12	12	12	0

** Land within existing I-64 right-of-way in the vicinity of NAVSTA Norfolk is classified as a military use (see Figure 3-2b). More refined right-of-way files have been compiled, confirmed with the US Navy, and used to calculate impacts for the Preferred Alternative. The commitment is made in this document that no military facilities would be impacted by the Preferred Alternative.*

Overall, the reduction in congestion that would result from construction of the Build Alternatives would benefit military operations. Alternative A would improve military connectivity via the I-64 corridor within Hampton and Norfolk. Alternatives B, C, and D would directly improve military connectivity for the region by providing improved local and regional access for military movement missions throughout the Hampton Roads region. Improvements in the I-564 Study Area Corridor and the new capacity along the I-664 Connector, I-564 Connector, and VA 164 Connector would improve connectivity to NAVSTA Norfolk and a number of other military facilities in the area. Improvements to the VA 164 Study Area Corridor and the new capacity along the VA 164 Connector would improve connectivity to the Craney Island US Naval Supply Center, and the US Coast Guard Station – Portsmouth.

Mitigation

Impacts to communities and community facilities are anticipated to be minor. The relocations required by the Build Alternatives would be conducted in accordance with all applicable Federal laws, regulations, and requirements. Relocation resources would be available to all residential and business relocatees without discrimination. There would be no impact to bike paths or recreational trails; therefore, no mitigation efforts would be required. Continued coordination with the US military occurred during the development of the Final SEIS, and will continue to occur during future design and construction. Impacts to US Coast Guard Station-Portsmouth and the Craney Island US Naval Supply Center are based on the preliminary LOD. Engineering refinements may occur during final design and permitting phases to reduce impacts where possible and further coordination may occur to address facility security needs. Similar efforts may be made for other facilities during final design.

3.2.2 Transportation Facilities

Affected Environment

Limited Access Highways, State Routes, and Local Roads

All of the highways that comprise the Study Area Corridors are limited access facilities. These facilities are summarized in **Table 3-7**. These highways serve a critical transportation function for commuters,

interstate and intrastate freight movement, national defense, emergency evacuation, and commercial activities. I-64 crosses the Hampton Roads Harbor via the Hampton Roads Bridge-Tunnel (HRBT) and I-664 crosses via the Monitor Merrimac Memorial Bridge-Tunnel (MMMBT). Both of these crossings are critical links in the regional transportation network connecting Southside and the Peninsula.

Table 3-7: Limited Access Highways

Highway	Functional Classification	Description
I-64	Interstate	I-64 extends from 1.7 miles west of the I-664 interchange in Hampton to approximately 0.5 miles south of the I-564 interchange in Norfolk, a distance of approximately 14 miles, including the 3.5-mile long HRBT
I-564	Interstate	I-564 is the primary access between NAVSTA Norfolk, NSA Hampton Roads, and the NIT on the west and I-64 on the east, a distance of approximately 3 miles.
I-664	Interstate	I-664 is 20.8 miles in length, beginning at Interchange 1 in Hampton and ending at Interchange 13 in Chesapeake.
VA 164	Other Freeway or Expressway	The Western Freeway extends for 3.4 miles east-west through Portsmouth and Suffolk from Virginia International Gateway Boulevard to I-664.

State routes and local roads which link to the limited access roadways of the Study Area Corridors are summarized in **Table 3-8**.

Table 3-8: Connecting State Routes and Locals Roads

Numerical Designation	Functional Classification	Roadway Name	Connecting Interstate	Interchange/ Exit Number	Locality
US 258	Other Principal Arterial	Mercury Boulevard	I-64	263A/B	Hampton
SR 167/ SR 134	Minor Arterial	LaSalle Avenue/ Armistead Avenue, Rip Rap Road	I-64	265	Hampton
US 60/SR 143	Minor Arterial	Settlers Landing Road	I-64	267	Hampton
SR 169	Minor Arterial	South Mallory Street	I-64	268	Hampton
US 60	Minor Arterial	4th View Street	I-64	273	Norfolk
SR 1070	Major Collector	1st View Street	I-64	Underpass	Norfolk
SR 907	Minor Arterial	Bay Avenue	I-64	274	Norfolk
US 460	Other Principal Arterial	Granby Street	I-64	276/276A	Norfolk
SR 165	Other Principal Arterial	Little Creek Road	I-64	276/276C	Norfolk
SR 337	Other Principal Arterial	Admiral Taussig Boulevard	I-564	Future Exit	Norfolk
SR 406	Other Principal Arterial	International Terminal Boulevard	I-564	Terminal Boulevard	Norfolk
SR 415	Minor Arterial	Power Plant Parkway	I-664	2	Hampton
SR 905	Minor Arterial	Aberdeen Road	I-664	3	Hampton

Numerical Designation	Functional Classification	Roadway Name	Connecting Interstate	Interchange/ Exit Number	Locality
SR 945/ SR 1020	Major Collector	Chestnut Avenue/Roanoke Avenue	I-664	4	Newport News
SR 143	Other Principal Arterial	Jefferson Avenue	I-664	5	Newport News
US 60	Other Principal Arterial	Warwick Boulevard/26th Street	I-664	6	Newport News
---	Ramps	Terminal Avenue	I-664	7	Newport News
SR 135	Minor Arterial	College Drive	I-664	8A/B	Suffolk
SR 133	Major Collector	New Town Point Road	I-664	Overpass	Suffolk
US 17/VA164	Other Freeway/ Expressway	Western Freeway/Western Branch Boulevard	I-664	9A/B	Suffolk
SR 947	Minor Arterial	Pughsville Road/Taylor Road	I-664	10	Chesapeake
SR 337	Minor Arterial	Portsmouth Boulevard	I-664	11A/B	Chesapeake
SR 1036	Major Collector	Dock Landing Road	I-664	12	Chesapeake
US 58	Minor Arterial	Airline Boulevard/West Military Highway	I-664	13A/B	Chesapeake
US 13	Minor Arterial	South Military Highway	I-664	13A/B & 14	Chesapeake
SR 905	Major Collector	Cedar Lane	SR164	Cedar Lane	Portsmouth
SR 947	Major Collector	Town Point Road	SR164	Town Point Road	Portsmouth

Source: Virginia Department of Transportation, 2014.

Transit Routes and Facilities

Public transportation in the region is provided by Hampton Roads Transit (HRT). HRT serves six cities: Chesapeake, Hampton, Newport News, Norfolk, Portsmouth and Virginia Beach. HRT operates a total of 56 local fixed bus routes, eight regional express commuter bus routes, seven major employer shuttles (e.g., Newport News Shipyard) as well as seasonal routes at the Virginia Beach oceanfront. Six of the eight regional express commuter routes utilize the Study Area Corridors (**Table 3-9**). In fiscal year 2015, HRT provided a total of 14.2 million unlinked passenger trips on its fixed route buses which includes the local bus routes, regional commuter express routes, and employer shuttles. Within its fixed route service area, HRT also provides complementary paratransit bus service in compliance with the Americans with Disabilities Act. HRT reported a total of 324,000 trips on its paratransit buses in fiscal year 2015.

Table 3-9: Metro Area Express (MAX) Routes

Route Number	Locality Connection	Route Termini	Study Area Corridors
918/919	Virginia Beach – Norfolk	Silver Leaf Park & Ride to Lafayette River Annex	I-564
922	Chesapeake – Norfolk	Greenbrier Mall to Naval Station Norfolk	I-564
961	Norfolk – Newport News	Downtown Norfolk to Newport News Transit Center	I-64, HRBT, and I-664
965	Newport News - Norfolk	Patrick Henry Mall to Naval Station Norfolk	I-64, HRBT, and I-564
967	Norfolk – Newport News	Military Highway Light Rail Station to Newport News Transit Center	I-664 and MMMBT

Source: Hampton Roads Transit, 2016.

In addition to fixed route and paratransit bus service, HRT operates "the Tide," a light-rail system which extends 7.4 miles from the Eastern Virginia Medical Center complex east through downtown Norfolk to Newtown Road at the border of Virginia Beach. HRT also operates a ferry route on the Elizabeth River between Norfolk and Portsmouth. The Tide and Elizabeth River ferry service do not currently operate within the Study Area Corridors.

Suffolk does not have a contractual agreement with HRT, and therefore operates its own transit system called Suffolk Transit. Suffolk Transit operates six routes within the City, as well as complementary paratransit service in compliance with the Americans with Disabilities Act. The bus routes operate Monday through Friday on one-hour headways.

The HRT Metro Area Express bus service, ("the MAX"), is a commuter express bus service which uses the Study Area Corridors to provide regional express bus service between the Peninsula and Southside. Service is provided to Park and Ride facilities throughout the region, connecting commuters to major employment destinations, such as NAVSTA Norfolk and Northrop Grumman in Newport News. **Table 3-9** summarizes the existing MAX routes which use the Study Area Corridors, and **Figure 3-4** illustrates the route patterns. The MAX is the only public transit option that connects the Peninsula and the Southside.

Local HRT bus routes intersect the Study Area Corridors in Hampton, Norfolk, Portsmouth, and Newport News via minor arterial roadways and/or major and minor collectors to serve local destinations. These local bus routes do not generally utilize I-64, I-664, I-564, or VA 164. One HRT commuter service bus uses I-664 and I-64 to connect Newport News with Williamsburg. In addition to the routes, the Wards Corner Bus Transfer Station is located near the intersection of Granby Street and Admiral Taussig Boulevard in Norfolk, adjacent to the interchange of I-64 and I-564.

Suffolk Transit uses I-664 for approximately 4 miles along the "Gold Route" extending from the Bowers Hill area northbound to Pughsville Road. The "Blue Route" travels along the Hampton Roads Parkway and crosses over I-664 in North Suffolk. All of these bus facilities operate in general purpose lanes and do not experience a travel time advantage over personal vehicles.

Port Facilities

Hampton Roads is home to multiple docking and mooring locations for military, commercial, and recreational watercraft. Two designated shipping lanes pass through the harbor and are federally

Figure 3-4: HRT MAX Routes

maintained by the USACE: the Newport News Channel and the Norfolk Harbor Reach Channel (**Figure 3-5)**. The existing depths of the channels are a minimum of 50 feet; however, the Port of Virginia has gained approval to dredge the channels to 55 feet depths. The deeper channels will allow the port facilities to accommodate the largest container ships that pass through the Panama Canal, referred to as Super Post Panamax ships. The harbor and shipping lanes allow commercial shipping lines to access major commercial ports in the region located in Newport News, Norfolk, and Portsmouth. These port facilities are substantial generators of traffic on area roadways resulting from employee work trips and long and short-haul truck traffic on and adjacent to the Study Area Corridors. All of the commercial ports are accessible by roadway, water, and rail to varying degrees.

The Port of Virginia is a public organization overseen by the Virginia Port Authority to market and operate port facilities in the Commonwealth of Virginia. In the Hampton Roads region, the Port of Virginia operates four deep-water marine terminals and an upriver barge terminal. These facilities are summarized in **Table 3-10** and shown in **Figure 3-5**. Outside of the Hampton Roads region, the Port of Virginia also operates the Port of Richmond and Virginia Inland Port located in Warren County. Collectively, Port of Virginia facilities processed 19.7 million tons of cargo in 2015, with an estimated value of $60 billion.

Table 3-10: Port Facilities

Port Facility	Owner	Locality	Access	Description
Newport News Marine Terminal (NNMT)	Port of Virginia	Newport News	Road: I-664 Rail: CSX Marine: Newport News Channel	165-acre general cargo terminal supporting Roll-On/Roll-Off, break-bulk, and warehouse operations. Gated entrance.
Norfolk International Terminals (NIT)	Port of Virginia	Norfolk	Road: Hampton Blvd/I-564 Rail: NS Marine: Norfolk Harbor Reach Channel	567-acre container terminal with six 50’ deep berths and 14 Super Post Panamax ship-to-shore cranes. Current operations rely primarily on straddle carriers. Gated entrance.
Virginia International Gateway (VIG)	Port of Virginia	Portsmouth	Road: Hampton Blvd/I-564 Rail: CSX and NS Marine: Norfolk Harbor Reach Channel	231-acre container terminal with three 50’ deep berths and 8 Super Post Panamax ship-to-shore cranes.
Portsmouth Marine Terminal (PMT)	Port of Virginia	Portsmouth	Road: VA 164/US 58 Rail: CSX, NS and NBPL Marine: Norfolk Harbor Reach Channel	285-acre mixed use terminal with two 43’ deep berths and 6 Post Panamax ship-to-shore cranes currently allocated to container operations. Primarily an over-the-road truck terminal.
Pier IX VA Terminal	Kinder Morgan	Newport News	Road: 18th Street Rail: CSX Marine: Newport News Channel	Three-dock marine terminal for the purpose of coal shipping and ground storage with a capacity of 1.4 Million tons.
Dominion Coal Shipping and Ground Storage Facility	Dominion Terminal Associates	Newport News	Road: 18th Street Rail: CSX Marine: Newport News Channel	Coal shipping and ground storage facility with a storage capacity of 1.7 million tons.

Port Facility	Owner	Locality	Access	Description
Lamberts Point Coal Terminal	Norfolk Southern	Norfolk	Road: US 460/I-64 Rail: NS Marine: Norfolk Harbor Reach Channel	NS-served and operated transshipment coal terminal located on the Elizabeth River

There are three privately-owned port facilities in Hampton Roads that store and transload coal to bulk carrier ships. Kinder Morgan and Dominion Terminal Associates operate port facilities southeast and adjacent to the Newport News Marine Terminal (NNMT) which is owned and operated by the Port of Virginia. Coal is transported to these facilities by CSX where it can be loaded onto ships. Roadway access to these facilities is provided via I-664. Norfolk Southern (NS) operates the Lamberts Point Coal Terminal in Norfolk which is located on the Elizabeth River. Lamberts Point Terminal is accessed by US 460 via I-64/I-564.

The Craney Island Marine Terminal is a facility under development by the Port of Virginia with a scheduled completion year of 2028. The terminal will be an automated container terminal with the capability to handle up to 50 percent of its container volume by rail. The existing Commonwealth Railway Line (shortline railroad) will be extended from VA 164 to CIDMMA. Extension of the rail line will provide access to the terminal for both NS and CSX, and allow for double-stack intermodal rail service. The terminal will be designed to serve Super Post-Panamax class ships and will also have direct access to the interstate highway system.

In addition to commercial and military activities, the harbor provides a safe port and anchorage destination for ships and boats to shelter during storms, and an open area for recreational use. To access the harbor, ships must pass over the HRBT, and to access the western reaches of the James River, they must pass over the MMMBT. Smaller rivers and creeks that feed into Hampton Roads act as harbors as well, including the Hampton River, the Elizabeth River, and the Lower James River.

Military vessels use the harbor to access NAVSTA Norfolk, the Naval Supply Center, the Coast Guard base, and Navy Shipyard in Portsmouth. These military installations are described in further detail in **Section 3.2.1**. The *Ports for National Defense Program* is a program established by the Department of Defense (DoD) to identify and asses the adequacy and responsiveness of defense-important infrastructure at ports that support DoD deployments. The Program identifies the Port of Virginia facilities as a designated strategic seaport.

Freight Railroad Network

With the regional importance and location of the Port of Virginia, the freight rail network is critical to the local economy and goods movement. The Hampton Roads region is served by two Class I freight railroad operators and three Class III shortline railroads. These railroads serve the port facilities and other businesses along the routes. Goods and natural resources are brought by rail to Hampton Roads to be exported, and imports are distributed nationwide via rail lines that service the marine terminals in Hampton Roads. The freight rail network within and adjacent to the Study Area Corridors is shown in **Figure 3-5**.

Figure 3-5: Port Facilities and Freight Rail Network

Emergency Evacuation Routes

Due to the substantial risk of hurricanes in the region, evacuation of the Hampton Roads region has been extensively analyzed by federal, state, and regional government stakeholders. In the event of a hurricane, the Virginia Department of Emergency Management (VDEM) has designated evacuation routes in the *Virginia Hurricane Preparedness Guide* (2010) for the region which are summarized in **Table 3-11** and shown in **Figure 3-6**. These evacuation routes include the Study Area Corridors of I-64 and I-664.

Table 3-11: Emergency Evacuation Routes

Area	Designated Jurisdictions	Routes
Peninsula	Hampton Newport News	• I-64 • I-664 North • US Route 17 North • US Route 60 West • SR 143
Southside	Suffolk Chesapeake Portsmouth Virginia Beach	• I-64 and I-264 • I-664 MMMBT • US Route 17 North • US Route 58 West • US Route 460 West • SR 10 West
Norfolk and Virginia Beach	Norfolk Virginia Beach	• I-64 operating with reversed eastbound lanes (westbound)

Source: Virginia Hurricane Preparedness Guide (VDEM, 2010).

The HRBT and MMMBT may be overtopped by water during extreme storm events. The HRBT is equipped with storm doors which can be shut to prevent flooding. While this preserves the tunnel structures, it would close off a vital route for evacuees and/or emergency personnel. Another impediment to evacuation is that the Hampton Roads region is low lying, and US 17, US 460, and US 58 are prone to flooding, further exacerbating evacuation conditions even after evacuees make it past the available water crossings.

Norfolk and Virginia Beach residents located north of I-264 are directed to use I-64 and the HRBT in the event of an evacuation. However, because of increased regional population, limited water crossings for large area evacuations, and peak congestion during typical daily use already occurring on designated emergency routes, the ability to effectively evacuate the population is hampered. The study routes and HRBT and MMMBT crossings are known bottlenecks during daily traffic and would be more so during evacuations.

Environmental Consequences

Limited Access Highways, State Routes, and Local Roads

A complete analysis of transportation impacts in the Study Area Corridors is provided in **Section 5.3** through **5.7** and the *HRCS Traffic and Transportation Technical Report*.

Figure 3-6: Emergency Evacuation Routes

Transit Routes and Facilities

The **No-Build Alternative** would not result in any project-related construction and would therefore not directly impact any transit routes and facilities. However, under the No-Build Alternative, traffic congestion would continue to worsen on the existing MAX routes within the Study Area Corridors.

All of the **Build Alternatives** would reduce congestion and improve mobility along the roadways included in the Alternative and would therefore improve travel time and reliability for the overlapping MAX routes. As **Alternative A** is the shortest of the Build Alternatives, it would provide the least benefit to existing MAX routes. **Alternative B** contains the same existing MAX routes as Alternative A and therefore, benefits would be same. **Alternative C** would include transit only lanes which would allow existing and future transit to have a competitive travel time advantage over personal vehicle use. **Alternative D** contains the most existing MAX Routes and would therefore provide the greatest length of improvements to MAX routes.

The **Preferred Alternative** would reduce congestion and improve mobility along I-64 thus improving travel time and reliability for the overlapping MAX routes (961 and 965). It has not yet been determined if a management strategy (such as High Occupancy/Tolled (HOT) lanes or High Occupancy Vehicle (HOV) lanes) would be included in the Preferred Alternative. However, if implemented, HOT/HOV lanes would be utilized by MAX and would further optimize the number of people and vehicles that travel in the lanes thus providing added benefit to mobility and reliability (more information may be found in the November 16, 2015 letter from Virginia Department of Rail and Public Transportation (**Appendix D**)).

Port Facilities

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

No long-term impacts to the port facilities and terminals are anticipated with the **Build Alternatives** or the **Preferred Alternative**. **Alternatives B, C, and D** would increase access to port facilities on the Peninsula, in Norfolk, and Portsmouth.

Freight Rail Network

The existing freight rail network operations and capacity would not be impacted by the **No-Build Alternative**, the **Build Alternatives**, or the **Preferred Alternative**.

Emergency Evacuation Routes

Under the **No-Build Alternative**, traffic conditions are expected to worsen which would impact the ability of residents in the region to evacuate using the Study Area Corridors. The **Build Alternatives** would generally improve evacuation in the region and expand capacity on the evacuation routes. **Alternative A** would improve the Norfolk and Virginia Beach evacuation route capacity along I-64. **Alternative B** would improve the Norfolk and Virginia Beach evacuation route capacity along I-64 and would provide an additional connection via the I-564 crossing of the Elizabeth River to connect to the Southside evacuation route (I-664). **Alternative C** would improve capacity along the Peninsula evacuation route (I-664 in Hampton) and along the Southside evacuation route (I-664 in Suffolk, Portsmouth, and Chesapeake). **Alternative D** would provide the greatest capacity improvements to evacuation routes, improving the capacity of each route in the region (Norfolk and Virginia Beach, Peninsula, and Southside).

The **Preferred Alternative** would improve the Norfolk and Virginia Beach evacuation route capacity along I-64.

Mitigation

Under any of the Build Alternatives, VDOT would coordinate with HRT and Suffolk Transit to notify the transit agencies, and their passengers, about temporary closures and detours along the Study Area Corridors which could impact travel times on bus routes. VDOT would coordinate with operators of port and terminal facilities (e.g., Port of Virginia) to notify them of temporary closures and detours along the Study Area Corridors which could affect the ability of truck and employee traffic to access the terminals. Since no impact is anticipated to the freight rail network, no mitigation is proposed. Since no permanent impact is anticipated to the designated evacuation routes, no mitigation is proposed. VDOT would coordinate with VDEM to notify the agency of temporary closures and detours along the Study Area Corridors which could affect evacuation routes.

3.2.3 Population and Housing

Methodology

Demographic and housing characteristics are identified based on the American Community Survey (ACS) 5-year (2009-2013) data, available online at American Factfinder. Data was gathered for the Census Block Groups and Traffic Analysis Zones (TAZ) within or adjacent to the Study Area Corridors and compared to similar data for the six cities surrounding the Study Area Corridors, and statewide. Existing conditions were reviewed by the local Cooperating Agencies during the development of this SEIS. The Study Area Corridors contain 66 Census Block Groups, which are referred to as the study Census Block Groups. Direct long-term and short-term impacts to population and housing are assessed by identifying the number of potential relocations for each alternative and assessing the availability of nearby alternative, comparable housing.

Affected Environment

Population

According to ACS 5-year (2009-2013) data, current total resident population in the Study Area Corridors, based on the studied Census Block Groups adjacent to the corridors, is approximately 113,393. **Tables 3-12** and **3-13** present the population within each Study Area Corridor Census Block Group, each locality, and statewide. The most populous Census Block Group (9.01-1), with 13,333 residents is located along I-564 in the military housing area of Camp Allen in Norfolk. The lowest population is found in Census Block Group 751.01-2, with 205 residents, and is located in the College Drive area of Suffolk. The study Census Block Group population is approximately 12 percent of the six cities' total population (968,412) and one percent of statewide population (8,326,289).

Table 3-12: Census Block Groups, Localities, and Statewide Population

Location	Population
Study Area Corridors (adjacent Block Groups) Total	113,393
Chesapeake	225,597
Hampton	136,957
Newport News	181,025

Location	Population
Norfolk	244,090
Portsmouth	95,901
Suffolk	84,842
Virginia	8,326,289

Source: ACS 5-year (2009-2013).

Table 3-13: Population by Census Block Group

Census Block Group	Locality	Population	Census Block Group	Locality	Population
213.01-1	Chesapeake	791	308-2	Newport News	539
214.04-4	Chesapeake	881	3-3	Norfolk	1,120
215.01-1	Chesapeake	2,161	4-1	Norfolk	1,727
215.01-2	Chesapeake	3,106	4-3	Norfolk	1,327
215.01-3	Chesapeake	3,422	5-2	Norfolk	1,384
215.01-4	Chesapeake	2,411	5-3	Norfolk	493
215.02-3	Chesapeake	2,198	5-4	Norfolk	417
215.02-4	Chesapeake	2,972	8-1	Norfolk	1,406
216.01-1	Chesapeake	2,575	8-2	Norfolk	1,021
216.02-3	Chesapeake	3,093	308-3	Newport News	647
103.11-1	Hampton	1,809	9.01-1	Norfolk	4,764
103.13-1	Hampton	416	9.02-1	Norfolk	13,333
105.01-1	Hampton	3,218	11-1	Norfolk	1,607
105.01-2	Hampton	1,733	13-2	Norfolk	1,917
105.02-1	Hampton	2,288	55-1	Norfolk	1,420
105.02-2	Hampton	812	57.01-3	Norfolk	1,578
106.01-1	Hampton	1,026	2130.01-1	Portsmouth	1,305
106.01-2	Hampton	1,432	2130.01-3	Portsmouth	2,658
106.02-2	Hampton	1,384	2130.02-3	Portsmouth	2,413
108-1	Hampton	1,832	2131.01-1	Portsmouth	1,730
108-4	Hampton	768	2131.01-2	Portsmouth	1,591
111-1	Hampton	592	2131.01-3	Portsmouth	2,050
112-3	Hampton	949	2131.03-1	Portsmouth	517
113-2	Hampton	1,238	2131.03-2	Portsmouth	1,098
114-1	Hampton	2,345	2131.03-3	Portsmouth	2,023
301-1	Newport News	2,397	751.01-1	Suffolk	1,640
301-2	Newport News	334	751.01-2	Suffolk	205
301-3	Newport News	1,915	751.01-3	Suffolk	2,061
304-1	Newport News	742	751.02-4	Suffolk	1,406
306-1	Newport News	512	752.04-1	Suffolk	2,843
306-3	Newport News	1,044	752.04-2	Suffolk	1,986
308-1	Newport News	771			

Source: ACS 5-year (2009-2013).

Housing

Table 3-14 presents housing characteristics in the Census Block Groups, localities, and statewide, based on ACS 5-year (2009-2013) data. Approximately 36,000 occupied housing units are in the study Census Block Groups, with the majority (1,416) in Census Block Group 105.01-01 in the Power Plant Parkway area of Hampton. Approximately 48 percent of occupied housing units are owner-occupied and 52 percent renter-occupied, as opposed to most of the cities surrounding the Study Area Corridors, where the rate of home ownership is higher. Only Norfolk has more renters than homeowners. Among the six cities surrounding the Study Area Corridors, there are approximately 390,000 housing units, and 3.4 million housing units statewide.

Table 3-14: Census Block Groups, Localities, and Statewide Housing Characteristics

Location	Total Housing Units	Total Occupied Housing Units	Owner-Occupied	Renter-Occupied
Census Block Groups Total	41,107	35,858	17,197	18,661
Chesapeake	84,403	79,421	57,579	21,842
Hampton	59,746	52,511	31,560	20,951
Newport News	76,637	69,211	35,601	33,610
Norfolk	95,271	85,557	38,066	47,491
Portsmouth	40,833	36,690	20,997	15,693
Suffolk	33,372	30,492	22,373	8,119
Virginia	3,381,332	3,022,739	2,033,102	989,637

Source: ACS 5-year (2009-2013).

Environmental Consequences

Residential property impacts, including number of properties impacted, acreage impacted, and number of residential relocations, are provided for each alternative. The **No-Build Alternative** would not result in any project-related construction and would therefore not directly impact population or housing. **Alternative A** would result in the least impacts to residential properties (24 properties, the majority of which are located along I-64 in Norfolk). **Alternative B** would result in the second greatest number of impacted residential properties, (29 properties), the majority of which are located along I-64 in Norfolk and VA 164 in Suffolk. **Alternative C** would impact 58 residential properties, the majority of which are located along I-664 in Hampton. **Alternative D** would impact the greatest number of residential properties (69 properties). Impacts and relocations are summarized in **Table 3-15**. (More detail is provided in the *HRCS Right-of-Way and Relocation Technical Memorandum.*) More information on the impacts by alignment segment are provided in **Appendix A**.

The **Preferred Alternative** would impact 22 residential properties. Like under Alternative A, nine residential relocations could result from implementation of the Preferred Alternative. Eight of the nine potential residential relocations are located near eastbound I-64, along Bayville Street on Willoughby Spit. The additional relocation is located along westbound I-64 south of Oastes Creek on West Chester Street. Residential impacts for the Preferred Alternative were reduced along the northeast side of I-64, just north of the HRBT, due to modifications to the LOD to avoid permanent impacts to Hampton University property.

Table 3-15: Residential Impacts by Alternative

Impact	Alternative A	Alternative B	Alternative C	Alternative D	Preferred Alternative
Number of residential properties impacted	24	29	58	69	22
Total residential acres impacted	0.5	0.6	1.9	2.1	0.5
Residential relocations	9	9	11	20	9

The impacts to population and housing resulting from the Build Alternatives would affect the communities in which the relocations are located. All of the proposed relocations are located along existing right-of-way at the periphery of any established community, and would not bisect residential areas or create new impediments to travel through communities.

Mitigation

Currently, there appears to be adequate available housing in the Study Area Corridors given the difference between total housing units and total occupied housing units identified in **Table 3-14**. It should be noted that any alternative considered in this HRCS SEIS could be implemented over many years and the availability of adequate housing could fluctuate. A determination on the availability of adequate housing would be made during detailed design for each Operationally Independent Section (OIS). For the purposes of this analysis, the discussion focuses on current conditions. Additional details are provided in the *HRCS Right-of-Way and Relocation Technical Memorandum*.

VDOT has the ability, and if necessary, is willing to provide housing of last resort, including the purchase of land or dwellings; repair to existing dwellings to meet decent, safe, and sanitary conditions; relocation or remodeling of dwellings purchased by VDOT; or construction of new dwellings. Assurance is given that all displaced families and individuals would be relocated to suitable replacement housing; all replacement housing would be fair housing available to all persons without regard to race, color, religion, sex, or national origin; and all replacement housing would be within the financial means of the displacees. Each person would be given sufficient time to negotiate for and obtain possession of replacement housing. No residential occupants would be required to move from property needed for the Build Alternatives until comparable decent, safe, and sanitary replacement dwellings have been made available to them.

All affected property owners would be compensated for the fair market value of the acquired portion of land and any structures acquired for the construction of the Preferred Alternative. Additionally, any individual, family, business, farm or non-profit organization displaced as a result of the acquisition of real property is eligible to receive reimbursement for the fair market value of property acquired, as well as moving costs. This process is known as relocation assistance. In accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (as amended, 1987), displaced property owners would be provided relocation assistance advisory services together with the assurance of the availability of decent, safe, and sanitary housing. Relocation resources would be made available to all displacees without discrimination.

3.2.4 Economics

Methodology

This economic analysis focuses on potential impacts of the alternatives to income, employment and business in the Study Area Corridors. Specifically, economic data is either collected by Census tracts, Census Block Groups, zip code boundaries, or TAZs that are within or immediately adjacent to the Study Area Corridors. Sources of data are the ACS 5-year (2009-2013) data and the decennial Censuses available online at American FactFinder, or from TAZ data provided by the HRTPO (2013b). Impacts are assessed qualitatively based on the relative number of potential business and residential relocations and the extent of the alternatives' area of effects.

Affected Environment

Income

Table 3-16 summarizes the ACS 5-year (2009-2013) data median household income (in 2013 inflation adjusted dollars) of persons residing in all the study Census Block Groups. **Table 3-17** shows the median household income for the six cities in which the Study Area Corridors are located and statewide. The median household income of the study Census Block Groups ranges from $2,500 to $103,424. The median household income of persons residing in the study Block Groups is $41,683 — less than the six cities crossed by the corridors, and $22,224 (35 percent) less than the statewide median household income.

Table 3-16: 2009-2013 Median Household Income by Study Census Block Group

Census Block Group	Median Household Income[1]	Locality	Census Block Group	Median Household Income[1]	Locality
215.01-3	$91,376	Chesapeake	308-3	$52,500	Newport News
215.01-1	$45,197	Chesapeake	9.02-1	$48,611	Norfolk
213.01-1	$36,964	Chesapeake	4-1	$44,718	Norfolk
214.04-4	$84,375	Chesapeake	3-3	$43,633	Norfolk
215.02-3	$86,557	Chesapeake	13-2	$32,661	Norfolk
215.02-4	$66,088	Chesapeake	9900-0	$0[2]	Norfolk
216.01-1	$83,333	Chesapeake	4-3	$40,586	Norfolk
216.02-3	$63,882	Chesapeake	8-1	$63,561	Norfolk
215.01-2	$103,424	Chesapeake	8-2	$37,377	Norfolk
215.01-4	$40,648	Chesapeake	55-1	$53,866	Norfolk
108-4	$38,750	Hampton	57.01-3	$22,227	Norfolk
103.11-1	$44,875	Hampton	11-1	$36,013	Norfolk
105.01-2	$26,164	Hampton	5-2	$46,713	Norfolk
108-1	$34,515	Hampton	5-3	$52,703	Norfolk
114-1	$2,500	Hampton	5-4	$61,806	Norfolk
105.02-1	$27,054	Hampton	9.01-1	$45,318	Norfolk
106.01-1	$28,369	Hampton	2131.01-3	$42,717	Portsmouth
106.01-2	$23,098	Hampton	2130.02-3	$63,645	Portsmouth
106.02-2	$33,000	Hampton	2131.03-1	$61,250	Portsmouth

Census Block Group	Median Household Income[1]	Locality	Census Block Group	Median Household Income[1]	Locality
105.01-1	$32,367	Hampton	2131.03-2	$65,149	Portsmouth
111-1	$90,625	Hampton	2131.03-3	$53,456	Portsmouth
103.13-1	$35,875	Hampton	2130.01-1	$45,757	Portsmouth
113-2	$38,125	Hampton	2130.01-3	$81,816	Portsmouth
105.02-2	$37,794	Hampton	2131.01-1	$38,591	Portsmouth
112-3	$58,219	Hampton	2131.01-2	$32,351	Portsmouth
301-2	$15,000	Newport News	751.01-0	$0[2]	Suffolk
301-3	$31,830	Newport News	751.01-1	$56,000	Suffolk
306-1	$29,792	Newport News	751.01-2	$91,210	Suffolk
301-1	$13,902	Newport News	751.01-3	$100,566	Suffolk
306-3	$32,031	Newport News	751.02-3	$0[2]	Suffolk
304-1	$15,981	Newport News	751.02-4	$90,650	Suffolk
308-1	$37,917	Newport News	752.04-1	$5,1563	Suffolk
308-2	$25,625	Newport News	752.04-2	$39,922	Suffolk

Source: ACS 5-year (2009-2013).
[1]In 2013 dollars. [2]Zero values are in Census units with no residential areas or over water.

Table 3-17: 2009-2013 Median Household Income

Location	Median Household Income[1]	Location	Median Household Income[1]
Study Block Groups	$41,683	Newport News	$51,027
Virginia	$63,907	Norfolk	$44,747
Chesapeake	$69,743	Portsmouth	$46,166
Hampton	$50,705	Suffolk	$66,085

Source: ACS 5-Year 2009-2013.
[1]In 2013 dollars.

Employment

Major employers in the study Census Block Groups include NAVSTA Norfolk (approximately 45,000 military and 12,000 civilian employees), the Port of Virginia that directly and indirectly supports 40,000 jobs in the region, and Hampton University (1,000 employees) (Hampton Roads Economic Development Alliance, 2015). The cities encompassing the Study Area Corridors are also major area employers. Regionally, other large employers include several additional military installations with approximately 136,000 personnel, Newport News Shipbuilding (24,000 employees), Sentara Healthcare (20,000 employees), Riverside Health System (7,050), NASA Langley Research Center (4,000), Bank of America (3,600 employees), and Old Dominion University (4,000 employees).

Business

A total of 4,775 business establishments are located in zip codes within and adjacent to the Study Area Corridors. Of these, the majority are in the northwestern portion of the Study Area Corridors (Hampton) in zip code 23666 (23 percent). The top five business sectors in the study zip codes are: retail trade (17 percent), health care and social assistance (12 percent), accommodation and food services (12 percent),

other services (except public administration) (12 percent), and professional, scientific, and technical services (11 percent). Among the six cities encompassing the Study Area Corridors, there are approximately 20,000 establishments with the majority in retail trade (3,200 or 16 percent). The majority of businesses in the study zip codes have one to four employees (344 establishments or 46 percent), and the largest include two establishments having 250 to 499 employees (0.3 percent).

In the six cities encompassing the Study Area Corridors, 9,330 establishments (47 percent) have from one to four employees and the largest 17 establishments have 1,000 or more employees (less than 1 percent), with the majority of those located in Norfolk.

Environmental Consequences

The **No-Build Alternative** would not result in any project-related construction and would therefore not directly impact income, employment or business.

The proposed **Build Alternatives** would not have a major impact on income or the distribution of business establishments and industry located within the Study Area Corridors. Potential business relocations are provided in **Table 3-18**. There are no business relocations anticipated under **Alternatives A** or **B**. **Alternative C** could require five commercial relocations and **Alternative D** could require four commercial relocations. The majority of the relocations would occur along I-664 in Hampton. Alternative C would result in greater relocations due to the wider footprint of the roadway to accommodate the transit only lanes. The **Preferred Alternative** would not result in any commercial relocations. Commercial impacts for the Preferred Alternative were reduced, compared to those resulting from Alternative A, along the southwest side of I-64, just north of the HRBT, due to modifications to the LOD to avoid permanent impacts to Hampton University property.

Table 3-18: Commercial Impacts by Alternative

Impact	No-Build Alternative	Alternative A	Alternative B	Alternative C	Alternative D	Preferred Alternative
Number of commercial properties impacted	0	6	10	23	23	2
Total commercial acres impacted	0	1.3	2.7	4.7	5.5	<0.1
Commercial relocations	0	0	0	5	4	0

Alternative A and the Preferred Alternative would improve access to commercial businesses within the Study Area Corridors (along I-64 in Hampton and Norfolk). Alternatives B, C, and D would increase access to port facilities on the Peninsula, in Norfolk, and Portsmouth and would improve access to commercial businesses and interstate highway travel throughout the region.

Mitigation

As with residential relocations, the acquisition of right-of-way and the relocation of commercial properties would be conducted in accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970. Assurance is given that relocation resources would be available to all displacees without discrimination. Impacts to business in the Study Area Corridors would be minimized through careful planning during future phases of the study. Ongoing coordination with area businesses,

particularly those located adjacent to proposed improvements or detour routes, would occur to prevent or minimize both short- and long-term disruptions.

3.2.5 Environmental Justice

Methodology

The US Environmental Protection Agency (EPA) defines Environmental Justice (EJ) as "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies." This EJ analysis has been prepared in accordance with the definitions, methodologies, and guidance provided in Executive Order (EO) 12898; the Council on Environmental Quality (CEQ) *Environmental Justice Guidance Under the National Environmental Policy Act* (1997); US Department of Transportation (USDOT) Order 5610.2(a) *Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (2012 revision); FHWA EJ Order 6640.23A *FHWA Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (2012); FHWA memorandum *Guidance on Environmental Justice and NEPA* (2011); the FHWA *Environmental Justice Reference Guide* (2015); and FHWA Technical Advisory T6640.8A: *Guidance for Preparing and Processing Environmental and Section 4(f) Documents*.

Executive Order 12898 itself does not define the terms "minority" or "low-income," but these terms have been defined in the USDOT and FHWA EJ Orders as described below, and are used in the EJ analysis:

- Minority Individual – The USDOT and FHWA EJ Orders define a minority individual as belonging to one of the following groups: Black, Hispanic or Latino, Asian American, American Indian and Alaskan Native, or Native Hawaiian and Other Pacific Islander.

- Low-Income Individual – The FHWA and USDOT EJ Orders define a "low-income" individual as a person whose median household income is at or below the Department of Health and Human Services (HHS) poverty guidelines. The 2013 HHS poverty guidelines for persons living in the contiguous 48 states and District of Columbia as presented in **Table 3-19**. While the 2015 HHS poverty guidelines are available, the 2013 guidelines are appropriate to be used for consistent comparison to the latest available American Community Survey (ACS) 2009-2013 *Median Household Income in the Past 12 Months (In 2013 Inflation-adjusted dollars)* data available at the Census Block Group level.

Executive Order 12898 and the USDOT/FHWA EJ Orders are concerned with identifying minority and low-income populations. This analysis was based on the following population definitions:

- Minority Populations – Any readily identifiable groups of minority persons who live in geographic proximity, and if circumstances warrant, geographically dispersed/transient persons (such as migrant workers or Native Americans) who would be similarly affected by a proposed USDOT/FHWA program, policy, or activity (USDOT and FHWA EJ Orders). For the purposes of this analysis, a minority population is present when: (a) the minority population of the affected area exceeds 50 percent of total population or (b) the minority population percentage in the affected area is "meaningfully greater" than the minority population percentage in the general population or other appropriate unit of geographical analysis (CEQ, 1997). For the purposes of this study, the minority population for a Census Block Group will be found to be "meaningfully greater" than surrounding Block Groups in the study area if its minority population is greater than the value of

the Block Group with the lowest percentage of minority population within the Study Area Corridors, plus an additional ten percent of that value.

- Low-Income Population – Any readily identifiable group of low-income persons who live in geographic proximity, and, if circumstances warrant, geographically dispersed/transient persons (such as migrant workers or Native Americans) who would be similarly affected by a proposed USDOT/FHWA program, policy, or activity (USDOT/FHWA EJ Orders). In the EJ analysis, low-income populations were identified where the median household income for a Census Block Group within the Study Area Corridors is at or below the 2013 HHS poverty threshold for a family of four ($23,550).

This methodology has been agreed upon by the EPA, FHWA, and VDOT as appropriate for the identification of minority populations for discussion in NEPA documents.

Table 3-19: Health and Human Services 2013 Poverty Guidelines

Persons in Family/Household	Poverty Guideline [1]
1	$11,490
2	$15,510
3	$19,530
4	$23,550
5	$27,570
6	$31,590
7	$35,610
8	$39,630
For families/households with more than 8 persons, add $4,020 for each additional person	

Source: HHS (2013).
[1]2013 HHS poverty guidelines are used for consistent comparison to the ACS 5-year (2009-2013) Median Household Income in the Past 12 Months (In 2013 Inflation-adjusted dollars) data available at the Census Block Group level used in this analysis.

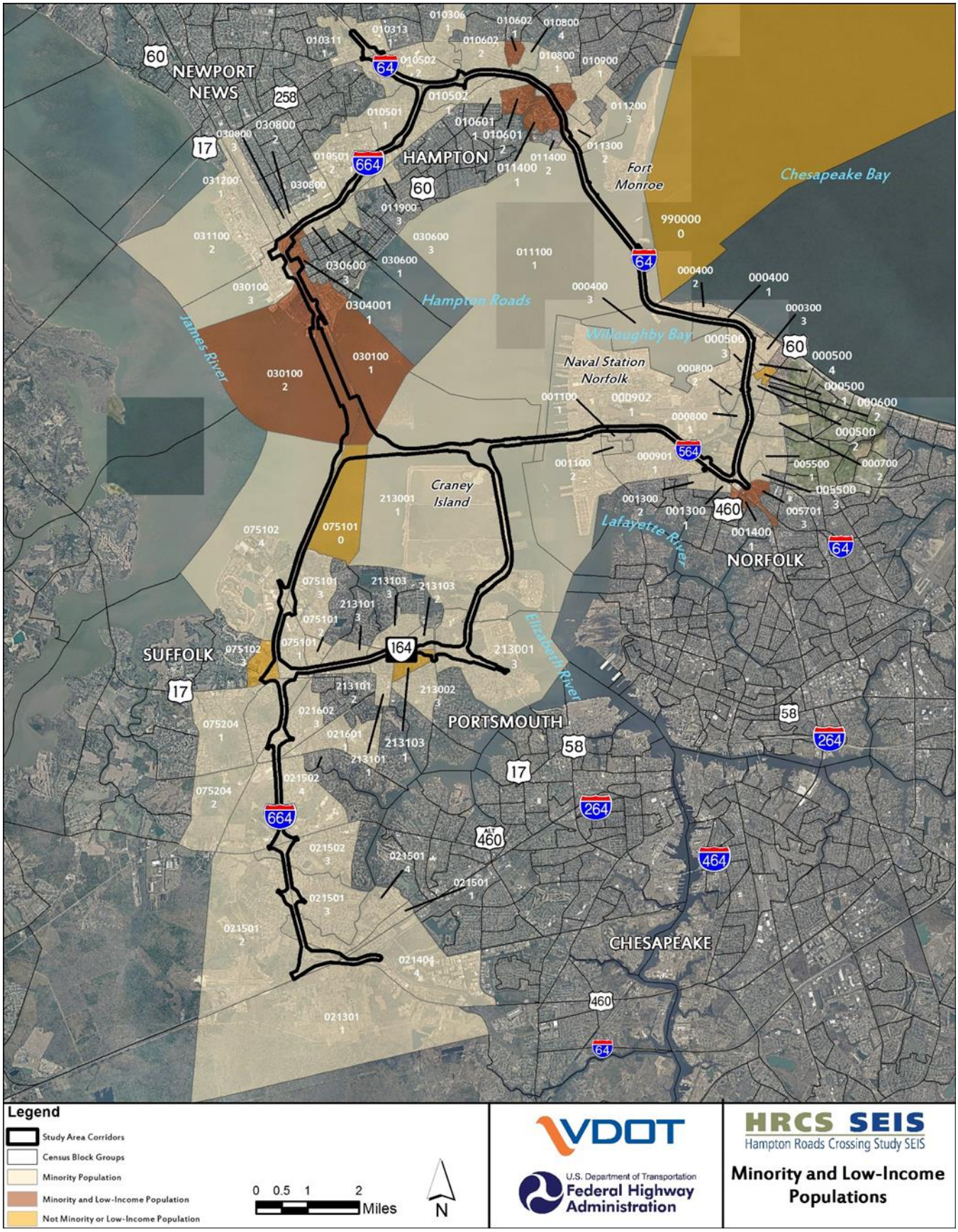
The study Census Block Groups selected for analysis of direct effects to EJ populations are those within or immediately adjacent to approximately ¼ mile (1,320 feet) of the Study Area Corridor's centerlines (78 total Block Groups).

Affected Environment

Data on race, minority, and low-income populations is provided in detail in the *HRCS Socioeconomic and Land Use Technical Report*. A total of 76 out of 78 study Census Block Groups meet the definition of a minority population. Of these, 8 meet the definition of both minority and low-income populations (106.01-2, 106.02-1, 114-1, 301-1, 301-2, 304-1, 14-1, and 57.01-3). The HHS poverty level for a family of four ($23,550) was used to identify the presence of low-income populations based on study census block groups median household income. Minority and Low-Income Populations are shown in **Figure 3-7**.

Minority populations located in Census Block Groups all along I-64 in the cities of Norfolk and Hampton, except the West Ocean View neighborhood of Norfolk. Minority populations are also located along the length of the I-564 Study Area Corridor in Norfolk, and with a few exceptions, along the length of I-664 through the cities of Hampton, Newport News, Suffolk, and Chesapeake. Areas along I-664 that are not classified as having minority populations are located in the Harbour View area of Suffolk. Along VA 164,

Figure 3-7: Minority and Low-Income Populations



minority populations are located adjacent to the freeway except in the south part of Towne Point (2141.03-1).

Similar to several Hampton Roads region cities, the most populous race in the study Census Block Groups is black or African American (42.7 percent). This is followed in frequency by white (42.65 percent), Hispanic or Latino (6.4 percent), two or more races (3.0 percent), Asian (3.0 percent), some other race (1.7 percent), American Indian and Alaska Native (0.4 percent), and Native Hawaiian or other Pacific Islander (0.1 percent) races.

Eight of the 78 study Census Block Groups with population meet the definition of a low-income population. All of the low-income populations identified are located in areas that also were documented above as having minority populations. As shown on **Figure 3-7**, low-income populations in the study Census Block Groups are found along I-64 in the Cottage Park neighborhood in Norfolk, Hampton University, and King's Square areas of Hampton. Along I-664, a low-income population resides in the Jefferson area of Newport News.

Environmental Consequences

The **No-Build Alternative** would not result in any project-related construction and would therefore not directly impact low income or minority populations.

The majority of the Census Block Groups adjacent to the **Build Alternatives** contain minority and low-income populations that meet the established threshold for EJ populations. As shown in **Table 3-20**, 67 percent of the Block Groups adjacent to **Alternative A** and the **Preferred Alternative** are EJ Block Groups, 77 percent of those adjacent to **Alternative B** are EJ Block Groups, 83 percent of those adjacent to **Alternative C** are EJ Block Groups and 80 percent of those adjacent to **Alternative D** are EJ Block Groups.

Table 3-20: EJ Block Group Impacts by Alternative

Impact	Alternative A	Alternative B	Alternative C	Alternative D	Preferred Alternative
Number of Block Groups Adjacent to Build Alternatives	12	22	30	44	12
Block Groups that meet the EJ Threshold	8 (67%)	17 (77%)	25 (83%)	35 (80%)	8 (67%)

Total relocations by Block Group are provided in **Table 3-21**. All the relocations under all the Build Alternatives are located in Block Groups containing EJ populations (minority and low-income).

Table 3-21: Total Residential Relocations within EJ Block Groups

Block Group	Community or Neighborhood	Alternative A	Alternative B	Alternative C	Alternative D	Preferred Alternative
400-3	Willoughby	8	8	0	8	8
800-1	Commodore Park	1	1	0	1	1
10501-2	Park Place	0	0	1	1	0
10501-1	Hampton Terrace	0	0	9	9	0
30800-1	Newsome Park	0	0	1	1	0
Total	**N/A**	**9**	**9**	**11**	**20**	**9**

The majority of the residential relocations are located in Block Groups 400-3 and 10501.1. Block Group 400-3 is located in the vicinity of I-64 in the Willoughby area. Widening of I-64 in this location would result in relocation of eight residential properties under Alternatives A and B. Block Group 10501-1 is located in the vicinity of I-664 in Hampton. Widening of I-664 in this location would result in relocation of nine residential properties under Alternatives C and D within the Hampton Terrace community. More information on the impacts by alignment segment are provided in **Appendix A**.

When impacts to EJ populations were identified, the impacts experienced by the affected population were compared to those experienced by others residing in the entire alternative alignment boundary. A disproportionately high and adverse effect on minority and low-income population locations is defined by the FHWA EJ Order as an impact that:

- Would be predominately borne by a minority and/or low-income population, or
- Would be suffered by the minority population and/or low-income population and is appreciably more severe or greater in magnitude than the adverse effect that would be suffered by the nonminority population and/or non-low-income population.

Per the FHWA Memorandum *Guidance on Environmental Justice and NEPA* (December 16, 2011), the impacts to minority and/or low-income populations were compared with respect to the impacts on the overall population within the project area (US Census Block Groups that intersect with the Build Alternatives). All relocations for each of the Build Alternatives would occur in Census Blocks that meet the definition of Environmental Justice populations. This is not unexpected since 76 of the 78 Block Groups in the Study Area Corridors meet the threshold for Environmental Justice. Furthermore, the ethnicity of individual relocatees has not been determined at this time. Therefore, while 100 percent of the Block Groups that would experience relocations meet the definition of an EJ population, the non-minority population within those same Block Groups range from 0 to 74 percent. This increases the probability that not all relocations would be borne by minorities and the impact would not be disproportionate.

As preliminary design and assessment of impacts advances, consideration of an alternative's impacts to individual minority or low-income persons will receive closer scrutiny. For example, minority or low-income extended families may be located adjacent to each other to assist each other with dependent care. In this type of circumstance, relocation of one household away from another may impose disproportionately high and adverse effects to minority or low-income individuals (see *FHWA's 2015 Environmental Justice Reference Guide* for detailed discussion).

The transportation benefits (e.g., reduced congestion, increased regional accessibility, etc.) would be borne by all users of the facility. The increased capacity of each Build Alternative would reduce congestion along all improved roadways, including those roads within Block Groups containing EJ populations.

To date, it has not been determined as to whether the new capacity would be tolled. HOT lanes are one of the options being considered, which would allow lower occupancy vehicles to gain access to the lanes by paying a toll. HOT lanes optimize the number of people and vehicles that travel in the corridor, managing demand through a user fee. If HOT lanes are implemented, the existing general purpose lanes would remain free for travelers using the facility; thus, there would be no disproportionate impact from tolls to EJ populations.

Because temporary easements for construction are anticipated to be short-term and would not preclude access to or impact use of properties, potential effects during construction are not considered high or adverse to minority and low-income populations.

Mitigation

Under the Build Alternatives, efforts would be made to relocate impacted residents, businesses, and community facilities within the same community. The displaced would receive fair compensation and relocation assistance, minimizing impacts to community cohesion. Mitigation measures for impacts to neighborhoods and community facilities would include advance and frequent notice before changes in travel patterns, plentiful signage for detours, restrictions on work hours to daytime hours, methods to reduce dust, and construction worker parking in surrounding lots to avoid disrupting existing area parking.

Specific noise mitigation measures would be considered for areas of severe and moderate impact, during final design. At that time, mitigation measures such as noise barriers and buffer zones would be evaluated in greater detail.

As described in the *HRCS Right-of-Way and Relocation Technical Memorandum*, property acquisition activities would be performed in accordance with the Uniform Relocation Assistance and Real Properties Acquisition Act of 1970 (Uniform Act), as amended. Fair market value would be provided to all property owners as compensation for land acquisition.

3.3 ENERGY

Methodology

Consideration of energy consumption and conservation potential of alternatives and mitigation measures in Environmental Impact Statement (EIS) documents is required by Council of Environmental Quality (CEQ) guidance at 40 CFR 1502.16(e) and FHWA technical guidance (TA 6640.8A).

This evaluation includes a qualitative comparison of energy consumption associated with the construction and maintenance of the evaluated alternatives and vehicle operation on the affected roadway network. Transportation energy use is categorized as direct or indirect use (FHWA TA 6640.8A). Direct energy use is related to the amount of fuel consumed for vehicle propulsion on the affected roadway. Energy use from vehicle operation is primarily a function of traffic volume, speed, distance traveled, and vehicle and fuel type. Roadway congestion affects travel speeds that impacts fuel consumption, resulting in slower speeds and increased idling that can increase energy consumption.

Indirect energy is energy consumed during construction of a transportation facility that is a function of the scale of the transportation infrastructure being constructed. Accurate construction energy costs cannot be determined given the uncertainty of field variables at this point in the study. However, construction energy factors include the amount of energy to extract raw materials, manufacture and fabricate construction materials, transport materials to the Study Area Corridors, and equipment operation to complete construction. In addition, temporary vehicle delays could be experienced resulting in additional energy usage and fuel consumption of commuter vehicles. More energy usage would also be incurred due to maintenance of the expanded facilities.

A qualitative assessment of the Alternatives' impacts on energy resources and conservation potential has been performed by comparing each alternative's energy consumption based on the length of the alternative and the relative construction scale or complexity, which is also based on alternative length.

Affected Environment

In the US, the transportation sector is the second largest consumer of energy behind the industrial sector. The transportation sector comprises approximately 27 percent of end-use energy consumption in the country (US Energy Information Administration (EIA), 2013). Within the Commonwealth of Virginia, the transportation sector is the largest consumer of energy accounting for approximately 30 percent of end-use energy consumption (EIA, 2013). Of this consumption, motor gasoline makes up the second largest source of consumption, next to net interstate flow of electricity (EIA 2013). Approximately three-fifths of the petroleum used in Virginia is consumed as motor gasoline (EIA, 2015).

Environmental Consequences

The **No-Build Alternative** involves no project-related construction and would therefore have no indirect energy consumption impact.

Severe congestion occurring during peak travel times at the HRBT, MMMBT, and stopping traffic at the HRBT to allow truck turnarounds leads to traveling at reduced speeds and increased idling that results in increased fuel consumption. During events involving accidents and disabled vehicles, diverting to alternate routes also results in additional fuel consumption to travelers due to extra travel distances. The increasing age of infrastructure in the Study Area Corridors, particularly at the HRBT, requires more frequent maintenance that also increases energy consumption.

Alternative A spans a distance of approximately 12 miles along I-64, including the HRBT. Expanding from four to six lanes and providing an additional tunnel would increase the capacity of I-64 in the Study Area Corridor. By increasing capacity, more vehicles could use the roadway, directly consuming more fuel. However, this would be offset by easing congestion – improving traffic speed and reducing vehicle idling – thereby reducing energy consumption. Additionally, future vehicular energy consumption is expected to be reduced in part by improvements to vehicle energy efficiency. Over time, older and less fuel-efficient vehicles are expected to be replaced with more fuel-efficient vehicles, including hybrid and electric vehicles.

Alternative A would make improvements over the smallest area compared to the other Build Alternatives, thus it would consume less indirect energy to build, operate and maintain. Construction energy would be applied to build the expanded mainlines, approach bridges, and tunnels. The construction energy used for Alternative A would therefore be greater than conditions under the No-Build Alternative. Alternative A would require less energy to construct than the other Build Alternatives due to its smaller scale. Because construction is a one-time occurrence and temporary, no long-term impacts to energy consumption would occur.

The **Alternative B** Study Area Corridor spans a distance of approximately 26 miles. Alternative B would be longer than Alternative A but shorter than Alternative C or D. Therefore, it would provide greater benefits relative to Alternative A of increased capacity that leads to more direct energy consumption, and reduced congestion that saves energy. Alternative B, while consuming more energy to construct, operate and maintain relative to Alternative A, would result in fewer benefits and adverse direct and indirect energy effects than Alternative C or D.

Alternative C encompasses approximately 40 miles of improvements. Alternative C would provide more travel lanes in addition to new dedicated transit lanes in both travel directions, but would not make improvements to I-64 or VA 164 from the new VA 164 Connector interchange to I-664. It would also cross the entire Hampton Roads Harbor via the I-664 and I-564 Connectors, and widen I-664 from Hampton to Chesapeake at the I-64/I-264 interchange. Alternative C would be longer than Alternative A or B. It would increase capacity that would consume more direct energy by roadway travelers; however, this consumption would be partially offset by reducing congestion over a larger area than Alternative A or B. Because Alternative C includes dedicated transit lanes, greater gains in transit travel reliability would result in some travelers opting to take transit rather than drive their own vehicle, further reducing energy consumption relative to Alternatives A and B. Alternative C would consume more energy to construct, operate, and maintain than Alternatives A and B. Because Alternative C improvements would be made to a shorter network of roads than Alternative D, it would provide fewer energy benefits and less direct and indirect energy consumption relative to Alternative D.

Alternative D is a combination of elements of all of the other Build Alternatives. Alternative D as a whole would encompass approximately 55 miles of improvements. Because it would increase capacity the most relative to the other Build Alternatives, Alternative D would realize more travel vehicle energy consumption than the other alternatives. Alternative D would also benefit energy consumption the most because of increased congestion relief compared to the other alternatives. This alternative would consume the most energy to construct, operate, and maintain, compared to the other alternatives.

The **Preferred Alternative** would result in the same energy usage as Alternative A.

Mitigation

Measures to mitigate the energy usage during construction may include limiting the idling of machinery and optimizing construction methods to lower overall fuel use.

3.4 FARMLANDS AND FORESTAL DISTRICTS

Methodology

This section evaluates the potential alternative impacts to resources protected under the Farmland Protection Policy Act (7 USC 4201 et seq. and 7 CFR 658) and the Virginia Agricultural and Forestal Districts Act (VC15.2-4300 et seq.). These resources include farmland, Virginia Agricultural and Forestal Districts, and sensitive soil types in the Study Area Corridors. In Virginia, the Virginia Department of Agriculture and Consumer Services (VDACS) is responsible for designating Farmland of Statewide Importance with concurrence from the NRCS.

Affected Environment

Active Farmland and Farmland Soils

According to VDACS, there are no active farmlands within the Study Area Corridors. The US Department of Agriculture Natural Resources Conservation Service (NRCS) designates two categories for Farmland and Farmland Soils: prime and unique farmland. NRCS defines Prime Farmland as land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oil seed crops and is available for these uses. Unique Farmland is land that is used for producing specific high-value food or fiber crops (NRCS, 2016).

The Study Area Corridors are located in highly urbanized areas that have already been developed or are planned for development. The National Cooperative Soil Survey by the NRCS shows the majority of the

Study Area Corridors do not contain protected farmland soils. There are soils within the I-664 Study Area Corridor on the Southside that are considered to be "prime farmland", "prime farmland if drained", or "prime farmland if protected from flooding or not frequently flooded during the growing season". However, no land in the Study Area Corridors is currently zoned or used for agriculture. Therefore, no lands in the Study Area Corridors are protected by the Farmland Protection Policy Act (FPPA).

Agricultural and Forestal Districts

Virginia State Code authorizes localities to designate Agricultural and Forestal Districts as a means of protecting working farm and forest land (§15.2-4300 and 4400). Designation of these districts require landowners to keep their land in forest product or agricultural production for four to ten years. According to Virginia Department of Forestry data, no Agricultural or Forestal Districts are currently established within the HRCS Study Area Corridors (DOF, 2016).

Environmental Consequences

Active Farmland and Farmland Soils

Because there is no farmland within the Study Area Corridors, there would be no impact to farmland or farmland soils as a result of the **No-Build Alternative**, **Build Alternatives**, or **Preferred Alternative**.

Agricultural and Forestal Districts

There would be no impact to agricultural and Forestal Lands as a result of the **No-Build**, **Build**, or **Preferred Alternatives**.

Mitigation

Because no effects to farmland are anticipated under any of the **Build Alternatives**, no mitigation is suggested.

3.5 RIGHT-OF-WAY AND RELOCATIONS

Methodology

Data and information were collected on social demographics, property values, and potential relocations, including individual tax parcel data, within the LOD of the retained alternatives. This information was compiled from: city tax parcel databases, aerial photos, the US Census website, Geographic Information System (GIS) databases, conceptual drawings, and field inspections. All existing data is based on information gathered at the time of this study.

Potential impacts were determined by using GIS to overlay the estimated LOD of the retained alternatives on city tax parcel digital data and aerial photography. The individual parcel data was then compiled and the area that may be acquired with implementation of a Build Alternative was computed. Property impacts are classified as either partial or total acquisitions. Total acquisitions occur when the primary structure is impacted, when access to the property is cut-off, when more than 50 percent of the property is taken, when the property is bisected, or when the improvements are located within 10 feet of the primary structure. Partial acquisitions occur when a portion of a parcel is acquired and that portion does not include a primary structure.

Potential relocations include all total acquisitions where there is a primary structure located on the property. Potential relocations may also occur on parcels that are partially acquired where a primary structure is impacted or access is cut off.

Affected Environment

Study Area Corridors are developed to analyze existing and proposed roadway conditions. As such, the Study Area Corridors include land and properties that do currently fall within existing VDOT right-of-way. The Study Area Corridors that make up Alternative A include 173.8 acres and 753 properties. Alternative B includes 634.9 acres and 1,026 properties. Alternative C includes 792.9 acres and 757 properties. Alternative D includes 1,090.0 acres and 1,709 properties.

Environmental Consequences

Potential relocations are summarized in **Table 3-22**. Most relocations are "Residential", with the greatest number occurring under **Alternative D**. The "Residential" numbers all represent single family residences. Potential "Commercial" relocations are a combination of business and commercial zoning, and would occur only with **Alternatives C** and **D**; "Commercial" relocations include a warehouse (Alternative C only), a pizza parlor, a building at an energy provider complex, and a single-family residence with a commercial use.

The **Preferred Alternative** would result in 9 residential relocations and 2 other relocations (VDOT- owned property east of I-64 in Hampton).

Table 3-22: Total Relocations by Alternative

Alternative	Alternative A	Alternative B	Alternative C	Alternative D	Preferred Alternative
Residential	9	9	11	20	9
Commercial	0	0	5	4	0
Other*	2	4	8	9	2
Total	**11**	**13**	**24**	**33**	**11**

**Other includes Institutional and Industrial zoning classifications.*

"Other" includes institutional and industrial properties; the greatest number of such takes would be with Alternative D. The institutional properties include two VDOT properties. The military property impact is located on the USCG site. The industrial properties include a pump technology company (Alternative C only), a pressure washer sales and services company, a building at a cabinet-making shop, and a building each at two port-related industries. Open space properties are included because, while they are zoned as such, buildings on these properties would be acquired as part of the project. The three open space properties would be included part of Alternatives C and D. More details are provided in the *HRCS Right-of-Way and Relocation Technical Memorandum*.

Mitigation

The acquisition of right-of-way and the relocation of displacements would take place in accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended (42 USC 4601). VDOT has the ability and, if necessary, is willing to provide housing of last resort, including the purchase of land or dwellings; repair of existing dwellings to meet decent, safe, and sanitary conditions; relocation or remodeling of dwellings purchased by VDOT; or construction of new dwellings. Assurance is given that all displaced families and individuals would be relocated to suitable replacement

housing, and that all replacement housing would be fair housing available to all persons without regard to race, color, religion, sex, or national origin and would be within the financial means of the displacees. Each person would be given sufficient time to negotiate for and obtain possession of replacement housing. No residential occupants would be required to move from property needed for the Retained Build Alternatives until comparable decent, safe, and sanitary replacement dwellings have been made available to them.

3.6 AIR QUALITY

Regulatory Context

Pursuant to the Federal CAA of 1970, the EPA established National Ambient Air Quality Standards (NAAQS) for major pollutants known as "criteria pollutants." Currently, the EPA regulates six criteria pollutants: ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter, and lead (Pb). Particulate matter (PM) is divided into two particle size categories: particles with a diameter less than 10 micrometers (PM_{10}) and those with a diameter of less than 2.5 micrometers ($PM_{2.5}$). The primary and secondary NAAQS for the criteria pollutants are listed in the *HRCS Air Quality Analysis Technical Report*.

EPA promulgated the transportation conformity rule (40 CFR Parts 51 and 93) pursuant to requirements of the CAA. The rule **only** applies in EPA designated non-attainment or maintenance areas (40 CFR 93.102(b))[1]. The Hampton Roads area is in attainment of all of the applicable NAAQS; therefore, transportation conformity rule requirements do not apply for this region.

The federal conformity rule requires that a conforming transportation plan and program be in place at the time of the project approval (40 CFR 93.114), and for the project to be included in the conforming plan and program (40 CFR 93.115). The HRCS was added to the HRTPO fiscal year (FY) 2012-2015 Transportation Improvement Program (TIP) and the 2034 Long Range Transportation Plan (LRTP) as a study-only project on March 21, 2013, and as such, did not require a new regional conformity determination. Since then, EPA revoked the 1997 8-hour ozone standard in its entirety effective April 6, 2015; therefore, transportation conformity requirements do not currently apply throughout the Study Area Corridors.

On May 16, 2016, FHWA and VDOT implemented a "*Programmatic Agreement for Project-Level Air Quality Analyses for Carbon Monoxide*" (hereinafter "2016 Agreement") that was developed based on a national template that was created in a recently completed National Cooperative Highway Research Program (NCHRP) study[2]. The NCHRP template was designed to be applied using state-specific background concentrations and persistence factors, without the need to update the detailed worst-case CO modeling as presented in its Technical Support Document (TSD). The 2016 Agreement uses number of lanes and other criteria to screen projects involving highway links, unskewed intersections and interchanges with adjacent unskewed intersections.

[1] See: https://www.gpo.gov/fdsys/pkg/CFR-2015-title40-vol20/xml/CFR-2015-title40-vol20-sec93-102.xml
[2] ICF International, Zamurs and Associates LLC, and Volpe Transportation Systems Center, "*Programmatic Agreements for Project-Level Air Quality Analyses*", NCHRP 25-25 (78), 2015. See: http://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=3311

As the new NCHRP template agreement does not include skewed intersections, the 2016 FHWA-VDOT Agreement incorporates by reference the previously existing 2009 FHWA-VDOT "*Project-Level Carbon Monoxide Air Quality Studies Agreement"* (hereinafter "2009 Agreement") that did include skewed intersections. Under the terms of the 2009 Agreement, project-level air quality (hot-spot) analyses are typically only conducted for CO for projects that exceed specified ADT and level of service (LOS) thresholds or for any project for which an Environmental Impact Statement is being prepared. Different ADT thresholds are specified for different intersection skew angles. Worst-case ranked intersections and interchanges that cannot be screened using the Agreement are quantitatively assessed using worst-case modelling assumptions for CO consistent with the VDOT Resource Document.

Projects that meet the criteria specified in the 2016 Agreement (or by reference the thresholds from the 2009 Agreement) do not require project-specific modelling for CO. For those projects, the air quality analysis can simply reference as appropriate the 2016 Agreement and the worst-case modelling for CO on which its thresholds/criteria are based.

In March of 2006, EPA and FHWA issued joint guidance for conducting a hot-spot analysis for particulate matter[3]. The guidance applies to projects within a maintenance or non-attainment area for $PM_{2.5}$ and outlines the criteria for determining whether a project is considered to be one of "air quality concern". EPA recently updated the Transportation Conformity guidance for quantitative hot-spot analyses in November of 2015[4]. The Study Corridor is located in an area designated by EPA as attainment for the coarse particulate matter (PM_{10}) and fine particulate matter ($PM_{2.5}$) NAAQS; therefore, transportation conformity requirements pertaining to particulate matter do not currently apply for this Project.

In December of 2012, the FHWA issued an interim guidance update regarding the evaluation of Mobile Source Air Toxics (MSAT)[5] in NEPA analyses and included projections utilizing the EPA MOVES emission model and updated research on air toxic emissions from mobile sources. In accordance with the MSAT guidance, the study area is best characterized as a project with "higher potential MSAT effects" since projected design year traffic is expected to reach the 140,000 to 150,000 annual average daily traffic (AADT) thresholds. Therefore, a quantitative MSAT analysis has been completed. It is important to note that the 2012 guidance was updated in October 2016 using EPA's MOVES2014 model. The updated guidance shows that there will be a combined reduction of over 90% in the total annual emissions rate for priority MSATs between 2010 and 2050 (the 2012 guidance showed over 80% reduction). Also, the 2016 guidance update projected an increase in VMT over 45% over this time period (the 2012 guidance had an increase of VMT over 100% during this time period). Therefore, the 2012 guidance represents a worst-case scenario compared to the 2016 guidance in terms of the model used and the VMT increase.

Climate change is a critical national and global concern. Human activity is changing the earth's climate by causing the buildup of heat-trapping greenhouse gas (GHG) emissions through the burning of fossil fuels and other human activities. Carbon dioxide (CO_2) is the largest component of human produced emissions; other prominent emissions include methane (CH_4), nitrous oxide (N_2O) and hydrofluorocarbons (HFCs). These emissions are different from criteria air pollutants since their effects

[3] http://www.fhwa.dot.gov/environment/air_quality/conformity/policy_and_guidance/pmhotspotguidatt.cfm
[4] https://www3.epa.gov/otaq/stateresources/transconf/documents/420b15084.pdf
[5] http://www.fhwa.dot.gov/environment/air_quality/air_toxics/policy_and_guidance/aqintguidmem.cfm

in the atmosphere are global rather than localized, and also since they remain in the atmosphere for decades to centuries, depending on the species.

Greenhouse gas emissions have accumulated rapidly as the world has industrialized, with concentration of atmospheric CO_2 increasing from roughly 300 parts per million in 1900 to over 400 parts per million today. Over this timeframe, global average temperatures have increased by roughly 1.5 degrees Fahrenheit (1 degree Celsius), and the most rapid increases have occurred over the past 50 years. Scientists have warned that significant and potentially dangerous shifts in climate and weather are possible without substantial reductions in greenhouse gas emissions. They commonly have cited 2 degrees Celsius (1 degree Celsius beyond warming that has already occurred) as the total amount of warming the earth can tolerate without serious and potentially irreversible climate effects. For warming to be limited to this level, atmospheric concentrations of CO_2 would need to stabilize at a maximum of 450 ppm, requiring annual global emissions to be reduced 40-70 percent below 2010 levels by 2050.[6] State and national governments in many developed countries have set GHG emissions reduction targets of 80 percent below current levels by 2050, recognizing that post-industrial economies are primarily responsible for GHGs already in the atmosphere. As part of a 2014 bilateral agreement with China, the US pledged to reduce GHG emissions 26-28 percent below 2005 levels by 2025; this emissions reduction pathway is intended to support economy-wide reductions of 80 percent or more by 2050.[7] To date, EPA has not established any air quality standards for GHG under the NAAQS, however, the EPA is taking a number of steps to address climate change from both stationary and mobile sources through:

- Collecting emissions data;
- Reducing GHG through regulatory initiatives (e.g. vehicle greenhouse gas rules, clean power plan, renewable fuel standard, new generation clean vehicle standards)
- Reducing EPA's carbon footprint;
- Evaluating Policy Options and the cost benefits
- Partnering Internationally along with States, Localities, and tribes
- Helping communities adapt.

As such, a qualitative analysis of GHG emissions was conducted to address climate change impacts from the Project.

Methodology

Project-level analyses for highway projects typically consist of evaluations of carbon monoxide (CO), particulate matter (PM), and Mobile Source Air Toxics (MSATs). The methodologies and assumptions applied for the analysis for each pollutant, which are discussed below, are consistent with FHWA and

[6] IPCC, 2014: Climate Change 2014: Synthesis Report Summary for Policymakers. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.
[7] "US-China Joint Announcement on Climate Change," White House, Office of the Press Secretary, November 11, 2014, on the White House website, https://www.whitehouse.gov/the-press-office/2014/11/11/us-china-joint-announcement-climate-change, accessed June 5, 2015.

EPA guidance as well as the VDOT Project Level Air Quality Analysis Resource Document[8] including its associated on-line data repository.

Carbon Monoxide

The CO hot-spot analysis utilized the traffic assessment conducted by the design team for the 2015 existing year, interim year Build and No-Build (2028), and the design year Build and No-Build (2040) conditions.

Intersections

An analysis of the LOS and peak hourly volumes was evaluated for each Alternative to confirm the worst-case intersection locations for consideration under the 2016 Agreement. The intersections were ranked for each Alternative using peak AM and PM volumes and LOS criteria as specified in the EPA guidance. The three highest ranked intersections by LOS and the higher of the AM or PM peak hourly ranked volumes were summarized for each Alternative (Figures are included in Section 4 and Appendix A of the *HRCS Air Quality Technical Report* denoting the worst-case intersections of each Alternative).

The 2016 Agreement was then applied to screen the worst-case intersections for each Alternative. Based on the traffic forecasts, all of the worst-case intersections identified for each Alternative would meet the design year ADT thresholds referenced in that Agreement. Project-specific CO hot spot modeling therefore is not needed for any of the intersections, as they can be cleared based on the Agreement and the worst-case CO hot-spot modeling for intersections on which it was based.

Interchanges

Similarly, the interchanges were also ranked by worst-case volumes for the mainline traveling through each interchange. Traffic volumes used in the ranking of the interchanges as well as the interchange locations studied for each Alternative is included in Section 4 and Appendix A of the *HRCS Air Quality Technical Report*. The top five interchanges by volume for each Alternative were further analyzed to include skew angles, average speeds, and LOS along the mainline for evaluation and justification for any additional interchanges for modeling beyond just worst-case traffic volumes.

In summary, the worst-case interchanges which were modeled based on the methodology described above are as follows:

- I-64 and I-664 (Northern Termini) (I-64 Exit 264 and I-664 Exit 1)
- I-564 and Route 460/Granby St and I-64 (I-64 Exit 276)
- I-64 and Route 167 Lasalle Ave (I-64 Exit 265)
- I-664 and West Military Hwy (I-664 Exit 13)
- I-664 and I-64 (Southern Termini) (I-664 Exit 15 and I-64 Exit 299)

For the highway interchanges, a worst-case analysis approach was taken using the latest version of the FHWA CAL3i program to develop conservative estimates for CO concentrations using a number of simplifying assumptions as discussed in more detail in Section 4 of the *HRCS Air Quality Technical Report*.

[8] VDOT Project–Level Air Quality Analysis Resource Document, April 2016.

Tunnel Assessment

The methodology and assumptions for assessing the tunnel air quality analysis were consistent with the most recent FHWA guidance: *Revised Guidelines for the Control of Carbon Monoxide (CO) Levels in Tunnels* and the methodologies developed from the Downtown Tunnel-Midtown Tunnel-Martin Luther King Freeway Extension (DT-MT-MLK) project in August, 2010. The methodology included a series of calculations using the tunnel dimensions, ventilation system data, and traffic emissions and assumptions to estimate the CO concentration inside the tunnel. According to the American Society of Heating, Refrigeration, and Air Conditioning (ASHRAE) standard, tests and operating experience have shown that when CO is adequately controlled, the other vehicle emission pollutants are likewise adequately controlled. Therefore, the analysis demonstrates that the one-hour CO NAAQS of 35 ppm along with the FHWA/EPA 15-minute exposure level of 120 ppm will be met inside the new tunnels. The analysis was conducted for the Existing, No-Build and each of the four 2040 Build Alternatives for two worst-case scenarios: 1) peak-hour conditions in order to address the worst-case scenario associated with routine peak hour traffic operations; and 2) an incident (idling) that stops traffic such as an accident or vehicle breakdown. A detailed discussion of the methodologies and assumptions used in the CO tunnel analysis is presented in Section 5 of the *HRCS Air Quality Technical Report*.

Mobile Source Air Toxics (MSAT)

The affected network for the MSAT analysis was developed using the Hampton Roads Travel Demand Forecast Model for each Alternative. Using the forecast model, the affected network will extend well-beyond the study area in order to capture changes in MSAT emissions due to changes in traffic volumes when comparing the No-Build to each Build Alternative condition. The affected networks for each Alternative were developed using as many of the FHWA criteria for which traffic data existed. For this analysis, the daily volume change and travel time change for congested and uncongested links was used to develop each network. Based on traffic projections for the base, opening year, and design years, the segments directly associated with the Study Area Corridors and those roadways in the affected network; where the AADT is expected to change +/- 5 percent or more and where travel time is expected to change by +/- 10 percent for the Build Alternatives compared to the No-Build Alternatives were identified. The affected network for each of the Build Alternatives is shown in Figures 4-11 through 4-18 of the *HRCS Air Quality Technical Report.* The EPA MOVES2014a model was utilized in order to obtain air toxic emissions for acrolein; benzene; 1,3-butadiene; diesel PM; formaldehyde; naphthalene; and polycyclic organic matter. Details on the traffic methodology used to develop the affected network and associated MOVES2014a inputs for each condition and Alternative are discussed in the *HRCS Air Quality Technical Report*.

Climate Change and Greenhouse Gas Emissions

GHG emissions from vehicles using roadways are a function of distance traveled (expressed as vehicle miles traveled, or VMT), vehicle speed, and road grade. GHG emissions are also generated during roadway construction and maintenance activities. VMT derived from the MSAT Affected Network for each Alternative was used to characterize the VMT changes for the GHG discussion as the links identified in the Affected Network include only roadway links that could significantly impact the project Study Area (based on FHWA criteria) and excludes roadway links not affected by the Alternatives.

VMT was not used to calculate GHG emissions for each Alternative because there is no context in which to evaluate the results. For example, there are no significance thresholds for mobile source GHG

emissions nor has the EPA or FHWA identified specific factors to consider in making a significance determination for GHG emissions. CEQ has noted that "it is not currently useful for the NEPA analysis to attempt to link specific climatological changes, or the environmental impacts thereof, to the particular project or emissions; as such direct linkage is difficult to isolate and to understand."[9] Accordingly, it is not useful to attempt to determine the significance of such impacts. There is a considerable amount of ongoing scientific research to improve understanding of global climate change and EPA and FHWA guidance will evolve as the science matures or if new Federal requirements are established. While the results could be used to differentiate between Alternatives, the VMT from which these emissions would be calculated serves the same purpose.

Indirect Effects

Effects of the project that would occur at a later date or are fairly distant from the project are referred to as indirect effects. Cumulative impacts are those effects that result from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions. Cumulative impacts are inclusive of the indirect effects. As summarized in the Environmental Consequences, the potential for indirect effects or cumulative impacts to air quality that may be attributable to this project is not expected to be significant.

Affected Environment

The Study Area Corridors are located in Chesapeake, Hampton, Newport News, Norfolk, Portsmouth, and Suffolk, Virginia. The EPA Green Book[10], which lists non-attainment, maintenance, and attainment areas, was reviewed to determine the designations for the jurisdictions within Hampton Roads in which the project is located. These include Chesapeake, Hampton, Newport News, Norfolk, Portsmouth, and Suffolk. The EPA Green Book shows that all of the jurisdictions in the region, including those spanning the entire project corridor, are designated as being in attainment for all of the NAAQS[11].

Environmental Consequences

The air quality analyses for the Draft SEIS was prepared using the 2034 Hampton Roads Transportation Planning Organization (HRTPO) travel demand model, which was the latest model available at the time. The 2034 model outputs were post-processed to produce 2040 peak hour volumes for the I-64 Study Area Corridor. These 2040 peak hour volumes were then used to support the air analysis. The mobile source air toxics (MSAT) and greenhouse gas (GHG) climate change air quality analyses relied on the raw 2034 model output, which was factored up to 2040 values by globally increasing the daily and peak hour link volumes by 7 percent, and re-computing the congested speeds for each link using the model's built-in Volume-Delay functions (VDFs). During the course of the preparation of the Final SEIS (August 8, 2016),

[9] CEQ (2010). Draft Guidance Consideration of the Effects of Climate Change and Greenhouse Gas Emissions, 75 Federal Register 8046 (February 23, 2010) available at http://www.whitehouse.gov/sites/default/files/microsites/ceq/20100218-nepa-consideration-effects-ghg-draft-guidance.pdf

[10] EPA Green Book: https://www3.epa.gov/airquality/greenbook/faq.html

[11] Effective April 6, 2015, EPA revoked the 1997 eight-hour ozone NAAQS for which the Hampton Roads region had previously been in attainment-maintenance. Therefore, the associated transportation conformity requirements that applied at the time that the FEIS was prepared no longer apply. See: https://www.gpo.gov/fdsys/pkg/FR-2015-03-06/pdf/2015-04012.pdf

the HRTPO released the 2040 HRTPO travel demand model. This updated model was used to update the traffic forecasts for the Preferred Alternative, including forecasts for basic HOV and HOT options.

To determine whether the air analysis should be updated for the Final SEIS to document a worst-case scenario, the Draft SEIS traffic forecasts were compared against the Final SEIS forecasts and model output. The Draft SEIS daily and peak hour volumes were higher than the revised Final SEIS volumes based on the 2040 model. Therefore, the worst-case scenario for CO, MSAT, and GHG emissions had already been analyzed during the Draft SEIS, and this finding is presented in the *Traffic, Air, and Noise Analyses Update* (**Appendix G**). Likewise, the raw model output for the HOV and HOT scenarios do not indicate that traffic volumes are expected to exceed the daily and peak hour volumes already developed for the Draft SEIS. It was reasonably concluded that the Draft SEIS traffic forecasts and the corresponding air analysis represent the worst-case traffic scenario (compared to the Final SEIS), and no updated air quality analyses were deemed necessary for the Final SEIS.

The microscale analysis was conducted using the latest version of the EPA MOVES (MOVES2014a) and CAL3QHC models to estimate worst-case CO concentrations at individual receptor (i.e., receiver) locations. Peak CO concentrations resulting from the project at each location were then added to the appropriate CO background concentrations to determine the worst-case CO impacts at each location. These values were then compared to the 1-hour and 8-hour CO NAAQS to determine compliance.

The results of the 1-hour and 8-hour CO hot-spot analysis for the worst-case interchange locations is presented in **Table 3-23** for the Existing, Interim, Design Year Build, and No-Build conditions.

Table 3-23: Modeling Results for the Worst-Case Interchanges

Intersection / Interchange	Averaging Period	2015[1, 2]	2028[1, 2]		2040[1, 2]		NAAQS (ppm)
		Base (No-Build)	No-Build Alternative	Build Alternative	No-Build Alternative	Build Alternative	
		Peak (ppm)	Peak (ppm)	Peak (ppm)	Peak (ppm)	Peak (ppm)	
I-64 and I-664 (northern Termini)	1-Hour	11.5 (4)	3.7 (4)	6.5 (4)	3.0 (4)	4.6 (4)	35
	8-Hour	8.2 (4)	2.4 (4)	4.5 (4)	1.9 (4)	3.1 (4)	9
I-564 and Route 460 and I-64	1-Hour	10.7 (13)	3.8 (9)	6.2 (13)	3.1 (9)	4.4 (13)	35
	8-Hour	7.6 (13)	2.5 (9)	4.3 (13)	1.9 (9)	2.9 (13)	9
I-64 and Route 167 Lasalle Ave	1-Hour	8.0 (9)	3.0 (10)	4.8 (6)	2.6 (13)	3.6 (5)	35
	8-Hour	5.6 (9)	1.9 (10)	3.2 (6)	1.6 (13)	2.3 (5)	9
I-664 and West Military Hwy	1-Hour	10.3 (1)	3.5 (13)	5.9 (1)	2.9 (13)	4.2 (1)	35
	8-Hour	7.3 (1)	2.2 (13)	4.0 (1)	1.8 (13)	2.8 (1)	9
I-664 and I-64 (southern Termini)	1-Hour	8.9 (4)	3.6 (4)	5.4 (4)	3.1 (4)	3.9 (2)	35
	8-Hour	6.3 (4)	2.3 (4)	3.7 (4)	1.9 (4)	2.5 (2)	9

Notes:
1. Number in parenthesis represents the modeled receptor number of maximum modeled concentration from CAL3QHC. Please refer to Figures 4.5 through 4-9.
2. Modeled concentrations includes 1-hour Background Value of 2.0 ppm and 8-hour background value of 1.1 ppm

The highest 1-hour predicted concentrations for the base, opening and design year build and no-build conditions were 11.5 ppm, 6.5 ppm and 4.6 ppm, respectively. The maximum 1-hour concentration for all base and future build and no-build conditions was predicted to occur at the I-64 and I-664 (Northern Termini) interchange. However, all predicted peak 1-hour CO concentrations are well below the 1-hour CO NAAQS of 35 ppm.

The highest 8-hour concentrations for the base, opening and design year build and no-build conditions were 8.2 ppm, 4.5 ppm and 3.1 ppm, respectively. Similar to the peak 1-hour concentrations, the maximum 8-hour CO concentration was also predicted to occur at the I-64 and I-664 (Northern Termini) interchange for the base and future build and no-build conditions. However, all predicted peak 8-hour CO concentrations are also below the 8-hour CO NAAQS standard of 9 ppm.

These results demonstrate that the worst-case interchanges for each existing, build and no-Build Alternative using very conservative assumptions would not cause or contribute to a violation of the CO NAAQS within the study corridor, and thereby satisfies all NEPA and CAA requirements pertaining to CO.

Tunnel Carbon Monoxide

Included in the air quality evaluation is the addition of new tunnels. A series of new tunnels are proposed along the I-64, I-564 Connector, and I-664 Study Area Corridors.

The ventilation system within the proposed tunnels would be designed consistent with the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE) Handbook, Chapter 15, Enclosed Vehicular Facilities - Tunnels[12]. The ventilation system design is based on controlling the level of emissions to acceptable concentrations inside the tunnel during normal operations, along with the capacity to remove smoke and gases during emergencies. The design assures the personal safety of both the traveling public, as well as highway/emergency workers. Further, the air quality within the tunnel would be consistent with normal ventilation air quantities as stated in the above referenced ASHRAE standard.

The results of the analysis show that CO levels in the tunnels are estimated to be below the one-hour CO NAAQS of 35 ppm and below the 15-minute FHWA/EPA guideline level of 120 ppm for both the peak hour and incident (idling) condition for all the Alternatives including the Build and No-Build conditions. The Existing and No-Build condition only includes the existing eastbound and westbound HRBT tunnels along I-64. The estimated worst-case CO concentration for the peak hour condition for the Existing condition is 24.0 ppm which is 20 percent of the FHWA/EPA guideline level and 68 percent of the CO NAAQS. The estimated worst-case CO concentration for the idling conditions is 11.1 ppm which is 9 percent of the FHWA/EPA guideline level and 32 percent of the CO NAAQS. Similarly, the estimated worst-case CO concentration for the peak hour condition for the No-Build condition is 12.4 ppm which is 10.3 percent of the FHWA/EPA guideline level and 35 percent of the CO NAAQS. The estimated worst-case CO concentration for the idling condition is 3.0 ppm which is 3 percent of the FHWA/EPA guideline level and 9 percent of the CO NAAQS.

For the peak hour condition for the Build Alternatives, the estimated worst-case CO concentration is 10.5 ppm (Alternative C I-664 Northbound) and is 30 percent of the CO NAAQS and 9 percent of the FHWA/EPA guideline level. For the incident idling condition, the estimated worst-case CO concentration

[12] 2015 ASHRAE Handbook -- HVAC Applications: Chapter 15, Enclosed Vehicular Facilities (SI)

is 7.0 ppm (Alternative C I-664 and I-564 Bus Only) and is 20 percent of the CO NAAQS and 6 percent of the FHWA/EPA guideline level.

The calculations include the one-hour CO ambient background level of 2.1 ppm, which was assumed to exist in the tunnel ventilation supply air.

Particulate Matter

The Study Area Corridors are located in the Hampton Roads Area which is designated by EPA as attainment for the coarse particulate matter (PM_{10}) and fine particulate matter ($PM_{2.5}$) NAAQS; therefore, transportation conformity requirements pertaining to particulate matter do not apply for this study. Regardless, the latest 3-year (2012-2014) monitoring data reported by the VDEQ for the Hampton monitor site show that the 24-hour and annual $PM_{2.5}$ background concentrations in the Study Area Corridors are 17 micrograms per cubic meter (ug/m^3) and 7.5 ug/m^3, respectively, which are both well below the respective $PM_{2.5}$ NAAQS of 35ug/m^3 and 12 ug/m^3.

Mobile Source Air Toxics

A quantitative MSAT analysis was conducted consistent with the guidance developed by FHWA. These include the 2012 Interim Guidance Update mentioned earlier, and the FHWA preliminary guidance for addressing a quantitative MSAT analysis using MOVES titled "Quick-start Guide for Using MOVES for a NEPA Analysis" along with training material developed by FHWA that provided detailed direction on the preparation of quantitative MSAT analyses. FHWA issued updated guidance for MSAT analyses in late 2016, as previously referenced. The updated guidance makes no material changes to the modeling approach, with the exception of the addition of two pollutants (acetaldehyde and ethylbenzene) to the list of MSATs to be assessed. The new guidance shows how emissions of these pollutants are expected to decline over the next few decades, with the same general downward trend applying for the two added pollutants.

The results of the quantitative MSAT analysis are presented in **Table 3-24**. Changes in emissions compared to the No-Build for the 2028 and 2040 condition and between the Build and base year are presented in **Table 3-25**. These tables show that all of the MSAT emissions are expected to increase slightly for the Build Alternative scenario when compared to the No-Build condition for 2028 and 2040. In addition, all MSAT pollutant emissions are expected to significantly decline in the opening and design years when compared to existing conditions. The downward trend in emissions is a result of technological improvements, i.e., more stringent vehicle emission and fuel quality standards coupled with ongoing fleet turnover, and is achieved despite increased VMT in this period.

In all cases, the magnitude of the MSAT emissions is small in the opening and design years and significantly lower than in the base year. Due to the small magnitude of projected MSAT emissions, the increase observed in 2028 and 2040 from the No-Build to the Build scenarios are not considered significant, especially when considering that emissions from all MSATs are expected to be significantly lower in future years than in the base year. The two new pollutants (acetaldehyde and ethylbenzene) added to FHWA's 2016 updated guidance were not included in the quantitative analysis. However, because the trends of these two pollutants over time closely resemble the trends for benzene and formaldehyde, the foregoing conclusions for the MSAT pollutants analyzed would also apply to acetaldehyde and ethylbenzene. Overall, the results of the MSAT analysis are consistent with national MSAT emission trends predicted by FHWA. No meaningful increases in MSATs have been identified and

are not expected to cause an adverse effect on human health as a result of any of the Build Alternatives in future years.

Table 3-24: Projected Annual MSAT Emissions in tons per year (TPY) on "Affected Network"

Year	Alternative	Annual Vehicle Millions of Miles Traveled (AVMT)	Acrolein (TPY)	Benzene (TPY)	1,3 Butadiene (TPY)	Diesel PM (TPY)	Formaldehyde (TPY)	Naphthalene (TPY)	Polycyclic Organic Matter (TPY)
2015 Base Year	Existing Alternative A	2,428.1	0.544	10.15	1.190	36.30	8.52	1.04	0.450
	Existing Alternative B	3,645.0	0.835	15.42	1.820	55.30	13.03	1.58	0.687
	Existing Alternative C	4,111.2	0.891	16.83	1.970	58.24	13.97	1.70	0.737
	Existing Alternative D	4,571.8	0.989	18.71	2.189	64.62	15.51	1.89	0.820
2028 Opening Year	Alternative A	3,564.9	0.196	4.05	0.049	8.94	3.66	0.373	0.154
	No-Build	3,492.8	0.187	4.04	0.046	8.42	3.50	0.360	0.152
	Alternative B	4,459.2	0.239	5.08	0.059	10.82	4.48	0.459	0.191
	No-Build	4,288.9	0.225	4.94	0.055	10.05	4.22	0.435	0.184
	Alternative C	5,274.1	0.275	6.00	0.068	12.36	5.16	0.531	0.223
	No-Build	5,064.6	0.274	5.67	0.067	12.00	5.00	0.528	0.212
	Alternative D	5,775.6	0.317	6.46	0.079	14.74	5.94	0.602	0.245
	No-Build	5,519.9	0.289	6.27	0.071	13.01	5.43	0.557	0.233
2040 Design Year	Alternative A	3,236.3	0.104	1.88	0.006	4.17	2.23	0.199	0.070
	No-Build	3,112.1	0.095	1.81	0.005	3.78	2.04	0.184	0.068
	Alternative B	4,859.9	0.145	2.82	0.008	5.71	3.10	0.281	0.105
	No-Build	4,647.8	0.139	2.70	0.008	5.49	2.97	0.269	0.100
	Alternative C	5,619.7	0.166	3.28	0.009	6.54	3.56	0.323	0.123
	No-Build	5,328.3	0.160	3.06	0.009	6.33	3.42	0.309	0.113
	Alternative D	6,385.6	0.189	3.67	0.010	7.46	4.04	0.366	0.136
	No-Build	5,972.6	0.183	3.45	0.010	7.29	3.91	0.352	0.129

Table 3-25: Projected Annual MSAT Change in Emissions (Percent) on "Affected Network"

Year	Alternative	Change Annual Vehicle Millions of Miles Traveled (AVMT)	Acrolein (TPY)	Benzene (TPY)	1,3 Butadiene (TPY)	Diesel PM (TPY)	Formaldehyde (TPY)	Naphthalene (TPY)	Polycyclic Organic Matter (TPY)
2028 Opening Year	Difference (Alternative A-No-Build)	72.10	0.01	0.01	0.00	0.52	0.16	0.01	0.00
	Difference (Alternative A-Existing)	1136.8	-0.348	-6.1	-1.141	-27.36	-4.86	-0.667	-0.296
	Difference (Alternative B- No-Build)	170.30	0.01	0.14	0.00	0.77	0.26	0.02	0.01
	Difference (Alternative B-Existing)	814.2	-0.596	-10.34	-1.761	-44.48	-8.55	-1.121	-0.496
	Difference (Alternative C-No-Build)	209.50	0.00	0.33	0.00	0.36	0.16	0.00	0.01
	Difference (Alternative C-Existing)	1162.9	-0.616	-10.83	-1.902	-45.88	-8.81	-1.169	-0.514
	Difference (Alternative D-No-Build)	255.70	0.03	0.19	0.01	1.73	0.51	0.04	0.01
	Difference (Alternative D-Existing)	1203.8	-0.672	-12.25	-2.11	-49.88	-9.57	-1.288	-0.575
2040 Design Year	Difference (Alternative A-No-Build)	124.20	0.01	0.07	0.00	0.39	0.19	0.02	0.00
	Difference (Alternative A-Existing)	808.2	-0.44	-8.27	-1.184	-32.13	-6.29	-0.841	-0.38
	Difference (Alternative B-No-Build)	212.10	0.01	0.12	0.00	0.22	0.13	0.01	0.00
	Difference (Alternative B-Existing)	1214.9	-0.69	-12.6	-1.812	-49.59	-9.93	-1.299	-0.582
	Difference (Alternative C-No- Build)	291.40	0.01	0.22	0.00	0.21	0.14	0.01	0.01
	Difference (Alternative C-Existing)	1508.5	-0.725	-13.55	-1.961	-51.7	-10.41	-1.377	-0.614
	Difference (Alternative D-No-Build)	413.00	0.01	0.22	0.00	0.17	0.13	0.01	0.01
	Difference (Alternative D-Existing)	1813.8	-0.8	-15.04	-2.179	-57.16	-11.47	-1.524	-0.684

Climate Change and Greenhouse Gas (GHG) Emissions Impacts

Under the No-Build Alternative, VMT would gradually increase in the project area for each Alternative between 2015 and 2040 as employment and population in the area increases (see **Table 3-24** for VMT by Alternative). Furthermore, under the Build Alternatives, increased capacity, less congestion, and improved transit access across Hampton Roads lead to an increase in VMT relative to the No-Build Alternative. The increase is similar because the project is anticipated to shift traffic to the mainlines from

other roadways, not necessarily increase traffic on the roadways beyond the background growth between 2015 and 2040.

Under the No-Build Alternative, VMT increases on average approximately 29 percent (the increase ranges from 28 percent to 31 percent depending on Alternative) between 2015 and 2040; under the Build Alternatives, VMT would increase on average approximately 36 percent compared to 2015 levels (the increases range from 33 percent to 39 percent depending on Alternative). For perspective, the VMT increases on average 3.7 percent (range of 2 percent to 5 percent) from the No-Build to Build Alternatives in 2028 and on average 5.2 percent (range of 4 percent to 7 percent) in 2040 depending on Alternative. Nationally, the Energy Information Administration (EIA) estimates that VMT will increase by approximately 38 percent between 2012 and 2040, so the VMT increase under the Build Alternatives is still at or below the projected national rate.

While VMT will increase as a result of the project, the anticipated increase in GHGs will be mitigated by improvements in national fuel economy standards. EIA projects that vehicle energy efficiency (and thus, GHG emissions) on a per-mile basis will improve by 28 percent between 2012 and 2040. This improvement in vehicle emissions rates will help mitigate the increase in VMT for both the No-Build and Build Alternatives. Other factors related to the project would also help reduce GHG emissions relative to the No-Build Alternative. The project would reduce congestion and improve vehicle speeds by increasing regional accessibility through providing extra lanes so that motorists can more easily pass slow-moving vehicles, improve transit access across Hampton Roads waterway, dedicated transit facilities in specific locations along with Bus Rapid Transit (BRT), and converting existing lanes to transit only lanes; the safety improvements associated with the planned upgrades would produce emissions benefits by reducing vehicle delay and idling.

The average travel speed across the mainlines within the Study Area would increase on average 49.4 miles per hour (range from 41 to 55 miles per hour) under the Build Alternatives compared to 44.7 miles per hour (range from 37 to 52 miles per hour) under the No-Build. GHG emissions rates decrease with speed over the range of average speeds encountered in this corridor, although they do increase at very high speeds. Reduction of road grade also reduces energy consumption and GHG emissions. The proposed road widening under the various Build Alternatives would match existing roadway grades. Proposed grades for both mainline and interchanges at-grade and on structure range from 0 to 4 percent. EPA estimates that each 1 percent decrease in grade reduces energy consumption and GHG emissions by 7 percent, although the effect is not linear. The safety improvements associated with the proposed widening and new Elizabeth River crossings, which include better incident management capabilities, would produce emissions benefits by reducing vehicle delay and idling.

Construction and subsequent maintenance of the project would generate GHG emissions. Construction of the roadway (e.g., earth-moving activities) involves a considerable amount of energy consumption and resulting GHG emissions. Manufacturing the materials used in construction and fuel used by construction equipment also contribute to GHG emissions. Typically, construction emissions associated with a new roadway account for approximately 5 percent of the total 20-year lifetime emissions from the roadway, although this can vary widely with the extent of construction activity and the number of vehicles that use the roadway.

The addition of new roadway miles to the study area roadway network would also increase the energy and GHG emissions associated with maintaining those new roadway miles in the future. The increase in

maintenance needs due to the addition of new roadway infrastructure would be partially offset by the reduced need for maintenance on existing routes (because of lower total traffic and truck volumes on those routes).

In connection with GHG emissions, transportation system resiliency and adaptation to extreme weather events have been a focus area for USDOT. Climate change and extreme weather events present potentially significant risks to safety, reliability, effectiveness, and sustainability of transportation infrastructure and operations. In 2008, the USDOT Center for Climate Change and Environmental Forecasting sponsored a study, *The Potential Impacts of Global Sea Level Rise on Transportation Infrastructure*. [13] The study was designed to produce high level estimates of the net effect of sea level rise and storm surge on the transportation network. As such, the study provides a broad, first look at potential sea level changes on the Atlantic coast using the predictions of global sea level rise from the Intergovernmental Panel on Climate Change (IPCC) Third and Fourth Assessment Reports. Due to the broad approach of the study and uncertainties in the models involved, the study considered sea level rise estimates from the IPCC study as uniform sea level rise estimates as opposed to estimates for a particular geographic location. The confidence stated by the IPCC in the regional distribution of sea level change is low due to significant variations in the included models; thus, according to the study, it is inappropriate to use the IPCC model series to estimate local changes in sea level rise.

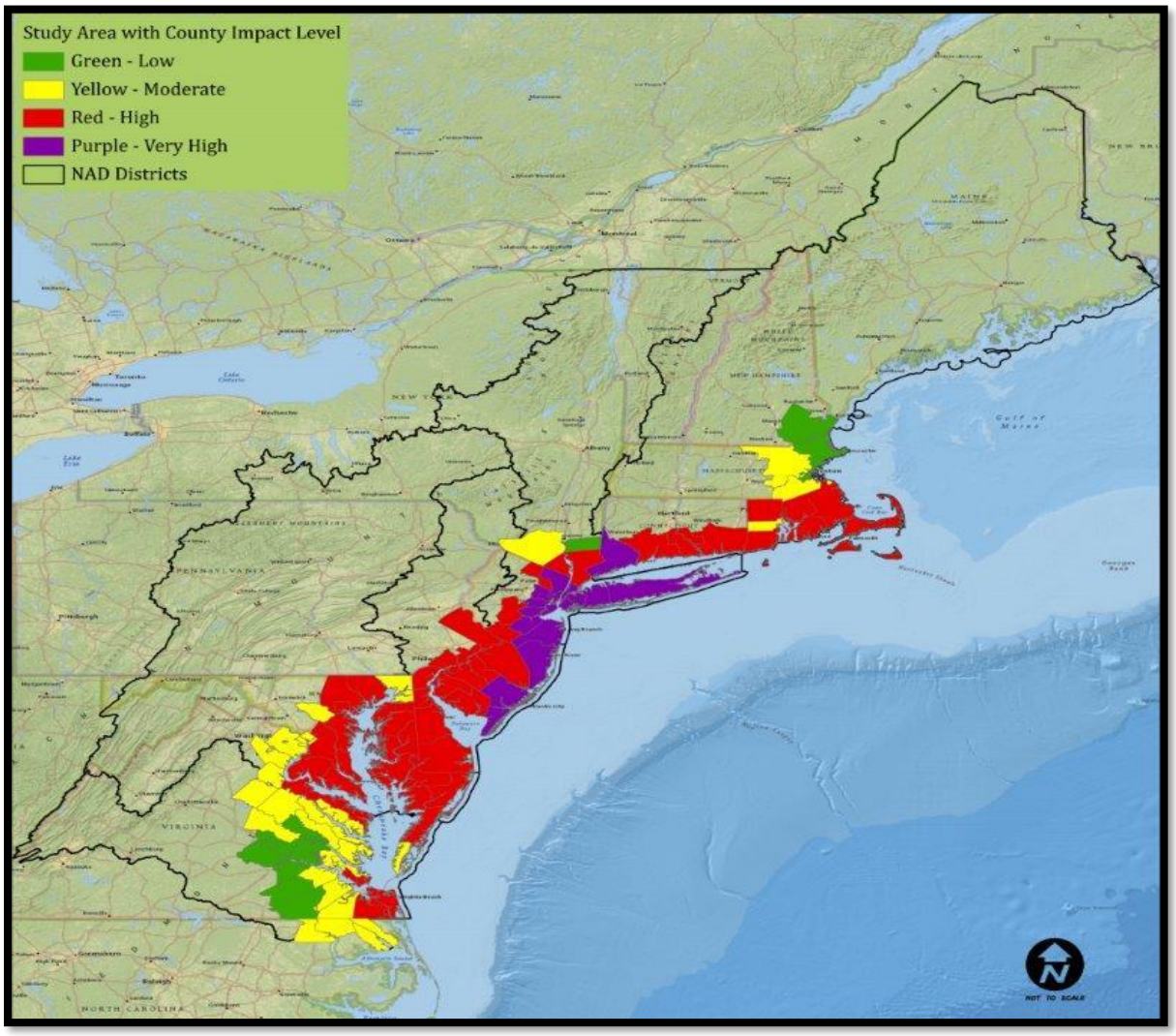
The study evaluated nine scenarios of sea level rise between 6 and 59 centimeters. For each scenario, regularly inundated areas and at-risk areas for the transportation system (i.e. highways, railroads, ports, and airports) were estimated. Based on the analysis, the majority of the HRCS study area corridors fall outside the potentially regularly inundated and at-risk areas due to sea level rise and storm surge for all scenarios. However, a couple sections of the corridors under consideration do fall within regularly inundated areas under the higher sea level rise scenarios. These portions include I-64 (in Hampton) and the VA 164 Connector (along the eastern edge of CIDMMA).

USACE completed a report detailing the results of a two-year study to address coastal storm and flood risk to vulnerable populations, property, ecosystems, and infrastructure affected by Hurricane Sandy in the United States' North Atlantic region.

The purpose the North Atlantic Coast Comprehensive Study (NACCS): Resilient Adaptation to Increasing Risk Final Report (January 2015) is to catalyze and spearhead innovation and action to implement comprehensive coastal storm risk management strategies. Action is imperative to increase resilience and reduce risk from, and make the North Atlantic region more resilient to future storms and impacts of relative sea level change (SLC). The NACCS is designed to help local communities better understand changing flood risks associated with climate change and to provide tools to help those communities better prepare for future flood risks. It builds on lessons learned from Hurricane Sandy and attempts to bring to bear the latest scientific information available for state, local, and tribal planners. The study area for the NACCS encompasses approximately 31,200 miles of coastline (**Figure 3-8**) and shows areas impacted by Hurricane Sandy with highlighted Counties included in NACCS Study Area.

[13] http://climate.dot.gov/impacts-adaptations/pdf/entire.pdf

Figure 3-8: NACCS Study Area Impact Map

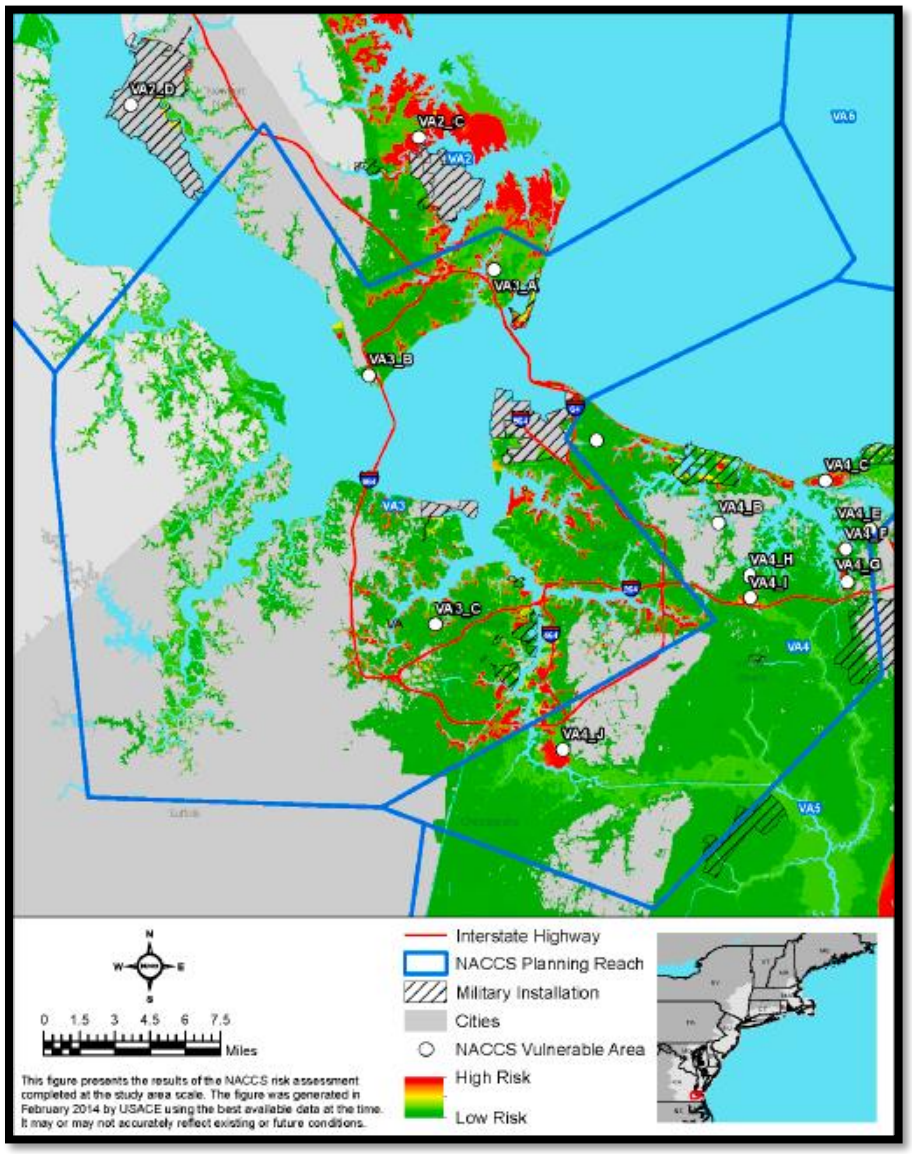


Source: North Atlantic Coast Comprehensive Study: Resilient Adaptation to Increasing Risk USACE (January 2015)

The goals of the NACCS are to provide a risk management framework, consistent with NOAA/USACE Infrastructure Systems Rebuilding Principles; and to support resilient coastal communities and robust, sustainable coastal landscape systems, considering future sea level and climate change scenarios, to reduce risk to vulnerable populations, property, ecosystems, and infrastructure. The HRCS SEIS takes into account the findings of the NACCS when assessing the potential impact of SLC and climate changes on the alternatives.

Hampton Roads, Virginia, is a low-lying, coastal metropolitan region that serves as the site for multiple military installations, including the largest naval base in the world, NAVSTA Norfolk. The NACCS describes the area VA3 (**Figure 3-9**) as where southern portion of the James River meets the Chesapeake Bay. This area also includes the Willoughby Bay and the Elizabeth, Nansemond, and Lafayette Rivers. The Port of Hampton Roads and CIDMMA are located within the reach on the Elizabeth River.

Figure 3-9: VA3 Hampton Roads Risk Areas



The NACCS conducted an exposure assessment for different categories including population density and infrastructure, social vulnerability, and environmental and cultural resources. Both Hampton and Norfolk, the location of the Preferred Alternative, are included in this assessment. Within the City of Hampton, flooding occurs along the Newmarket Creek, Back River, and other tidal tributaries. The City of Norfolk is an urbanized, densely populated city with approximately 70 percent of its land use classified as residential. It is a low-lying community with 144 miles of shoreline. In addition to NAVSTA Norfolk, this area is also home to the North American Headquarters for NATO and the Norfolk International Airport. The proximity to tidally influenced tributaries, proximity to shorelines, and low-lying areas make both cities at risk of flooding impacts. In addition, the City of Hampton has one census tract and the City of Norfolk has four census tracts that are considered to have high social vulnerability due to the large percent of persons living below the poverty level. No environmental and/or cultural resources exposure areas were identified in the analysis.

VA3 covers a large segment of the Hampton Roads Region, including Hampton, southern Newport News, Suffolk, Portsmouth, Chesapeake, and Norfolk. The majority of Virginia's Federal deep draft navigation channels are in VA3. The Cape Henry and Thimble Shoal channels are at the mouth of the Chesapeake Bay and the Willoughby and Norfolk Harbor Channels are on the Elizabeth River. There are also Federal shore stabilization and flood risk management projects located throughout including Hampton University, Anderson Park, and the Norfolk floodwall project. Hampton University and Anderson Park are both small shoreline stabilization projects that were designed only to prevent land loss under normal conditions and would not provide coastal storm risk management to any structures during a coastal storm event, as tide levels and wave heights would exceed the design of the revetment structures.

There are three projects in VA3 that were designed for the purpose of coastal storm damage reduction on the Chesapeake Bay. One of these, the Chesapeake Bay Shoreline project, is a USACE project that was cost shared with the City of Hampton. The project widened the beach in front of the existing seawall that was constructed by the city and has been regularly renourished since initial construction. The City has also constructed nearshore breakwaters at the project. The other two beach projects, Salt Ponds and Willoughby, were implemented by the cities of Hampton and Norfolk, respectively. The City of Hampton regularly uses material dredged from Salt Ponds Inlet as beachfill to maintain the dunes and beach at Salt Ponds. In Norfolk, the City has been maintaining the beach in Willoughby and has also constructed nearshore breakwaters in the area. Because these projects are all well maintained and have been designed to reduce storm damages, the risk of flooding and other storm damage is lower in the areas they protect than in locations without similar flood risk management measures.

Climate change and extreme weather impacts, such as more frequent and intense heat waves and flooding, will increasingly affect system integrity and threaten the considerable federal investment in transportation infrastructure.

Climate change impacts may include, but are not limited to, shoreline retreat from erosion and inundation, increased frequency and magnitude of storm related flooding, increased frequency of minor local flooding during high tide (NOAA, 2014), and saltwater intrusion into the estuaries and aquifers.

Climate change is projected to have a number of impacts on the natural environment. Relative SLC will not only inundate the landscape, but will also be a driver of change in habitat and species distribution. Additionally, the presence of developed shorelines behind many of these habitats will prevent migration of those habitats landward and limit their capacity for adaptation. Habitat changes may be structural or functional; species that depend on coastal habitats for feeding, nesting, spawning, protection, and other activities could be severely impacted if this critical habitat is converted or lost. Additional ecosystem services provided by coastal habitats would also be affected.

Climate change is anticipated to have effects on water resources in Hampton Roads. Warming temperatures and sea level rise may cause existing water supplies to decline or disappear, forcing utilities and regions to change the way water is used and distributed. Climate change is anticipated to have water quality impacts. Greater precipitation intensity will likely increase runoff, which will decrease surface water quality. Overall, climate change is expected to impact humans culturally, socially, and economically.

Not only are the sea-levels rising and projected to continue rising in the future, but the southern Chesapeake Bay region also experiences issues related to land subsidence which enhances the impact of rising sea levels. Land subsidence is the sinking or lowering of the land surface. According to the USGS,

land subsidence has contributed to the region's highest rates of sea-level rise on the Atlantic Coast (USGS, 2013). The following is summarized from the Land Subsidence and Relative Sea-Level Rise in the Southern Chesapeake Bay Region circular prepared by USGS in 2013. Further, data indicates that land subsidence has been responsible for more than half the relative sea-level rise measured in the region. Land subsidence contributes to relative sea-level rise and also can increase flooding, alter wetland and coastal ecosystems, and damage infrastructure. As land subsidence continues to occur and sea levels rise, shoreline areas are at an increased risk of further flooding related impacts. Other impacts of land subsidence include those to sensitive ecosystems such as wetlands and marshes. These shoreline environments are subjected to increased wave action as a result of relative sea-level rise which increases damaging erosion. Infrastructure is also vulnerable to relative sea-level rise including buildings, bridges, and underground utilities. Sewer overflows would become more frequent with increased flooding as well. In relation to sea-level rise, adaptation measures could be implemented using the 2009 AASHTO Guidelines which are detailed more thoroughly in Section 6 of the *HRCS Alternatives Technical Report*. The design parameters considered for sea level rise include clearance under channel, vertical clearance above water for approach bridges, width of channel, horizontal offset from existing tunnel/bridge, and horizontal offset between new tunnels.

Newly constructed infrastructure should be designed and built in recognition of the best current understanding of future environmental risks. In order for this to happen, understanding of projected climate changes would need to be incorporated into infrastructure planning and design processes, across the many public and private builders and operators of transportation infrastructure. Building resilience to climate change risk is common-sense management to protect current and future investments and to maintain safe operational capabilities. Engineering solutions to adapt to climate vulnerabilities for highway facilities are anticipated to be implemented during project design and construction to address climate change, SLC, and extreme weather impacts. One example of an adaptation measure would be the implementation of the structural design parameters detailed in Section 6 (Table 6-3) of the *HRCS Alternatives Technical Report,* as referenced from the 2009 AASHTO Guidelines.

FHWA is partnering with VDOT, the University of Virginia (UVA), the Hampton Roads Planning District Commission (HRPDC), and HRTPO to evaluate the *Computational Enhancements for the VDOT Regional River Severe Storm Model* that is anticipated to be completed in 2017. This pilot study used an existing decision model to evaluate how the transportation priorities of the region might be influenced by a variety of climate change, economic, regulatory, travel-demand, wear-and-tear, environmental, and technology scenarios. Some of these, sea-level rise, storm surge and other extreme weather events – already are affecting Virginia's Tidewater region. Being able to accurately and quickly project the potential impacts to transportation infrastructure from forecasted weather events will become more critical, given such challenges. The VDOT Hampton Roads District has begun to address the issue by creating a flood-warning system called the Regional River Severe Storm Model. The model is a planning tool to help VDOT efficiently allocate resources when roads are closed and assist first responders with entering and exiting flood-prone areas. The purpose of this study is to speed the time from when rainfall forecasts are made to when on-the-ground projections of road closures are available to decision-makers.

The **No-Build Alternative** would not involve any construction or any efforts to adapt the existing transportation system to extreme weather impacts. As a result, environmental effects to the transportation system from climate change would continue to worsen under the No-Build Alternative.

It is expected that the **Build Alternatives** could be developed to adapt to the effects of climate change. During final design the best available climate science data and methods, as well as the results of the current FHWA/VDOT pilot study to evaluate engineering solutions, operations and maintenance strategies, and asset management plans to address risk, could be used to inform refinements to the Preferred Alternative.

Indirect Effects and Cumulative Impacts

The quantitative assessments conducted for project-specific CO and MSAT impacts can be considered indirect effects analyses because they look at air quality impacts attributable to the project that occur at a later time in the future. These analyses demonstrated that in the future, 1) air quality impacts from CO would not cause or contribute to violations of the CO NAAQS; and 2) MSAT emissions from the affected network would be significantly lower than they are today.

Regarding the potential for cumulative impacts, EPA's air quality designations for the region (as attainment of all of the NAAQS) reflect, in part, the accumulated mobile source emissions from past and present actions.

Therefore, the indirect and cumulative effects of the project are not expected to be significant.

Construction Emissions

The temporary air quality impacts from construction activities under any of the Build Alternatives are not expected to be significant. Construction activities would be performed in accordance with VDOT's current "Road and Bridge Specifications." The specifications require compliance with all applicable local, state, and federal regulations.

Mitigation

The Study Area Corridors are located within a volatile organic compounds (VOC) and nitrogen oxides (NOx) Emissions Control Area. As such, all reasonable precautions will be taken to limit the emissions of VOC and NOx. In addition, the following VDEQ air pollution regulations must be adhered to during the construction of this project: 9 VAC 5-130, Open Burning restrictions; 9 VAC 5-45, Article 7, Cutback Asphalt restrictions; and 9 VAC 5-50, Article 1, Fugitive Dust precautions.

3.7 NOISE

Methodology

The noise assessment has been performed pursuant to 23 CFR 772: Procedures for Abatement of Highway Noise and Construction Noise and the VDOT *Highway Traffic Noise Impact Analysis Guidance Manual* (Version 7, July 2015). To assess the degree of impact of highway traffic and noise on human activity, the FHWA established Noise Abatement Criteria (NAC) for different categories of land use activity (**Table 3-25**). The NAC are given in terms of the hourly, A-weighted, equivalent sound level in decibels (dBA). The A-weighted sound level is commonly used when measuring environmental noise to provide a single number descriptor that correlates with human subjective response to noise because the sensitivity of human hearing varies with frequency. The A-weighted sound level is widely accepted by acousticians as a proper unit for describing environmental noise. Most environmental noise (and the A-weighted sound level) fluctuates from moment to moment, and it is common practice to characterize the fluctuating level by a single number called the equivalent sound level (L_{eq}). The L_{eq} is the value or level

of a steady, non-fluctuating sound that represents the same sound energy as the actual time-varying sound evaluated over the same time period. For traffic noise assessment, L_{eq} is typically evaluated over a one-hour period, and may be denoted as $L_{eq}(h)$.

In this study, residential (Category B), recreational (Category C), indoor institutional (Category D) and commercial (Category E) land uses are evaluated for noise impact. For Categories B and C, noise impact is assumed to occur when predicted exterior noise levels approach or exceed 67 dBA in terms of $L_{eq}(h)$ during the loudest hour of the day. For Category D (noise-sensitive institutional) land uses such as schools and church buildings, impact is projected where predicted interior sound levels due to the Project would approach or exceed 52 dBA, $L_{eq}(h)$. For Category E land uses, examples of which are outdoor eating areas adjacent to restaurants or offices and motel swimming pools, noise impact is assumed to occur when predicted exterior noise levels due to the Project approach or exceed 72 dBA in terms of $L_{eq}(h)$ during the loudest hour of the day. VDOT defines the word "approach" in "approach or exceed" as within 1 decibel. Therefore, the threshold for noise impact is where exterior noise levels are within 1 decibel of 67 dBA $L_{eq}(h)$, or 66 dBA for Categories B and C, and within one decibel of 72 dBA $L_{eq}(h)$, or 71 dBA for Category E. For Category D, the threshold for noise impact is where interior noise levels are within 1 decibel of 52 dBA $L_{eq}(h)$, or 51 dBA. Noise impact also would occur wherever Project noise causes a substantial increase over existing noise levels. VDOT defines a substantial increase as an increase of 10 decibels or more above existing noise levels.

All traffic noise computations for this study were conducted using the latest version of the FHWA Traffic Noise Model (FHWA TNM version 2.5). TNM incorporates state-of-the-art sound emissions and sound propagation algorithms, based on well-established theory or on accepted international standards. The acoustical algorithms contained within TNM have been validated with respect to carefully conducted noise measurement programs, and show excellent agreement in most cases for sites with and without noise barriers.

Available project engineering plans, aerial photography, topographic contours and building information are used to create a three-dimensional model in the TNM of the geometry of the existing and future design roadway configurations and the surrounding terrain and buildings. The noise modeling also accounts for such factors as propagation over different types of ground (acoustically soft and hard ground), elevated roadway sections, significant shielding effects from local terrain and structures, distance from the road, traffic speed, and hourly traffic volumes including percentage of medium and heavy trucks. To fully characterize existing and future noise levels at all noise-sensitive land uses in the study area, over 6,600 noise prediction receivers (also called "receptors" and "sites"), were added to the measurement sites in TNM.

To fully account for potential noise impacts, barrier analysis along VA 164 assumed widening to the outside. Additional detailed information regarding the noise analysis methodology is provided in the *HRCS Noise Technical Report*.

Affected Environment

The existing, measured short-term noise levels are provided in **Table 3-26** as equivalent sound levels (L_{eq}), along with site address. The measured "Total" L_{eq} range from a low of 52 dBA at the Churchland High School baseball field in Portsmouth (Site M54) to a high of 74 dBA at 9279 Coleman Avenue in Norfolk (Site M25). These measurement results also show that the measured total L_{eq}s and the "Traffic-only" L_{eq}s are the same at most sites, which is an indication that traffic is the dominant source of

noise at most locations in spite of the presence of occasional aircraft. Monitoring at sites M1 through M31 was conducted during 2011 for the HRBT Draft EIS study, sites M32 through M69 were measured in 2015 for the HRCS SEIS project, and monitoring for sites MR1 through MR3 was carried out in 2014 for the I-564 Intermodal study.

Table 3-26: Noise Measurement Results

Site	Address	Total L_{eq}, dBA	Traffic Only L_{eq}, dBA
M1	48 Red Robin Turn, Hampton	55	55
M2	Swing Set @ Horizon Plaza Apts, Hampton	60	60
M4	1303 Patrick Court, Hampton	62	62
M5	1105 Thomas Street, Hampton	69	69
M6	808 Langley Avenue, Hampton	66	66
M7	931 Mason Street, Hampton	69	66
M8	100 Spanish Trail (Pool Deck), Hampton	61	61
M9[1]	15 Colbert Avenue, Hampton	67[1]	N/A
M10	326 Poplar Avenue, Hampton	67	67
M11	101 Brough Lane, Hampton	67	67
M12	72 S Boxwood Street. Hampton	62	62
M13	Hampton University Baseball Stadium, Hampton	62	62
M14	114 Cameron Street, Hampton	63	63
M15	9 Home Place, Hampton	63	63
M16	Small Beach East Side of I-64, Hampton	63	63
M17	1560 Chela Avenue, Norfolk	63	63
M18	1353 Bayville Court, Norfolk	66	65
M19	Int. of 14th View and Little Bay Avenue, Norfolk	65	65
M20	Pier/Beach Willoughby Boat Club, Norfolk	61	61
M21	Captain's Quarters Waterfront Park, Norfolk	59	59
M22	9605 6th View Street, Norfolk	61	58
M23	8667 O'Conner Crescent, Norfolk	69	64
M24	381 Cherry Street, Norfolk	65	62
M25	9279 Coleman Avenue, Norfolk	74	73
M26	9246 Hickory Street, Norfolk	66	61
M27[1]	235 Burgoyne Road, Norfolk	68[1]	NA
M28	15 Burrage Road, Norfolk	59	59
M29	145 Burrage Road, Norfolk	69	NA[1]
M30	8587 Granby Street, Norfolk	64	64
M31	Executive Manor Apartments Norfolk	69	69
M32	340 Bradford Ave, Norfolk	63	63
M35	North End of Summerset, Chesapeake	68	68

Site	Address	Total L_{eq}, dBA	Traffic Only L_{eq}, dBA
M36	Side Yard of 1432 Branchview Way, Chesapeake	66	66
M37	4355 Topsail Landing, Chesapeake	69	69
M38	1509 James Landing, Chesapeake	62	62
M39	4401 Old Woodland Dr, Chesapeake	67	66
M40	4441 Woodland Dr, Chesapeake	64	64
M41	4512 Winnie Dr, Chesapeake	63	63
M42	2914 Old Stone Way, Chesapeake	66	64
M43	4956 Old Pughsville Rd, Chesapeake	60	60
M44	4903 Clifton St, Chesapeake	69	69
M45	3670 Mardean Dr, Chesapeake	65	65
M46	4733 Camelia Dr, Suffolk	68	68
M47	7020 Kenny Ln, Portsmouth	60	60
M48	3909 Old Farm Rd, Portsmouth	59	59
M49	3105 Polk St, Portsmouth	52	52
M50	6229 Hightower Rd, Portsmouth	57	56
M51	5229 Crabtree Pl., Portsmouth	55	55
M52	5416 Lilac Crescent, Portsmouth	57	56
M53	5010 Huntersville Pl, Suffolk	60	60
M54	Churchland HS Baseball Field - Cedar Ln, Portsmouth	52	52
M55	535 13th St, Newport News	62	62
M56	523 22nd St, Newport News	60	60
M57	Madison Ave, North of 36th St, Newport News	62	62
M58	Corner of 40th and Madison, Newport News	61	61
M59	Between Marshall Ave and Orcutt Ave, Newport News	65	65
M60	1118 41st St, Newport News	59	56
M61	1124 39th St, Newport News	72	72
M62	2604 W Pembroke Ave, Newport News	66	66
M63	730 Birch Ave, Hampton	73	73
M64	309 Ward Drive, Hampton	60	60
M65	228 Prince James Drive, Hampton	60	59
M66	Back yard of #5 Dundee Road, Hampton	66	66
M67	Hampton High School Batting Cages, Hampton	61	61
M68	West End of Braemar Drive, Hampton	66	66
M69	52 Allison Sutton Drive, Hampton	67	66
MR1	Fleet Recreation Park Pools, Norfolk	63	NA
MR2	Breezy Point Apartments, Norfolk	60	NA

Site	Address	Total L_{eq}, dBA	Traffic Only L_{eq}, dBA
MR3	Ingersol Ave. Apt. Complex, Rec. Areas, Golf Crs., Norfolk	62	NA

Note: Detailed data are provided in Appendix D of the HRCS Noise Technical Report and in the HRBT and I-564 Intermodal Connector Noise Technical Reports.
[1] 24-hour long-term measurement site. Loudest-hour L_{eq} is reported.
[2] Duration too short for meaningful measurement.

Existing Noise Barriers

There are several existing noise barriers along the I-64, I-664 and VA 164 Study Area Corridors. Field surveys and reviews of these barriers were conducted so that their locations and heights could be included in the noise modeling of both the existing and future conditions. More detail is provided in the *HRCS Noise Technical Report*.

Environmental Consequences

The noise analysis for the Draft SEIS were prepared using the 2034 Hampton Roads Transportation Planning Organization (HRTPO) travel demand model, which was the latest model available at the time. The 2034 model outputs were post-processed to produce 2040 peak hour volumes for the I-64 Study Area Corridor. These 2040 peak hour volumes were then used to support the noise analysis. Noise analyses relied on the peak hour volumes and projected levels of service at mainline sections along I-64. During the course of the preparation of the Final SEIS (August 8, 2016), the HRTPO released the 2040 HRTPO travel demand model. This updated model was used to update the traffic forecasts for the Preferred Alternative, including forecasts for basic HOV and HOT options.

The Draft SEIS traffic forecasts and the corresponding noise analysis represent the worst-case traffic scenario (compared to the Final SEIS); no updates were deemed necessary for the Final SEIS (please see *Traffic, Air, and Noise Analyses Update* in **Appendix G**).

All noise levels predicted are the A-weighted equivalent sound level, or L_{eq}, in dBA. Loudest-hour noise levels are predicted for the Existing 2015 and the Design Year 2040 No-Build and Build Alternatives. Sound levels at all study area receivers are computed explicitly from the provided traffic data for Build Alternatives B, C and D. It was determined during the loudest-period assessment that the traffic for I-64 in Alternative A is very similar to that for Alternative B, such that the noise levels along I-64 are different by an average of less than 0.2 decibels. VDOT agreed that this made the two alternatives effectively equivalent along I-64. Therefore, only Alternative B is evaluated in detail, and all of the conclusions about noise along I-64 for Alternative B are applied to Alternative A as well. Overall, predicted exterior noise levels range from around 50 up to 77 dBA. On average for all receptors, sound levels are predicted to increase by approximately 1 decibel from the 2015 Existing case to the 2040 No-Build condition, due to increases in projected traffic volumes. Sound level increases from Existing to the 2040 Build Alternatives are similar to those for the No-Build, that is, approximately 1 decibel or slightly greater than existing levels, except in places where there are proposed improvements that would bring roadways closer to affected communities, or in places where existing shielding, such as existing noise barriers must be removed as part of the project construction. In those areas, sound level increases are higher, and particularly where barriers would be removed, can constitute “Substantial Increases” in existing noise

levels greater than 10 dBA. While VDOT has a policy of replacing existing barriers that must be removed for roadway improvements, the sound levels and impact without the replacement barriers are reported initially.

Notably, the existing noise barriers along I-64 in Hampton and Norfolk are not affected by the roadway widening, which is planned to occur to the inside of the existing lanes. Therefore, these barriers have been retained for the Build Alternative noise analysis, and their benefits accrue to the receptors in all alternatives. However, the existing barriers along VA 164 in Portsmouth and along I-664 in Hampton and Newport News must all be removed in the Build Alternatives that apply to those roadways to accommodate the roadway widening.

Table 3-27 presents a summary of the predicted noise impact for the 2015 Existing and 2040 **No-Build Alternative** and **Build Alternatives**. In this table, the impacts are summarized by major corridors in the study area and by FHWA land use activity categories. In addition, a grand total of noise impact by alternative is given at the bottom. **Alternative D** has the greatest total impact, since it represents all of the project corridors. **Alternative B** has the next highest total impact, and it is greater than the No-Build Alternative impact primarily because of the removal of the existing noise barriers along VA 164 in Portsmouth, where there are 859 more impacts in Alternative B than in the No-Build Alternative. All of the Build Alternatives are predicted to have less impact than the No-Build Alternative in the I-64 corridor, due to two factors related to the roadway widening occurring to the inside of the existing roadway throughout much of the corridor. Where I-64 is elevated on structure, such as over the water near Willoughby Spit and at overpasses, the gap between the eastbound and westbound structures would be closed by the widening. That would prevent noise from the far direction lanes from traveling under the structure carrying the near direction lanes to receivers below the roadway. Closing this gap results in reductions of up to 2 or 3 decibels in some areas relative to the existing and No-Build conditions. The second benefit of widening to the inside is that the existing noise barriers along I-64 in Norfolk and Hampton are expected to be able to remain in place, so the existing benefit they provide is also assumed to occur in the future Build conditions.

The I-64 corridor has many Category C recreational land uses along it that are predicted to be impacted under all of the alternatives, including several cemeteries, golf courses, and playing fields.

Along the I-664 corridor, Alternatives C and D show similar levels of impact, although, the slightly higher traffic volumes forecasted for Alternative C on the peninsula would result in somewhat higher noise impact there. The removal of noise barriers along I-664 in Newport News and Hampton would result in noticeably higher impact under the Build Alternatives as compared with the Existing and No-Build Alternatives.

Table 3-27: Noise Impact Summary by Corridor and Land Use Activity Category

Corridor	Alternative	Number of Receptors Impacted by Activity Category				
		Residential Category B	Recreational/ Parks Category C	Institutional Interior Category D	Commercial Category E	Total
I-64	2015 Existing	653	125	0	0	778
	2040 No-Build	826	176	0	0	1,002
	2040 Alternative A	780	173	0	0	953
	2040 Alternative B	780	173	0	0	953

Corridor	Alternative	Number of Receptors Impacted by Activity Category				
		Residential Category B	Recreational/ Parks Category C	Institutional Interior Category D	Commercial Category E	Total
	2040 Alternative D	705	159	0	0	864
I-564	2015 Existing	1	17	0	0	18
	2040 No-Build	7	0	0	0	7
	2040 Alternative B	10	8	0	0	18
	2040 Alternative C	14	8	0	0	22
	2040 Alternative D	14	8	0	0	22
VA 164	2015 Existing	26	0	0	0	26
	2040 No-Build	51	0	0	0	51
	2040 Alternative B	901	6	3	0	910
	2040 Alternative C	1	0	0	0	1
	2040 Alternative D	751	6	3	0	760
I-664 Southside	2015 Existing	250	11	0	0	261
	2040 No-Build	323	14	0	0	337
	2040 Alternative B	104	2	0	0	106
	2040 Alternative C	386	14	0	0	400
	2040 Alternative D	397	16	0	0	413
I-664 Peninsula	2015 Existing	124	24	0	1	149
	2040 No-Build	263	37	0	1	301
	2040 Alternative C	492	62	0	1	555
	2040 Alternative D	422	58	0	1	481
Alternative A Totals	**2015 Existing A**	**653**	**125**	**0**	**0**	**778**
	2040 No-Build A	**826**	**176**	**0**	**0**	**1,002**
	2040 Alternative A	**780**	**173**	**0**	**0**	**953**
Alternative B Totals	**2015 Existing B**	**722**	**143**	**0**	**0**	**865**
	2040 No-Build B	**930**	**178**	**0**	**0**	**1,108**
	2040 Alternative B	**1,795**	**189**	**3**	**0**	**1,987**
Alternative C Totals	**2015 Existing C**	**368**	**58**	**0**	**1**	**427**
	2040 No-Build C	**585**	**59**	**0**	**1**	**645**
	2040 Alternative C	**921**	**92**	**0**	**1**	**1,014**
Alternative D Totals	**2015 Existing D**	**1,047**	**183**	**0**	**1**	**1,231**
	2040 No-Build D	**1,462**	**235**	**0**	**1**	**1,698**
	2040 Alternative D	**2,289**	**255**	**3**	**1**	**2,548**

Mitigation

When the predicted Design Year Build Alternative scenario noise levels approach or exceed the NAC during the loudest hour of the day or cause a substantial increase in existing noise, consideration of traffic noise reduction measures is warranted. If it is found that such mitigation measures would cause adverse social, economic or environmental effects that outweigh the benefits received, they may be dismissed from consideration. FHWA noise abatement criteria are provided in **Table 3-28**.

Table 3-28: FHWA Noise Abatement Criteria

Activity Category	$L_{eq}(h)$[1]	Description of Activity Category
A	57 (Exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose
B[2]	67 (Exterior)	Residential
C[2]	67 (Exterior)	Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails, and trail crossings
D	52 (Interior)	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios
E	72 (Exterior)	Hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in A-D or F
F	–	Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing
G[2]	–	Undeveloped lands that are not permitted (without building permits)

[1] *Hourly Equivalent A-weighted Sound Level (dBA).*
[2] *Includes undeveloped lands permitted for this activity category.*
Source: 23 CFR Part 772.

Noise Abatement Measures

VDOT guidelines recommend a variety of mitigation measures that should be considered in response to transportation-related noise impacts. While noise barriers and/or earth berms are generally the most effective form of noise mitigation, additional mitigation measures exist that have the potential to provide considerable noise reductions under certain circumstances. Mitigation measures considered for this project include:

- Traffic management measures,

- Alteration of horizontal and vertical alignments,
- Acoustical insulation of public-use and non-profit facilities,
- Acquisition of buffer land,
- Construction of earth berms,
- Construction of noise barriers.

Traffic management measures normally considered for noise abatement include reduced speeds and truck restrictions. Reduced speeds would not be an effective noise mitigation measure alone since a substantial decrease in speed is necessary to provide a significant noise reduction. Typically, a ten mph reduction in speed will result in only a two dBA decrease in noise level, which is not considered a sufficient level of attenuation to be considered feasible. Further, a two dBA change in noise level is not considered to be generally perceptible. Restricting truck usage on the different Study Area Corridors is not practical since one of the primary purposes of those facilities is to accommodate trucks. Diversion of truck traffic to other roadways would increase noise levels in heavily developed residential areas.

A significant alteration of the horizontal alignment of the Study Area Corridors would be necessary to make such a measure effective in reducing noise, since a doubling of distance to the highway is usually needed to affect a five-decibel reduction. However, such shifts would create undesirable impacts by increasing right-of-way acquisitions and relocations. Also, shifting the horizontal alignment is not practical since there are impacted receptors on both sides of the corridor throughout much of the study area. Shifting the alignment away from receptors on one side of the road would bring it closer to receptors on the other side of the road. Further alteration of the vertical alignment would not be feasible since the majority of the project involves widening an existing facility. Particularly given the large number of interchanges, raising or lowering the vertical alignment of the Study Area Corridors would result in significant environmental impacts to the surrounding environment and costly engineering challenges.

Acoustical Insulation of public-use and non-profit facilities applies only to public and institutional use buildings. Since no public use or institutional structures are anticipated to have interior noise levels exceeding FHWA's interior NAC, this noise abatement option will not be applied.

The purchase of property for noise barrier construction or the creation of a "buffer zone" to reduce noise impacts is only considered for predominantly unimproved properties because the amount of property required for this option to be effective would create significant additional impacts (e.g., in terms of residential relocations), which were determined to outweigh the benefits of land acquisition.

Berms are considered a more attractive alternative to noise walls where there is sufficient land and fill available for them. However, berms do not appear feasible for the HRCS because they would greatly increase the cost and the footprint of the project by substantially increasing the amount of right-of-way required to accommodate the berms. Since much of the study corridor is densely developed, many costly and disruptive residential relocations necessarily would result from acquiring the needed right-of-way. The feasibility of berms in any areas with available unimproved property adjacent to the project may be reevaluated during the detailed noise study during final design.

Additionally, the Noise Policy Code of Virginia (HB 2577, as amended by HB 2025) states: *Requires that whenever the Commonwealth Transportation Board or the Department plan for or undertake any highway construction or improvement project and such project includes or may include the requirement for the mitigation of traffic noise impacts, first consideration should be given to the use of noise reducing design and low noise pavement materials and techniques in lieu of construction of noise walls or sound*

barriers. Vegetative screening, such as the planting of appropriate conifers, in such a design would be utilized to act as a visual screen if visual screening is required. Consideration would be given to these measures during the final design stage, where feasible. The response to this requirement from project management is included Appendix F of the *HRCS Noise Technical Report*.

Noise Barriers

The only remaining abatement measure for consideration is the construction of noise barriers. The feasibility of noise barriers is evaluated for locations where noise impact is predicted to occur in the Build condition. Where the construction of noise barriers is found to be physically practical, barrier noise reduction is estimated based on roadway, barrier, and receiver geometry as described below.

To be constructed, any noise barriers identified in this document must satisfy VDOT's feasibility and reasonableness criteria. Therefore, the noise barrier design parameters and cost identified in this document are preliminary and should not be considered final. A final decision on the feasibility and reasonableness of noise barriers would be made during final design when the project design is developed and traffic updated. If a noise barrier is determined to be feasible and reasonable, the affected public would be given an opportunity to decide whether they are in favor of construction of the noise barrier.

Feasibility and Reasonableness

FHWA and VDOT require that noise barriers be both "feasible" and "reasonable" to be recommended for construction.

To be feasible, a barrier must be effective, that is it must reduce noise levels at noise sensitive locations by at least five decibels, thereby "benefiting" the property. VDOT requires that at least 50 percent of the impacted receptors receive five decibels or more of insertion loss from the proposed barrier for it to be feasible.

A second feasibility criterion is that it must be possible to design and construct the barrier. Factors that enter into constructability include safety, barrier height, topography, drainage, utilities, maintenance of the barrier, and access to adjacent properties. VDOT has a maximum allowable height of 30 feet for noise barriers.

Barrier reasonableness is based on three factors: cost-effectiveness, ability to achieve VDOT's insertion loss design goal, and views of the benefited receptors. To be "cost-effective," a barrier cannot require more than 1600 square feet per benefited receptor. VDOT's maximum barrier height of 30 feet figures into the assessment of benefited receptors. Where multi-family housing includes balconies at elevations above 30 feet, these receptors are not assessed and included in the determination of a barrier's feasibility or reasonableness.

The second reasonableness criterion is VDOT's noise reduction design goal of seven decibels. This goal must be achieved for at least one of the impacted receptors for the barrier to be considered reasonable.

The third reasonableness criterion relates to the views of the owners and residents of the potentially benefited properties. A majority of the benefited receptors must favor the barrier for it to be considered reasonable to construct. Community views would be surveyed in the final design phase of projects.

Existing Noise Barriers

There are many existing noise barriers in the Study Area Corridors. Several of these along I-64 are expected to be able to remain in place, since the proposed widening will not displace them, and no

impact or limited noise impact is predicted behind them. However, the proposed roadway widening would impact the existing barriers adjacent to I-664. Replacement barriers that would provide at least the same level of protection as the existing barriers have been evaluated for each of these existing barriers, in accordance with VDOT's policy.

Details of Replacement and Potential Barriers

The noise analysis presented in the SEIS examines the potential for noise abatement along the length of the Study Area Corridors is consistent with FHWA policy. However, during final design-level noise analysis, this analysis will be limited to the area of proposed improvements which would extend from Settlers Landing Road (Exit 267) to I-564. Noise abatement must be considered where noise impact is predicted. Noise abatement is evaluated to determine if it is warranted, feasible and reasonable. **Table 3-29** summarizes each corridor and city, the total length, estimated cost and benefits separately, that would be provided by the potential and replacement barriers evaluated that are found to be warranted, feasible, and reasonable. All replacement barriers are feasible and reasonable. Since the different Build Alternatives in each corridor are identical or nearly the same physically and they are also projected to carry very similar traffic in 2040, the barriers and their benefits are the same for each alternative in most of the corridors. Feasible and reasonable noise barriers are summarized below. Preliminary feasible and reasonable noise barriers are shown in **Appendix B**. Noise barrier activities are anticipated to occur beyond the study area LOD and were not fully included in the calculation of right-of-way impacts. The noise analysis contained in this SEIS was conducted using planning-level design data. Final design traffic data would inform more detailed noise analyses during the final design and permitting phases of the study, after the issuance of the ROD. Final noise analysis would dictate the final selection and placement of noise barriers that may fall outside the NEPA LOD. During final design, noise barriers may not be included beyond of the area of proposed roadway improvements.

Table 3-29: Summary of Feasible and Reasonable Noise Barriers

Corridor and City	Alternatives	Length (miles)	Estimated Cost ($31/sq. ft.)	Number of Benefited Receptors		
				Impacted	Not Impacted	Total
I-64 Hampton	A, B, D	3.7	9,902,609	174	239	**413**
I-64 Norfolk	A, B, D	5.3	19,159,888	574	718	**1,292**
I-564 Norfolk	B, D	1.2	2,759,496	14	93	**107**
I-564 Norfolk	C	1.3	3,100,155	22	94	**116**
VA 164 Portsmouth	B, D	3.1	11,000,164	545	1,152	**1,697**
I-664 Chesapeake	C, D	3.8	12,950,746	243	349	**592**
I-664 Suffolk	C, D	1.9	7,653,094	145	284	**429**
I-664 Newport News	C, D	3.5	14,018,665	281	782	**1,063**
I-664 Hampton	C, D	2.9	8,714,968	213	386	**599**

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 (R4) and perennial (R3) 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 evaluate 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 3-30 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 benthic invertebrates.

Table 3-30: 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
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

Waterbody	Alternative A	Alternative B	Alternative C	Alternative D
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 USM and are shown in *Appendix B* of the *HRCS Natural Resources Technical Report*. No R3 or R4 streams are crossed by the Study Area Corridor of Alternative A, which also encompasses the Preferred Alternative. 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 evaluated 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 3-31** 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 resources 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 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 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.

Figure 3-10: Named Waterbodies

Table 3-31: Potential Impacts to Tidal and Non-Tidal Waters

Stream Type	Alternative A	Alternative B	Alternative C	Alternative D	Preferred Alternative
Tidal (acres)	147	216	369	461	176
Shallow Water Habitat (acres)	43	59	29	73	47
Non-Tidal (linear feet)	0	0	548	548	0

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 **Preferred Alternative** would impact 176 acres of tidal waters, including 47 acres of shallow water habitat in Hampton Roads and Willoughby Bay along I-64. Impacts from the Preferred Alternative may ultimately be less than Alternative A since the wider LOD through the HRBT would provide additional flexibility and innovation to reduce impacts during design and construction.

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 results of the USM assessment, the length of impact based upon final design, and coordination with the USEPA, 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 interests 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 3-32** 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 3-32: Potential Impacts to Maintained Navigable Channels and the CIDMMA (acres)

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

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, meaning that any ship can cross, regardless of their height from the waterline, because there are no bridges that block the waterway. 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.

The **Preferred Alternative**, similar to Alternative A, would require the expansion of the HRBT with a new parallel bridge-tunnel. While the Preferred Alternative's LOD is slightly wider across the Norfolk Harbor Entrance Reach to allow flexibility and innovation during design and construction, it would be no closer to the Hampton River Entrance. The construction of the HRBT expansion would ensure that navigation of the Norfolk Harbor Entrance Reach and Hampton River Entrance is not impeded. Like Alternative A, a tunnel would be used at the Norfolk Harbor Entrance Reach crossing in Hampton Roads to preserve the no air draft restriction, and 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. The Preferred Alternative would maintain access to 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 3-33 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 3-33: 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

Cowardin Abbreviation	Cowardin Classification	Alternative A	Alternative B	Alternative C	Alternative D
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 3-33**. 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 3-34** and **3-35** 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 3-34: 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 3-35** provides the results of the assessment.

Table 3-35: 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 **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 3-36, 3-37, and 3-38**. 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 3-36** are listed by Cowardin classification per alternative. Wetland impacts per alternative on **Table 3-37** 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 3-38**, which compares the extent of wetland types that are altered (excavated or manmade) to those that are relatively unaltered per alignment.

Table 3-36: Potential Wetland Impacts by Cowardin Classification (acres)

Impact Type	Alternative A	Alternative B	Alternative C	Alternative D	Preferred Alternative
E2EM	4.6	8.5	6.2	10.8	4.6
E2EMx	0.1	0.1	0.0	0.1	0.1
E2US	0.5	0.5	0.0	0.5	0.5
PEM	0.0	10.6	11.4	10.7	0.0
PEMF	0.0	0.0	0.0	0.0	0.0
PEMFx	0.0	0.0	0.2	0.2	0.0
PEMx	0.2	6.1	6.4	8.8	0.2
PFO	0.3	36.6	55.4	55.6	0.1
PFOF	0.0	0.0	0.0	0.0	0.0
PFOFx	0.0	0.0	6.7	6.7	0.0
PFOx	2.0	3.2	18.0	19.2	2.0
PSS	0.0	0.3	0.3	0.3	0.0
PSSx	0.0	0.2	0.2	0.2	0.0
PUB	0.0	0.0	0.0	0.0	0.0
PUBF	0.0	0.0	0.0	0.0	0.0
PUBFx	0.0	0.2	0.3	0.2	0.0
PUBx	0.0	6.2	6.3	6.3	0.1
Total	**7.7**	**72.5**	**111.4**	**119.6**	**7.6**

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

Table 3-37: Potential Wetland Impact Totals (acres)

Impact Type	Alternative A	Alternative B	Alternative C	Alternative D	Preferred Alternative
Tidal Wetlands	5.2	9.1	6.2	11.4	5.2
Non-tidal Vegetated Wetlands	2.5	57.0	98.6	101.7	2.3
Non-tidal Open Water	0.0	6.4	6.6	6.5	0.1
Total	**7.7**	**72.5**	**111.4**	**119.6**	**7.6**

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

Table 3-38: Potential Impacts Comparison of Altered vs. Unaltered Wetlands (acres)

Impact Type	Alternative A	Alternative B	Alternative C	Alternative D	Preferred Alternative
Tidal Wetlands	5.1	9.0	6.2	11.3	5.1
Non-tidal Vegetated Wetlands	0.3	47.5	67.1	66.6	0.1
Total Unaltered Wetlands	**5.4**	**56.5**	**73.3**	**77.9**	**5.2**
Excavated Tidal Wetlands	0.1	0.1	0	0.1	0.1
Excavated Non-tidal Vegetated Wetlands	2.2	9.5	31.5	35.1	2.2
Non-tidal Open Water	0.0	6.4	6.6	6.5	0.1
Total Altered Wetlands	**2.3**	**16.0**	**38.1**	**41.7**	**2.4**

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

Alternative A would potentially impact approximately five acres of tidal wetlands and 3 acres of non-tidal vegetated wetlands. Approximately 88 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 approximately nine acres of tidal wetlands and 57 acres of non-tidal vegetated wetlands. Approximately 17 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 approximately six acres of tidal wetlands and 99 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 approximately 11 acres of tidal wetlands and 102 acres of non-tidal vegetated wetlands. Approximately 35 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**.

The **Preferred Alternative** would potentially impact approximately five acres of tidal wetlands and two acres of non-tidal vegetated wetlands. Approximately 96 percent of the potential palustrine wetland impacts in the Preferred Alternative would occur to altered wetlands. Effects of the Preferred Alternative on palustrine wetlands are the same as Alternative A, where they overlap, with a slight reduction in the quantity of impacts due to narrowing and shifting the LOD to avoid Hampton University. As discussed for Alternative A, impacts within the highly developed areas of the Preferred Alternative 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 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 could cause reduction in wetland condition. Additional point sources and tidal restrictions would also reduce conditions.

Mitigation

Minor alignment shifts would be evaluated to avoid and minimize impacts to wetlands, including isolating remnants/fragments of wetlands. Consideration of additional bridging to reduce impacts to waters and wetlands would 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 the Preferred Alternative. The USACE and VDEQ can only permit the Least Environmentally Damaging Practicable Alternative (LEDPA), which is determined through the federal and state permitting process. As such, impacts may continue to be avoided and minimized through the design phase of the selected alternative. The USACE finds no reason to object that the Preferred Alternative could be the LEDPA. Both the USACE and EPA concurred with the recommendation of the Preferred Alternative given in part that it has the least amount of wetland impacts (see correspondence in **Appendix D**). Compensatory mitigation would be required for all unavoidable impacts to vegetated wetlands.

Compensatory mitigation may include the purchase of credits from a suitable mitigation bank, payment to an-lieu fee fund, or permittee-responsible mitigation in accordance with the April 2008 Final Compensatory Mitigation Rule (33 CFR Part 332). A combination of all three mitigation types may be used. As of February 2017, there are at least five non-tidal wetland mitigation banks and two tidal wetland mitigation banks servicing the affected HUCs. These banks have over 317 non-tidal wetland credits available and 3.49 tidal wetland credits available. A comprehensive mitigation plan would be developed and provided as part of the permit application process.

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 *Final 2014 305(b)/303(d) Water Quality Assessment Integrated Report* was released by VDEQ on June 13, 2016 following approval by the USEPA on May 19, 2016. The 2014 report summarizes water quality conditions in Virginia from January 1, 2007 through December 31, 2012. Data from this report are available as GIS shapefiles (VDEQ, 2016). 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

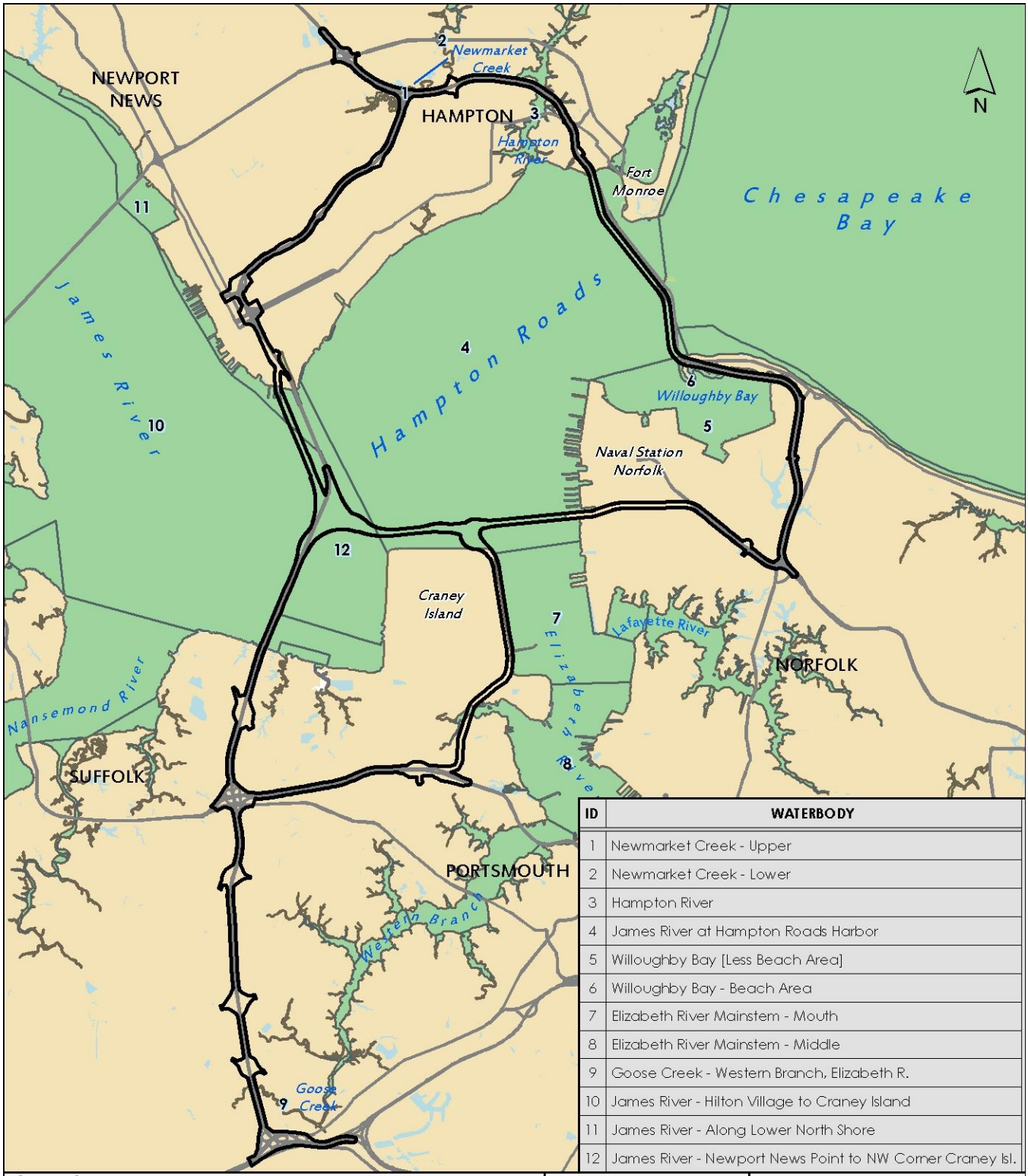
Impaired waterways exist throughout the Hampton Roads region. Many of these waterbodies do not support use for aquatic life and fish consumption due to dissolved oxygen levels, absence of submerged aquatic vegetation, levels of Chlorophyll-a, benthic invertebrate communities, and PCBs in fish tissue. Other waterbodies do not support recreational and shellfishing uses due to *Enterococcus* and fecal coliform exceedances. Impaired waters, by waterbody are summarized in **Table 3-39**. As shown on **Figure 3-11**, all of the Study Area Corridors are located within impaired waters.

Table 3-39: Impaired Waters

Waterbody	Designated Use	Impairment
Newmarket Creek - Upper	Aquatic Life	Dissolved Oxygen, Aquatic Plants (Macrophytes)
	Fish Consumption	PCB in Fish Tissue
	Recreation	*Enterococcus*
	Shellfishing	Fecal Coliform
Newmarket Creek Lower	Aquatic Life	Dissolved Oxygen, 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), Dissolved Oxygen
	Fish Consumption	PCB in Fish Tissue
Elizabeth River Mainstem – Middle	Aquatic Life	Estuarine Bioassessments (Benthics), 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, Dissolved Oxygen, Aquatic Plants (Macrophytes)
	Fish Consumption	PCB in Fish Tissue
James River – Along Lower North Shore	Aquatic Life	Chlorophyll-a, Dissolved Oxygen, Aquatic Plants (Macrophytes)
	Fish Consumption	PCB in Fish Tissue
James River – Newport News Point to NW Corner CIDMMA	Aquatic Life	Chlorophyll-a, Dissolved Oxygen, Aquatic Plants (Macrophytes)
	Fish Consumption	PCB in Fish Tissue

Source and notes: DEQ VEGIS 2016.
http://www.deq.virginia.gov/mapper_ext/default.aspx?service=public/2014_adb_anyuse.

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.

Legend

- Major Roads
- Study Area Corridors
- Impaired Waters

0 0.5 1 2 Miles

VDOT

U.S. Department of Transportation Federal Highway Administration

HRCS SEIS
Hampton Roads Crossing Study SEIS

Impaired Waterbodies

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. 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.

Each of the **Build Alternatives** has 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 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* sp. 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 currently listed 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 3-39**. 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 the Build Alternatives (see **Table 3-40** 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, along with the Preferred Alternative, would have 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 3-39** 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 3-40** 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 3-40** 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 would be added adjacent to the MMMBT and one tunnel constructed across the Elizabeth River (see **Table 3-40** 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.

The **Preferred Alternative** would have a total of 305 acres of disturbance associated with construction. The impaired waters that the Preferred Alternative crosses or drains to are the same as those for Alternative A. The current impairments are noted in **Table 3-39.** The Preferred Alternative would require the same amount of dredging for a new tunnel at the HRBT as Alternative A (see **Table 3-40** for estimated dredge quantities for proposed tunnels on all alternatives). The potential effects to water quality would be no greater than those from Alternative A, and could be less given the additional flexibility afforded for design and construction of the HRBT expansion with the larger LOD through this area.

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.

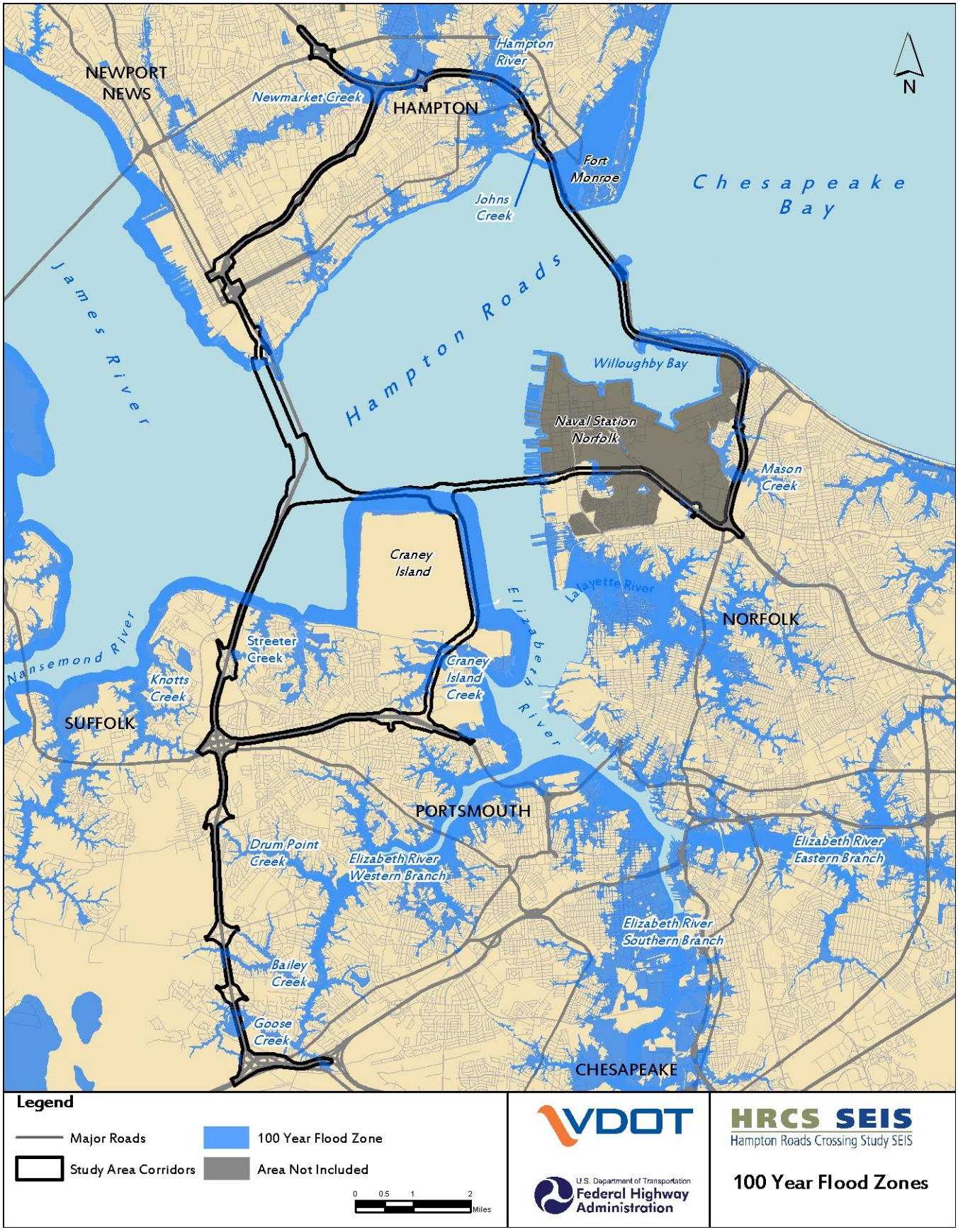
Environmental Consequences

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.

Figure 3-12: 100 Year Flood Zones



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, **Alternative D** would impact 313 acres, and the **Preferred Alternative** would impact 149 acres. The actual encroachment may be different based upon the total extent of fill required for construction and the use of bridges at the major waterways. 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 elevations, due to bottom shear stress, sedimentation from erosion or settlement of suspended sediment, current patterns, water circulation, water fluctuation, and wind and wave action.

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) evaluated the potential impact on surface water elevation, flow, salinity, and bottom shear stress in their report: *Hampton Roads Crossing Study Supplemental Environmental Impact Statement: Evaluation of Potential Impact on Surface Water Elevation, Flow, Salinity, and Bottom Shear Stress* (VIMS Study) (January 17, 2017). Their study improves upon a previous numerical modeling effort in the same study area (Boon et al. 1999); the latter used VIMS' three-dimensional Hydrodynamic-Sedimentation Model (HEM3D) to study the impact of the bridge-tunnel infrastructure on physical characteristics (including tides, currents, circulation, salinity and sedimentation potential) under the existing and future Build Alternative scenarios. In this updated study, VIMS used 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 applied SCHISM modeling as a validated 'Base Case' or no-build baseline condition from which to compare build scenarios associated with Alternatives A, B, C, and D. The Base Case model was calibrated and validated against available observation data from NOAA (http://tidesandcurrents.noaa.gov/tide_predictions.html), the EPA's Chesapeake Bay Program (http://www.chesapeakebay.net/groups/group/21890), and USGS. The model calibration used water level, ADCP (Acoustic Doppler Current Profile), and temperature across the lower Chesapeake Bay, James River, and Elizabeth River to represent the existing conditions of the year 2011, with further validation over the years of 2010 to 2013. Year 2011 was chosen as the simulation period to maximize the availability of data for the study.

Planning level impacts were analyzed by determining differences between the Base Case condition and each of the Study Corridor Alternatives, using both local and global perspectives. 'Local analysis' focused on the localized effect of environmental changes at any single point location. Sediment erosion and deposition potential was quantified using bottom shear stress as a measure. Global analysis determined percentages of the total area associated with environmental differences from the Base Condition. The 'total area' refers to the entire region from the mouth of the James River upstream to the James River Bridge, where the Study Area Corridors are located. This global analysis was based on a yearlong comparison of the Base Case to the four Study Corridor Alternatives in the form of an area-weighted frequency histogram and cumulative frequency function with hourly intervals. The 95th percentile values for Alternatives A, B, C, and D were divided by the reference values (Base Case), resulting in a percentage of impact. The following parameters were measured in this way: surface current, bottom current, surface salinity, bottom salinity, and bottom shear stress.

Affected Environment

The study area for which SCHISM modeling has been applied includes all of Hampton Roads and encompasses all of the Study Area Corridors. The channels, in particular the Norfolk Harbor Entrance Reach, serve as the main conduit for ocean water to enter the James and Elizabeth Rivers. The VIMS Study evaluates impacts from the many bridge pilings throughout the Study Area Corridors. Collectively,

these pilings may exert some impact on the overall physical characteristics of the river and may also influence sediment transport patterns locally, which translates into more widespread bottom alterations along over-water portions of these alignments.

The approximate number of pilings that were considered at an early planning level to be added to over-water areas for each of the Alternatives is summarized below. The VIMS study includes estimates for Alternatives A, B, C, and D. Based on the limited over-water refinements made to A as part of the Preferred Alternative and the planning-level nature of the hydrodynamic study, VDOT does not anticipate the Preferred Alternative having different impacts than those modeled for Alternative A.

- Alternative A – approximately 280 additional pilings
- Alternative B – approximately 450 additional pilings
- Alternative C – approximately 920 additional pilings
- Alternative D – approximately 1,200 additional pilings

As presented in the VIMS study local analysis, the addition of new bridge pilings could alter the flow patterns in the vicinity of the Study Area Corridors with regard to total outflow, although tidal changes and mean sea level would be clearly marginal from any of these alternatives. The addition of new pilings generally decreases both the amplitude and the mean of flow by a small amount, which may be negligible. The ratio between the total area of the new pilings and the total surface area is less than 1% in all alternatives, despite the presence of a large number of pilings (VIMS 2017).

Based on collected data, bottom salinity shows a much sharper gradient between the navigational channels and the adjacent non-maintained areas (shoals) compared to surface salinity. 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 2-5 practical salinity units (PSU) over the channel. According to the VIMS Study, flow blocking as a result of new structures would result in localized increases in salinity, although impacts would likely be minor. Pilings also increase localized vorticity and promote horizontal mixing, leading to higher bottom salinity; however, greater spatial patterns of residual flows throughout the Hampton Roads tidal flat from I-664 to I-64 would remain largely unaltered by any of the alternatives (VIMS 2017). Additionally, the residence time of flow may be increased by the tunnel island and the bridge pilings within the Study Area Corridors.

Erosion and deposition potential is related to shear stress and would increase by installing new pilings associated with the alternatives. Changes in shear stress are mostly localized, and bottom shear stress generally decreases both upstream and downstream of the pilings, resulting in deposition, while increasing between the pilings, resulting in scour.

Environmental Consequences

The VIMS Study provided a complete assessment of potential impacts on surface water elevation, flow, salinity, and bottom sediments. The following section summarizes the findings made by VIMS:

- The No-Build Alternative includes continued routine maintenance and repairs of existing transportation infrastructure within the Study Area Corridors, without additional improvements. This alternative would result in no difference to Base Case conditions.
- **Alternative A** - Would result in the smallest increase in average surface and bottom salinity by approximately <0.5 PSU in the vicinity of the HRBT, due to localized reduced flushing. These

impacts would be largely confined to the added lanes of I-64. The salt intrusion along the main channels of the James and Elizabeth Rivers would not be substantially affected. The expansion of I-64 would increase the vorticity in the vicinity of I-64 and approximately 3.7 miles upstream in the Elizabeth River and Willoughby Bay, due to horizontal transport of turbulence. The greatest increase in flow residence time (measured as water age) for Alternative A would occur in Mill Creek and near the southern tunnel island, with a 0.3-day increase. This is approximately the same as the effects on residence time from Alternative B. Due to potential decreased flow occurring mostly near the tunnel islands of the HRBT, this is the area where shear stresses would be reduced most by Alternative A (approximately 0.1 Pa).

- **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. This alternative would result in up to 1 PSU increase in salinity there and into the Elizabeth River; however, intrusion along the main channels of the James and Elizabeth Rivers would not be substantially affected. Alternative B pilings would generally increase the vorticity within the Study Area Corridor, and would result in a similar increase in flow residence time as Alternative A (approximately 0.3 days) near the tunnel island of the I-564 Connector. Small decreases in shear stress (approximately 0.02 Pa) would be caused by the addition of I-564 and I-664 Connectors, and effects would be localized. Changes would be lessened, compared to other alternatives, because the flow near the entrance of the Elizabeth River is not as strong as that of the James River; therefore, the installation of new pilings have less effect on deposition/scour.
- **Alternative C** – Increases in salinity would be higher in Alternative C than in either Alternatives A or B (up to 1.5 PSU increase), and would affect areas to the north and west of Craney island. This increase suggests higher blocking of flow by the new pilings in that area. The impact on bathymetry would be greater and more wide-spread compared to Alternatives A and B, especially in shallow water portions of Hampton Roads. As a result, the increase in the turbulence mixing and retention time would lead to a larger increase in the surface salinity near the alignment. The expansion of I-664 and I-564 in Alternative C creates new vorticity both upstream and downstream of the alignment. While flow residence time in Mill Creek would be unaffected, the most prominent increase to residence time would be in the newly created semi-enclosed area north of Craney Island. Increased blocking of flow with the I-664 expansion, would result in decreases in shear stress (approximately 0.06 Pa) to Alternative C near the tunnel islands, but higher shear stress (0.06 Pa) on the north and west sides of the southern tunnel.
- **Alternative D** - This scenario would combine the salinity increases from Alternatives B and C, particularly at the surface. In the semi-enclosed Willoughby Bay and Mill Creek bottom salinity would increase slightly more than that resulting from the Alternative B scenario. This suggests retention of intruded salt water by the new pilings along I-664 and I-564. Alternative D would also increase vorticity, due to horizontal mixing, and flow residence time roughly equivalent to the sum of Alternatives B and C. The increased vorticity also increases bottom salinity in some areas, such as the northern shallow shoal. Residence time increases would be the highest for this alternative, resulting in an approximate one-day increase at the entrance of the Elizabeth River, near the new tunnel island. Changes to bottom shear stress for Alternative D are approximately the sum of the changes described for Alternatives B and C. Flow tends to slow down both upstream and downstream as a result of the blocking effects of the pilings, but increases between pilings, due to constriction there.

- **The Preferred Alternative (Not separately evaluated)** – The changes to salinity associated with Alternative A would also apply to the Preferred Alternative. The salt intrusion along the main channels of James and Elizabeth Rivers would not be substantially affected. Also similar to Alternative A, the expansion of I-64 would increase the vorticity in the vicinity of I-64 and approximately 3.7 miles upstream in the Elizabeth River and Willoughby Bay, due to horizontal transport of turbulence. Flow residence time would increase similarly to Alternatives A and B, with an effect generally in the same areas as Alternative A (Mill Creek and near the southern tunnel island). Changes to bottom shear stress, resulting in potential deposition and/or scour are expected to be similar to Alternative A. Since the Preferred Alternative has limited over water refinements compared to Alternative A, and the completed study is for planning purposes, VDOT does not anticipate the Preferred Alternative having different impacts than those modeled for Alternative A.

These results suggest that the impacts from new pilings on water quality are likely localized to the vicinity of new pilings within the Study Area Corridors (VIMS 2017). Based on the modeled results, changes in deposition/erosion potential is also localized at the pier scale to new pilings, and when the entire vicinity of the Study Area Corridors in the lower James River is considered, changes in sediment erosion and deposition are expected to be small and impacts to the existing shipping channels would be minimal. As stated in the VIMS study, critical bed shear stress is approximately 0.23 to 0.25 Pa depending on the grain size distribution. Critical shear stress is met when shear stress becomes sufficiently great to overcome the frictional and gravitational forces holding the grains. According to the VIMS study, this range is not expected to result from any of the alternatives; however, the analysis was conducted at the planning level and does not assume full design and construction details (VIMS 2017).

The 'global analysis' included in the VIMS Study provides a holistic assessment, taking into account the aerial percentage of potential changes over the entire study area. In the proposed alternatives in the James River, it is possible that large and small eddies may be affected by the proposed pilings and tunnel islands in the local area; however, the creation or alteration of eddies does not automatically equate to an appreciable impact on the mean flow fields, such as tidal, wind-driven, or gravitational generated circulation. Based on the results of the VIMS Study's frequency histogram, the frequency and cumulative distribution function for the surface velocity, bottom velocity, surface salinity, bottom salinity and bottom shear stress had similar results under all of the alternatives. It was found that all variables have a mean central tendency toward zero deviation from the Base Case (no change due to implementation of the alternatives). The data distributions showed generally symmetric spreads around this mean zero deviation; however, it was skewed to the positive for salinity, indicating possible increases. In particular, the spread of distribution moving away from the central mean was the largest for surface salinity under Alternatives C and D. Frequency distributions presented in the VIMS Study compared percent of impact of each alternative relative to the Base Case (No-Build Alternative). Results showed that all of the relative impacts under Alternatives A and B were below 1% total deviation from the Base Case, and Alternatives C and D were less than 2% total deviation for all measured parameters. While it remained below 2%, Alternative D would clearly result in the largest impact; however, from the standpoint of an environmental risk assessment, values less than 2% are considered to be small (VIMS 2017).

Salinity changes are predicted in the vicinity of bridges on pilings, especially those for Alternative D. This is primarily a response to piling-induced turbulence, increased vertical mixing, and the elimination of surface-to-bottom salinity gradients immediately around pilings. No changes are predicted in the

longitudinal salinity distribution along the channel axis of the James River in response to any of the alternatives except an increase of the bottom salinity in two semi-enclosed coastal basins: Mill Creek and Willoughby Bay (VIMS, 2017). As stated above, the relative impacts from all alternatives would be less than 2% total deviation. In addition, the maximum predicted change from any of the alternatives of up to 1.5 PSU is small compared to the 10 PSU variability over the course of a year shown at the monitoring stations in the lower James River that were used for model calibration in the VIMS study. These small changes in salinity should have little to no effect on the species using the area since it's smaller than the natural variability.

The VIMS Study validates the conclusions previously presented by Boon et al. in which the hydrodynamic changes associated with any of the Study Area Corridor Alternatives are largely localized in nature and the overall impacts of transportation infrastructure on the lower James River are relatively small compared to the No-Build Base Case.

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. Tunnels 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.

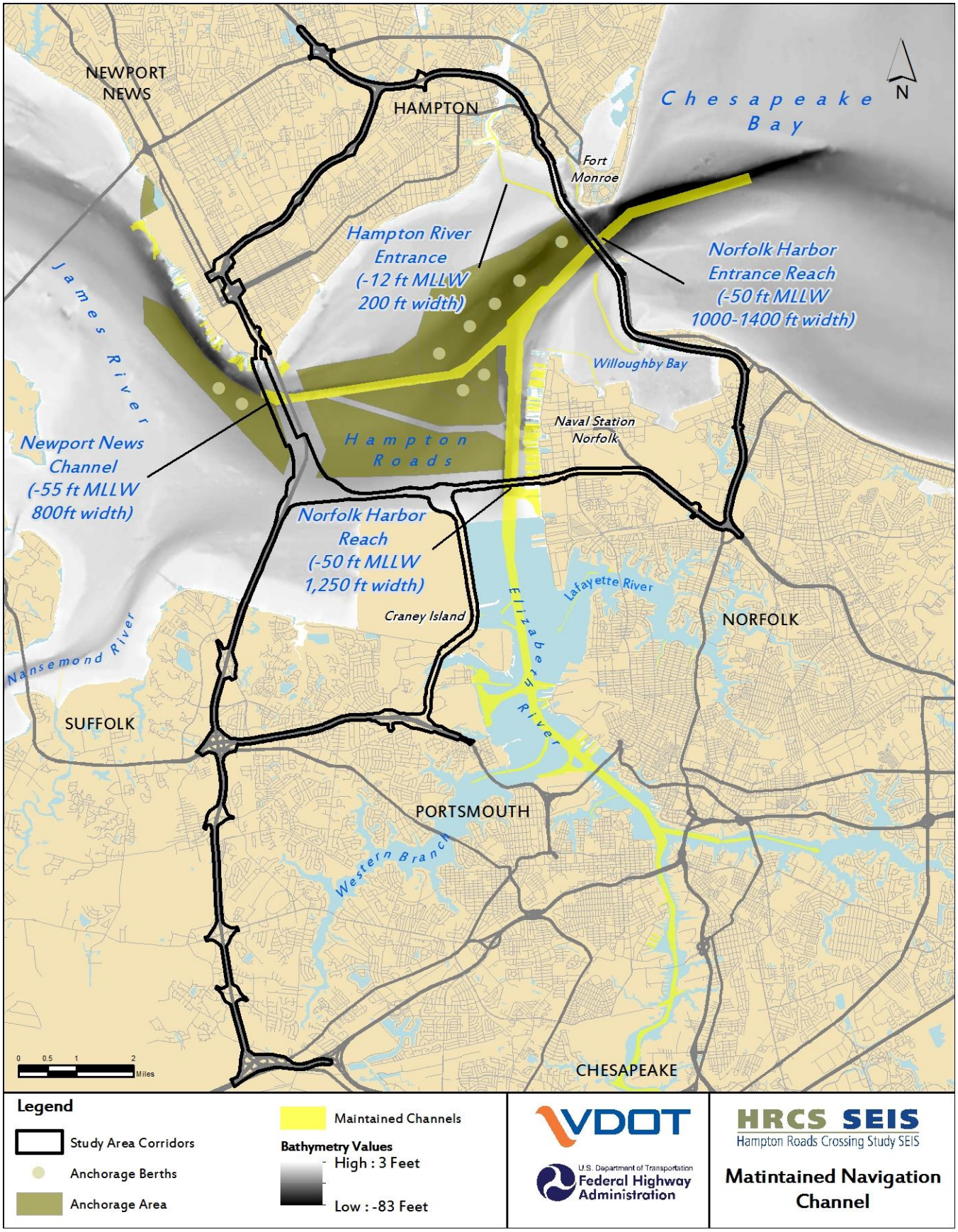
Coarser sandy bottom sediments are located in the channel and northern flank in Hampton Flats and finer muddy bottom sediments in the southern flank near CIDMMA (Nichols et al., 1991). The surficial sediments contain benthic organisms that form an important part of the food web. Benthic organisms in the vicinity of the Study Area Corridors include commercially important shellfish, such as blue crab, hard clam, and eastern 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 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.

Figure 3-13: Maintained Navigation Channel



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 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 3-40**. 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 3-40: Estimated Dredge Quantities (cubic yards)

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

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 3-40** 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 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 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. Examples of beneficial use include wetlands restoration, beach nourishment, shoreline construction, and habitat creation (USEPA, 2016). Compared to disposal of dredged material in CDFs, beneficial use reduces the need for disposal.

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. Suitability would be determined 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 would 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).

Had Alternative B, C, D, or a hybrid been identified as the Preferred Alternative, it may have been implemented in phases over the course of many years resulting in final 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 would 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, 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 would 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 and after dredging activities may be conducted to address potential re-suspension of contaminants and nutrients contributions 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 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 designated as 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 3-41** summarizes public water supplies.

Table 3-41: 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 any of the **Build Alternatives**, including the **Preferred Alternative** 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 3-42**.

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 3-42: Virginia Coastal Zone Management Program Enforceable Regulatory Programs

Regulatory Program	Resource	Virginia Code	Regulatory Agency	Notes
Fisheries Management	Conservation and enhancement of finfish and shellfish	28.2-200 to 28.2-713 29.1-100 to 29.1-570	VMRC VDGIF	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 28.2-1301 to 28.2-1320	VDEQ VMRC Wetlands Boards	Non-tidal Tidal
Dunes Management	Prevent destruction or alteration of primary dunes	28.2-1400 to 28.2-1420	VMRC 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 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 9 VAC 25-830-10 *et seq*.	VDEQ 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 September 19, 2016, 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 uncommon and fragmented as residential, commercial, industrial, government/military, and open water areas are common, resulting in predominantly 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 characteristics of natural vegetation (e.g., wetland and waterbody margins, protected areas) may support wildlife having more specialized ecological requirements or that are more sensitive to anthropogenic activity (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). With the exception of the Atlantic Sturgeon (*Acipenser oxyrinchus*), the Hampton Roads Bridge-Tunnel Conservation Site's natural heritage resources are all waterbirds and further discussion is presented in the Waterbird Nesting section.

As a measure of habitat quality, biodiversity significance rankings range on a scale from B1 to B5, with B1 habitat being most significant and B5 habitat being least significant. The Craney Island Conservation Site has a biodiversity significance ranking of B4. 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, the least significant ranking. The natural heritage resource of concern at this site is the Canebrake rattlesnake (VDCR, 2016d). See the Threatened and Endangered Species Section for further discussion of the suitability of habitat and potential impact to the Canebrake rattlesnake. 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 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 second 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 would 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 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, habitat quality is similar and would likely result in comparable fragmentation effects. 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 likely result in the greatest level of impact to terrestrial wildlife and its habitat.

The **Preferred Alternative** would have similar potential impacts as Alternative A since the terrestrial portion of both alternatives largely overlaps. The Preferred Alternative has a slightly narrower LOD to avoid Hampton University which results in decreased impacts to the narrow forested buffer between I-64 and the University property. The Preferred Alternative's LOD is also narrower along the north shore of the Hampton Roads crossing to avoid Hampton University property. This results in decreased impacts to the park's open space. Impacts to terrestrial wildlife and habitat are the same as Alternative A in all other aspects. Due to its narrower LOD, the Preferred Alternative has the least amount of impact on terrestrial wildlife and habitat.

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. During design of the selected alternative, the request for a CWA Section 401/404b permit would automatically initiate coordination with those agencies having jurisdiction over terrestrial wildlife and habitat, such as VDGIF and USFWS. This coordination, along with the necessary permitting, would help to avoid and minimize potential impacts to these resources through a collaborative process of determining applicable design changes and techniques and construction methods to be used during implementation.

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 practicable 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). Species 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.

With the exception of the Atlantic Sturgeon (*Acipenser oxyrinchus*), 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*). It has a biodiversity significance ranking of B5 on a scale of B1-B5, B5 being least significant. 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 within the Study Area Corridors. The colonies potentially impacted by construction of the Build Alternatives are shown in **Table 3-43. Alternatives A, B, D,** and the **Preferred Alternative** 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 3-43: Potential Waterbird Colony Impacts

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

Any construction activity on the HRBT islands that generates noise or sediment could potentially impact waterbird colonies. Proposed construction would occur within current breeding habitat, and could render it unsuitable for breeding at least while active construction occurs. Permanent fragmentation effects could also occur. However, the colonies have demonstrated the ability to persist at this location amid constant disturbances from cars, boats, airplanes, shipping traffic, naval traffic, and coastal storms. 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.

The alternatives that will pass over/adjacent to Craney Island would 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.

Mitigation

Close coordination with the VDCR, VDGIF, and USACE is underway and would continue in order to minimize impacts to waterbird colonies to the maximum extent practicable. Strict adherence to time-of-year restrictions and erosion and sediment control measures would be required by these agencies. 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 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 eastern oyster (*Crassostrea virginica*), as well as the benthic community assemblage.

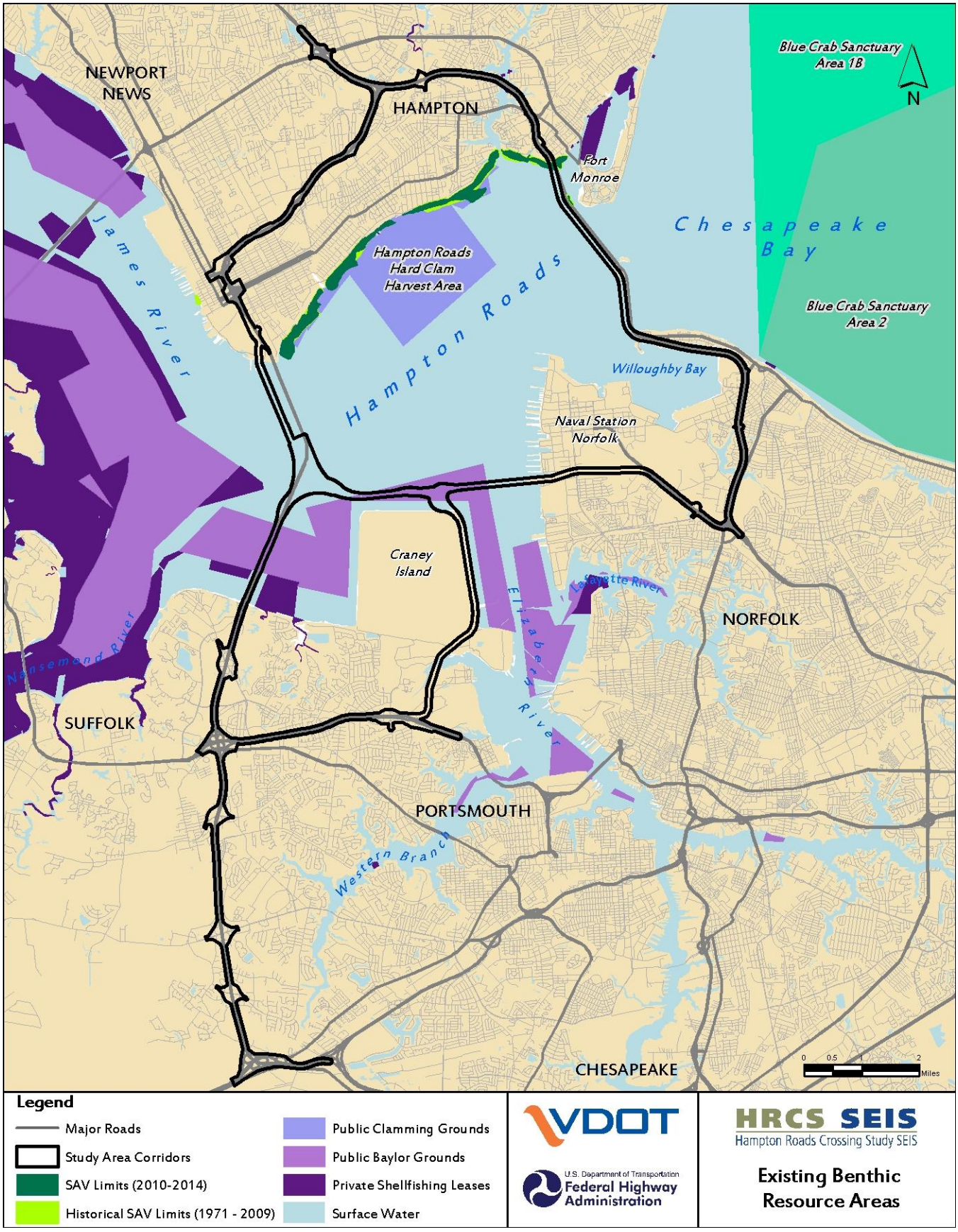
The VMRC manages both recreational and commercial saltwater fishing and marine water bottoms in public trust. The agency is responsible for shellfish regulation and private leasing of State bottom as well as encroachment on these resources under Section 28.2-1203 of the Virginia Code. Impacts to benthic 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 VIMS Center for Coastal Resources Management's Comprehensive Coastal Inventory Program (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.

Figure 3-14: Existing Benthic Resource Areas



Potential impacts to the hard clam, blue crab, and eastern 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, which includes the Preferred Alternative. 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 hard clam habitat because throughout Hampton Roads the bottom is composed of sand, mud, or a combination suitable for hard clams.

There are 273 acres of clam habitat present within Alternative A, 576 acres in Alternative B, 961 acres in Alternative C, and 1,477 acres in Alternative D.

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 3-4**).

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 3-44**. Areas of impact apply to potential habitat and protected areas for each of the three commercially significant species (hard clam, blue crab, and eastern 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 the **Preferred Alternative**, and which would require legislation to convert use prior to permitting construction.

Table 3-44: Potential Impacts to Benthic Resources (acres)

Resource	Alternative A	Alternative B	Alternative C	Alternative D	Preferred Alternative
Hard Clam Habitat	154	236	571	657	155
Hard Clam Habitat (tunnels)[1]	109	143	294	370	109
Hard Clam Habitat (portal island expansions and new islands)[1]	29	57	87	105	29
Public Clamming Grounds[2]	0	0	0	0	0
Blue Crab Habitat/SAV[3]	2	2	0	2	0.12
Blue Crab Sanctuary[4]	0	0	0	0	0
Oyster Reefs[4]	0	0	0	0	0
Oyster Sanctuary[4]	0	0	0	0	0
Public Baylor Grounds[4]	0	5	93	85	0
Private Shellfishing Leases[5]	0	0	0	0	0

Source and notes: All shellfish impacts are within a Condemnation Zone, including hard clams and eastern oysters. 1)The entire footprint beneath each alternative is considered potential hard clam habitat because the entire bottom is composed of sand, mud, or a combination suitable for hard clams (NOAA, 2015d and NOAA, 2016f). 2)CCRM, 2016). 3) VIMS, 2014. 5) VMRC, 2016a.4. Low density eastern oysters may be present; however, no high quality eastern 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 would be minimized and avoided through implementation of stormwater management plans designed to minimize impacts from increases in impervious surfaces, mitigate increases in runoff volume, and satisfy requirements to reduce pollutant loads below existing baseline conditions, as required by the VSMP regulations and Chesapeake Bay TMDL. This would minimize any increases in contaminants which could cause impairment of the area waterbodies. Stormwater management measures, including bioretention, stormwater basins, infiltration practices, vegetated swales, filter strips, open space conservation, and others would be implemented to avoid and minimize water quality impacts.

The introduction of additional hard substrate such as pilings and riprap protection could provide beneficial habitat where it did not previously exist for oysters and other marine benthic organisms. The expansion of the portal islands would impact potential clam and benthic infaunal habitat composed of the fine particle substrates 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, eastern 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 would 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-minute 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 the Study Area Corridors including nine fish species, two shark species, and three skate species (**Table 3-45**). 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 3-45: 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 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, **Alternative D** would impact 636 acres, and the **Preferred Alternative** would impact 158 acres. Impacts from the Preferred Alternative may ultimately be less than Alternative A since the wider LOD through the HRBT would provide additional flexibility and innovation to reduce impacts during design and construction. 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

In January 2017, NOAA Fisheries stated that they would provide conservation recommendations in the future when more information is known about the means, methods, and materials for construction of various project elements. The time of year and length of dredging operations may need to be considered in coordination with NOAA Fisheries 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 of controls 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 3-46**). The Atlantic sturgeon (*Acipenser oxyrinchus*), a federally and state-listed endangered species, is also an anadromous fish, but is addressed separately in the Threatened and Endangered Species section. 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 3-46: Anadromous Fish and Use Areas

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

Source: 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 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 food sources, such as insects, small fish, worms, and small crustaceans could temporarily affect the distribution of anadromous fish. Such activities 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 565 acres, **Alternative D** would impact 636 acres, and the **Preferred Alternative** would impact 158 acres of Potential Anadromous Fish Use Areas. Impacts from the Preferred Alternative may ultimately be less than Alternative A since the wider LOD through the HRBT would provide additional flexibility and innovation to reduce impacts during design and construction. 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 3-30**): 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 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 approximately two 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. The **Preferred Alternative** would impact approximately 0.12 acre. The smaller impact is due to a narrower LOD along the north shore of the Hampton Roads crossing to avoid Hampton University property. 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* 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 second least potential impact from spread of invasive species and 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. The **Preferred Alternative** would have the least potential impact from spread of invasive species since its LOD on land is similar but smaller than Alternative A due to the avoidance of Hampton University property.

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 required for environmentally sensitive areas and would be determined during the design and permitting process. In addition, in order to prevent the introduction of new invasive species and to prevent the spread of existing populations, 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. Likewise, in January 2017, NOAA Fisheries stated that they will provide conservation recommendations in the future when more information is known about the means, methods, and materials for construction of various project elements. On January 14, 2016, the USFWS published a final 4(d) Rule that defines prohibitions for purposeful and incidental take of Northern Long-eared Bat (NLEB). A December 2016 range-wide programmatic agreement between USFWS and FHWA, Federal Railroad Administration (FRA), and Federal Transit Administration (FTA) for the Indiana Bat and Northern Long-eared Bat (NLEB) can be utilized for these species in lieu of formal Section 7 consultation, if the project adheres to the scope and criteria of the range-wide Biological Assessment (BA). As indicated in a letter on January 23, 2017, NOAA Fisheries will not provide recommendations until the means, methods, and materials for construction have been determined during final design. The Intra-Service Programmatic BO on the final 4(d) Rule for the NLEB may be used for projects only affecting the NLEB, that do not include the Indiana Bat. In lieu of concluding the Section 7 consultation process during the development of this Final SEIS, 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 USFWS 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;
    - Conduct presence/absence surveys if necessary;
    - Submit project information to USFWS to determine whether the project adheres to the scope and criteria of the range-wide BA for the Indiana and Northern long-eared bat, and the Intra-Service Programmatic BO on the Final(d) Rule for the NLEB, if necessary; and
    - 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 3-47**. More detail is provided in the *HRCS Natural Resources Technical Report*.

Table 3-47: Threatened and Endangered Species Regulatory Context and Methodology

Resource	Regulatory Context	Methodology
Threatened and Endangered Species	• Endangered Species Act • Virginia Department of Agriculture and Consumer Services • Memorandum of Agreement between VDCR & VDACS • Range-wide Programmatic Agreement for Indiana Bat and Northern Long-eared Bat – FHWA, FRA, FTA • Intra-Service Programmatic BO on the Final(d) Rule for the Northern Long-eared Bat	• Habitat Assessment • GIS overlays

As a result of agency coordination, **Table 3-48** represents the agreed upon list of species that are currently listed as threatened or endangered and their status. 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 to spawning areas upstream. Therefore, no habitat assessments were performed.

Table 3-48: 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 3-49**). **Table 3-50** shows the proposed critical habitat for the Atlantic sturgeon within the Study Area Corridors. The Study Area Corridor for the **Preferred Alternative** is the same as for Alternative A, therefore its areas are the same.

Table 3-49: 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**

Table 3-50: Proposed Critical Habitat for Atlantic Sturgeon within Study Area Corridors (acres)

Species	Alternative A	Alternative B	Alternative C	Alternative D
Atlantic Sturgeon	202	483	935	1,382

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.

Atlantic Sturgeon

Atlantic sturgeons primarily use the project area as a migration corridor during spawn migrations. During the migrations, they primarily transit along the river within natural or artificial channels (Balazik et al, 2012). Atlantic sturgeon would generally be found within these deep water habitats in the alternatives during the migration period. Potential foraging habitat is present throughout Hampton Roads as the

entire substrate is composed of sand, mud, or a combination suitable for benthic species. SAV beds could be used for foraging and occur only along the eastern side of the north island of the HRBT, just west of Fort Monroe, and along the north shore of Hampton Roads between I-64 and I-664. No individuals in early life stages are expected to be present in the vicinity of the Study Area Corridors since they cannot withstand exposure to salinity.

NOAA Fisheries issued a proposed rule on June 2, 2016 declaring all portions of the James River from Boshers Dam west of Richmond, downstream to the mouth of the river, as critical habitat for the Atlantic sturgeon. This area encompasses all of the Study Area Corridors. Critical habitat is defined as geographic areas that are occupied by the species, and that contain features essential to the conservation of that species. Critical habitat can also include geographical areas that are not currently occupied by the species, but that are essential to its conservation. Once critical habitat is designated, Section 7(a)(2) of the ESA requires Federal agencies to ensure that any action they fund, authorize, or carry out is not likely to destroy or adversely modify that habitat (16 U.S.C. 1536(a)(2)). This requirement is in addition to the Section 7(a)(2) requirement that Federal agencies ensure that their actions are not likely to jeopardize the continued existence of ESA-listed species. Further coordination will be required with NOAA Fisheries to avoid impact to either the species or the proposed critical habitat.

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 agency-agreed upon listed terrestrial species within the LOD for each of the Build Alternatives are shown in **Table 3-51**. **Table 3-52** shows the potential impacts to the Atlantic sturgeon proposed critical habitat.

Table 3-51: Terrestrial Threatened and Endangered Species Habitat within the LOD (acres)

Species	Alternative A	Alternative B	Alternative C	Alternative D	Preferred Alternative
Shorebirds (Piping Plover, Wilson's Plover, Gull-billed Tern, Red Knot)	1	63	63	64	1
Canebrake Rattlesnake	0	21	37	37	0
Mabee's Salamander	0	0	0.02	0.02	0
Bats (NLEB, Little Brown Bat, Tri-colored Bat)	0	28	64	53	0
Total	**1**	**112**	**164**	**154**	**1**

Table 3-52: Proposed Critical Habitat for Atlantic Sturgeon within the LOD (acres)

Species	Alternative A	Alternative B	Alternative C	Alternative D	Preferred Alternative
Atlantic Sturgeon	138	214	565	636	158

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 would 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).

Atlantic sturgeon could potentially be affected by Alternative A construction activities due to their utilization of the area during seasonal breeding migrations. Their presence would most likely be in deep water habitat such as the federally maintained channels. They may also be found where suitable forage (e.g., benthic invertebrates such as mollusks and crustaceans) and appropriate habitat conditions are present (e.g., areas of SAV). Effects from the HRBT expansion to their prey species and foraging areas would be as described in the Environmental Consequences portions of the Benthic Species and SAV sections. The physical disturbance of sediments and entrainment of associated benthic resources could reduce the availability of Atlantic sturgeon prey, but the impacted benthic habitat represents an insignificant amount of the available habitat in the region, and recolonization of the opportunistic benthic species would occur quickly as described in the Environmental Consequences portion of the Benthic Species section, making impacts to Atlantic sturgeon habitat and prey negligible. Atlantic sturgeon may be susceptible to entrainment or impingement by dredge equipment that would be used for the HRBT tunnel construction, however the mobility and ability of adult and sub-adult sturgeon to avoid the low intake velocities of dredge equipment makes impingement unlikely. Eggs and young of the year would not be present in the area due to the salinity. Sound created by the installation of marine pilings has been documented to impact fish, including Atlantic sturgeon. As noted above, the entire Study Area Corridor lies within proposed critical habitat, however no pilings would be driven in the proximity of the deepest water within the habitat where Atlantic sturgeon would most likely occur since a tunnel would be constructed in the maintained channel. In addition, since Hampton Roads is approximately 3.5 miles wide at this point, it is expected that the majority of the waterway would be unaffected by the sound of driving bridge piles, and Atlantic sturgeon would be able to avoid the affected area.

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.

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

Alternative C has the potential to affect the most threatened and endangered species and/or habitat of all the Build Alternatives. Alternative C intersects the Craney Island Conservation Site and therefore would have the same effects on shorebirds at this location as described for Alternative B, but does not

intersect the Hampton Roads Bridge-Tunnel Island Conservation Site. Impacts to potential foraging habitat within 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.

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

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

The **Preferred Alternative** is similar to Alternative A, but encompasses a larger portion of 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. There are no significant differences in the impact to habitat of other terrestrial species between the Preferred Alternative and Alternative A. Impacts to the Atlantic sturgeon may ultimately be less than Alternative A since the wider LOD through the HRBT would provide additional flexibility and innovation to reduce impacts during design and construction.

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.

Specific minimization techniques are typically recommended and could be employed to minimize impacts to aquatic threatened and endangered species. The time of year and length of dredging may need to be considered. Certain dredging methods, such as hopper dredging, may increase the likelihood of entrainment and incidental take. Atlantic sturgeon are not averse to turbid waters, however turbidity curtains could further minimize impacts to them as well as their prey species. In order to further minimize the risk of potential impacts to Atlantic sturgeon from underwater noise, staging of pile driving activities and utilizing vibratory hammers could be employed. Additional measures that could be incorporated into the project to reduce the noise levels associated with pile driving activities include cushion blocks, ramp-up or soft strike procedures, and bubble curtains.

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 listed 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 3-53**.

Table 3-53: 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.

Species	Time of Year Restrictions
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.*

3.9 HISTORIC RESOURCES

Methodology

Section 106 of the National Historic Preservation Act (NHPA) of 1966 (as amended) (54 U.S.C. 306108) and its implementing regulations (36 CFR Part 800) require federal agencies to take into account the effects of their undertakings on "historic properties", defined as buildings, structures, sites, districts and objects, generally at least 50 years of age, that are listed on or eligible for listing on the National Register of Historic Places (NRHP). The Section 106 process is undertaken by federal agencies in consultation with the State Historic Preservation Officer (SHPO), who in Virginia is the director of the Virginia Department of Historic Resources (VDHR); the Advisory Council on Historic Preservation (ACHP), as appropriate; federally-recognized Indian tribes; representatives of local government; and other parties with a demonstrated interest in an undertaking (as identified in **Appendix D**).

The technical cultural resources studies undertaken to date in support of the Section 106 process for the HRCS are identified in **Appendix G**. These studies detail the results of VDOT's efforts thus far to identify the archaeological and non-archaeological, or "architectural" resources that might be affected by HRCS Alternatives A, B, C, D and the Preferred Alternative and to assess the significance of these resources against the eligibility criteria of the NRHP (36 CFR Part 60.4).

Prior to undertaking the technical studies, an Area of Potential Effects (APE) was defined for each Build Alternative. The APE is the geographic area within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties. The size and shape of the APE is influenced by the scale and nature of an undertaking. For the HRCS, 500-foot-wide Study Area Corridors associated with each Build Alternative (along with expanded areas at the locations of potential interchange improvements) were defined which, for the purposes of Section 106, constituted the APE for direct effects for the Draft SEIS Build Alternatives. In general, in undeveloped areas or in areas where alternatives cross water, the HRCS's APE for indirect effects (e.g., visual or auditory effects on historic setting) was defined as extending 500 feet beyond each side of the 500-foot Study Area Corridor. In developed areas where the Build Alternatives would involve improvements to existing highways, the indirect effects APE extends across tax parcels directly abutting the 500-foot Study Area Corridor and across any parcels immediately adjacent to the abutting properties.

The 500-foot Study Area Corridors used in the cultural resources technical studies were recognized as so-called "worst-case scenarios" for direct impacts. As work on this SEIS proceeded, more realistic and commonly narrower LOD were delineated for Alternatives A, B, C, and D based on early preliminary engineering. In some locations, early preliminary engineering resulted in a modification to the alignment of the 500-foot Study Area Corridor associated with a Build Alternative, or a LOD wider than the original

Study Area Corridor. The original cultural resources technical studies, prepared in April 2016, were revised in July 2016 to address these changes. The LOD delineated for the Preferred Alternative required no additional technical studies.

3.9.1 Architectural Resources

Affected Environment

The results of field surveys and archival research undertaken for the purposes of identifying architectural historic properties within the direct and indirect effects APEs for the four Build Alternatives are detailed in the technical report titled *Architectural Survey: Management Summary* (April 2016; revised July 2016). These results were coordinated with the SHPO, who concurred on April 28, 2016, and on December 5, 2016, that there are 20 architectural resources within the direct or indirect APEs associated with the four Build Alternatives either already listed on the NRHP or eligible for listing on the NRHP. For the purposes of applying the requirements of Section 106 of the NHPA to the HCRS, FHWA and VDOT have assumed that seven additional architectural resources within the APEs are eligible for listing on the NRHP.

Table 3-54 lists these 27 architectural historic properties and notes whether they are contained within the direct or indirect effects APE or the LOD for each of the four Build Alternatives included in the Draft SEIS, or within the LOD for the Preferred Alternative, which has an indirect effects APE that is identical to Alternative A. The acreage of land within the LOD for each alternative, including the Preferred Alternative, is listed in **Table 3-55**. This acreage is based on the identified National Register boundary or National Register eligible boundary for historic properties. For historic districts, all area within the historic district boundary was included in the acreage value, regardless of whether the area was considered a contributing element of the district. Historic properties are mapped in **Figures 3-15a – 3-15f** and historic battlefields are shown on **Figure 3-16**.

Table 3-54: Resources Listed On, Eligible for, or Assumed Eligible for Listing on the NRHP

VDHR #	City	Resource	NRHP Eligibility Status	Draft SEIS Alternative/ Preferred Alternative	Draft SEIS Alternatives			Preferred Alternative LOD
					Direct APE	Indirect APE	LOD	
114-0002	Hampton	Fort Monroe	NHL 1960; NRHP-Listed 1966	A, B, D, & Preferred Alternative		Yes		
114-0006	Hampton	Hampton Institute Historic District[1]	NRHP Listed 1969; NHL 1974; NHL Boundary Revised 1976	A, B, D, & Preferred Alternative	Yes	Yes	Yes	
114-0021	Hampton	Old Point Comfort Lighthouse	NRHP-Listed 1973	A, B, D, & Preferred Alternative		Yes		
114-0041	Hampton	Fort Wool	NRHP-Listed 1969	A, B, D, & Preferred Alternative		Yes	Yes	

VDHR #	City	Resource	NRHP Eligibility Status	Draft SEIS Alternative/ Preferred Alternative	Draft SEIS Alternatives			Preferred Alternative LOD
					Direct APE	Indirect APE	LOD	
114-0101	Hampton	Hampton Veterans Affairs Medical Center Historic District	NRHP-Eligible 1981	A, B, D, & Preferred Alternative	Yes	Yes		
114-0114	Hampton	Chamberlin Hotel	NRHP-Listed 2007	A, B, D, & Preferred Alternative		Yes		
114-0118	Hampton	Pasture Point Historic District	NRHP-Listed 2012	A, B, D, & Preferred Alternative		Yes		
114-0148	Hampton	Hampton National Cemetery	NRHP-Listed 1996	A, B, D, & Preferred Alternative		Yes		
114-0155	Hampton	Elmerton Cemetery	Recommended Potentially Eligible 2016	A, B, D, & Preferred Alternative		Yes		
114-5002	Hampton	Phoebus–Mill Creek Terrace Neighborhood Historic District	NRHP-Listed 2006	A, B, & D, & Preferred Alternative	Yes	Yes	Yes	Yes
114-5471; VA008	Hampton	Battle of Hampton Roads	NRHP-Eligible 2007	A, B, C, D, & Preferred Alternative	Yes	Yes	Yes	Yes
114-5600	Hampton	Hampton Coliseum	Recommended Potentially Eligible 2016	A, B, C, D, & Preferred Alternative	Yes	Yes		
121-0032	Newport News	St. Vincent de Paul Catholic Church	NRHP-Listed 2005	C & D		Yes		
121-0033	Newport News	Brown Manufacturing Coca-Cola Bottling Works, Daily Press Building	Recommended Potentially Eligible 2016	C & D		Yes		
121-0157	Newport News	Peninsula Catholic High School/St. Vincent's School for Girls	Recommended Potentially Eligible 2016	C & D	Yes	Yes		
121-0299	Newport News	Noland Company Building	NRHP-Listed 2010	C & D	Yes	Yes		

VDHR #	City	Resource	NRHP Eligibility Status	Draft SEIS Alternative/ Preferred Alternative	Draft SEIS Alternatives			Preferred Alternative LOD
					Direct APE	Indirect APE	LOD	
122-0410	Norfolk	Norfolk Naval Base Historic District[2]	Portions Considered NRHP-Eligible by Commander Navy Region Mid-Atlantic	A, B, C, D, & Preferred Alternative	Yes	Yes		
122-0531	Norfolk	Forest Lawn Cemetery	NRHP-Eligible 2012	A, B, D, & Preferred Alternative	Yes	Yes		
122-0954	Norfolk	Ocean View Elementary School	NRHP-Eligible 1998	A, B, D, & Preferred Alternative		Yes		
122-5045	Norfolk	Norfolk Naval Base Golf Club Historic District	NRHP-Eligible 1997	B, C, & D	Yes	Yes		
122-5426; VA001	Norfolk	Battle of Sewell's Point	NRHP-Eligible 2007	A, B, D, & Preferred Alternative	Yes	Yes	Yes	Yes
122-5434	Norfolk	Merrimack Landing Apartment Complex/ Merrimack Park Historic District	NRHP-Eligible 2012	A, B, D, & Preferred Alternative		Yes		
122-5930	Norfolk	Willoughby Elementary School	Recommended Potentially Eligible 2016	A, B, D, & Preferred Alternative		Yes		
124-5267	Portsmouth	Battle of Craney Island	NRHP-Eligible (ABPP 2007)	B, C, & D	Yes	Yes	Yes	
131-5325	Chesapeake	Sunray Agricultural Historic District	NRHP-Listed 2007	C & D		Yes		
Not assigned	Hampton, Newport News, Norfolk, Portsmouth, Suffolk	Captain John Smith Chesapeake National Historic Trail	Assumed Eligible for the Purposes of this Study	A, B, C, D, & Preferred Alternative	Yes	Yes	Yes	Yes

VDHR #	City	Resource	NRHP Eligibility Status	Draft SEIS Alternative/ Preferred Alternative	Draft SEIS Alternatives			Preferred Alternative LOD
					Direct APE	Indirect APE	LOD	
Not assigned	Hampton, Newport News, Norfolk, Portsmouth, Suffolk	Washington-Rochambeau Revolutionary Route National Historic Trail	Assumed Eligible for the Purposes of this Study	A, B, C, D, & Preferred Alternative	Yes	Yes	Yes	Yes

[1] Includes both the Hampton Institute Historic District and the Hampton Institute National Historic Landmark, which has a smaller boundary than the historic district. The Hampton Institute National Historic Landmark is not in the direct effects APE or LOD of the Draft SEIS Build Alternatives or the Preferred Alternative.

[2] Subsequent to publication of the Draft SEIS the SHPO clarified that it considers all of Naval Station Norfolk and Naval Support Activity Hampton Roads to be an historic district eligible for listing on the NRHP, but does not consider the highway right-of-way associated with existing I-64 and I-564 to be contributing to the district.

Table 3-55: Acreage of Architectural Historic Properties Located within the Limits of Disturbance

Historic Property	Alt. A	Alt. B	Alt. C	Alt. D	Preferred Alt.
Fort Monroe (VDHR #114-0002)	0	0	0	0	0
Hampton Institute Historic District (VDHR #114-0006)	1.1	1.1	0	1.1	0
Old Point Comfort Lighthouse (VDHR #114-0021)	0	0	0	0	0
Fort Wool (VDHR # 114-0041)	0	0	0	0	0
Hampton Veterans Affairs Medical Center Historic District (VDHR #114-0101)	0	0	0	0	0
Pasture Point Historic District (VDHR #114-0118)	0	0	0	0	0
Chamberlin Hotel (VDHR #114-0114)	0	0	0	0	0
Hampton National Cemetery (VDHR #114-0148)	0	0	0	0	0
Phoebus–Mill Creek Terrace Neighborhood Historic District (VDHR #114-5002)	0.7	0.7	0.0	0.7	0.7
Battle of Hampton Roads (VDHR #114-5471; VA008)	156.8	337.8	720.3	801.0	164.2
St. Vincent de Paul Catholic Church (VDHR #121-0032)	0	0	0	0	0

Historic Property	Alt. A	Alt. B	Alt. C	Alt. D	Preferred Alt.
Noland Company Building (VDHR #121-0299)	0	0	0	0	0
Norfolk Naval Base Historic District (VDHR #122-0410)[1]	29.4	46.7	60.0	46.7	0[3]
Forest Lawn Cemetery (VDHR # 122-0531)	0	0	0	0	0
Ocean View Elementary School (VDHR #122-0954)	0	0	0	0	0
Norfolk Naval Base Golf Club Historic District (VDHR #122-5045)	0	0	0	0	0
Battle of Sewell's Point (VDHR #122-5426; VA001) [2]	130.2	130.2	0	130.2	137.2
Merrimack Landing Apartment Complex/Merrimack Park Historic District (VDHR #122-5434)	0	0	0	0	0
Sunray Agricultural Historic District (VDHR #131-5325)	0	0	0	0	0
Elmerton Cemetery (VDHR #114-0155)	0	0	0	0	0
Hampton Coliseum (VDHR #114-5600)	0	0	0	0	0
Brown Manufacturing Coca-Cola Bottling Works, Daily Press Building (VDHR #121-0033)	0	0	0	0	0
Peninsula Catholic High School/St. Vincent's School for Girls (VDHR #121-0157)	0	0	0	0	0
Willoughby Elementary School (VDHR #122-5930)	0	0	0	0	0
Battle of Craney Island (VDHR #124-5267)	0	6.7	6.7	6.7	0
Captain John Smith Chesapeake National Historic Trail (VDHR # Not assigned)[3]	0	0	0	0	0
Washington-Rochambeau Revolutionary Route National Historic Trail (VDHR # Not assigned)[3]	0	0	0	0	0

[1]Subsequent to publication of the Draft SEIS the SHPO clarified that it considers all of Naval Station Norfolk and Naval Support Activity Hampton Roads to be an historic district eligible for listing on the NRHP, but does not consider the highway right-of-way associated with existing I-64 and I-564 to be contributing to the district.
[2] The Draft SEIS incorrectly reported that portions of Alternative C crossed the NRHP-eligible boundaries of this battlefield.
[3] The NRHP boundaries of this resource have not been determined.

Figure 3-15a: Architectural Historic Properties on Draft SEIS Study Corridors, Alternatives A, B, C, & D

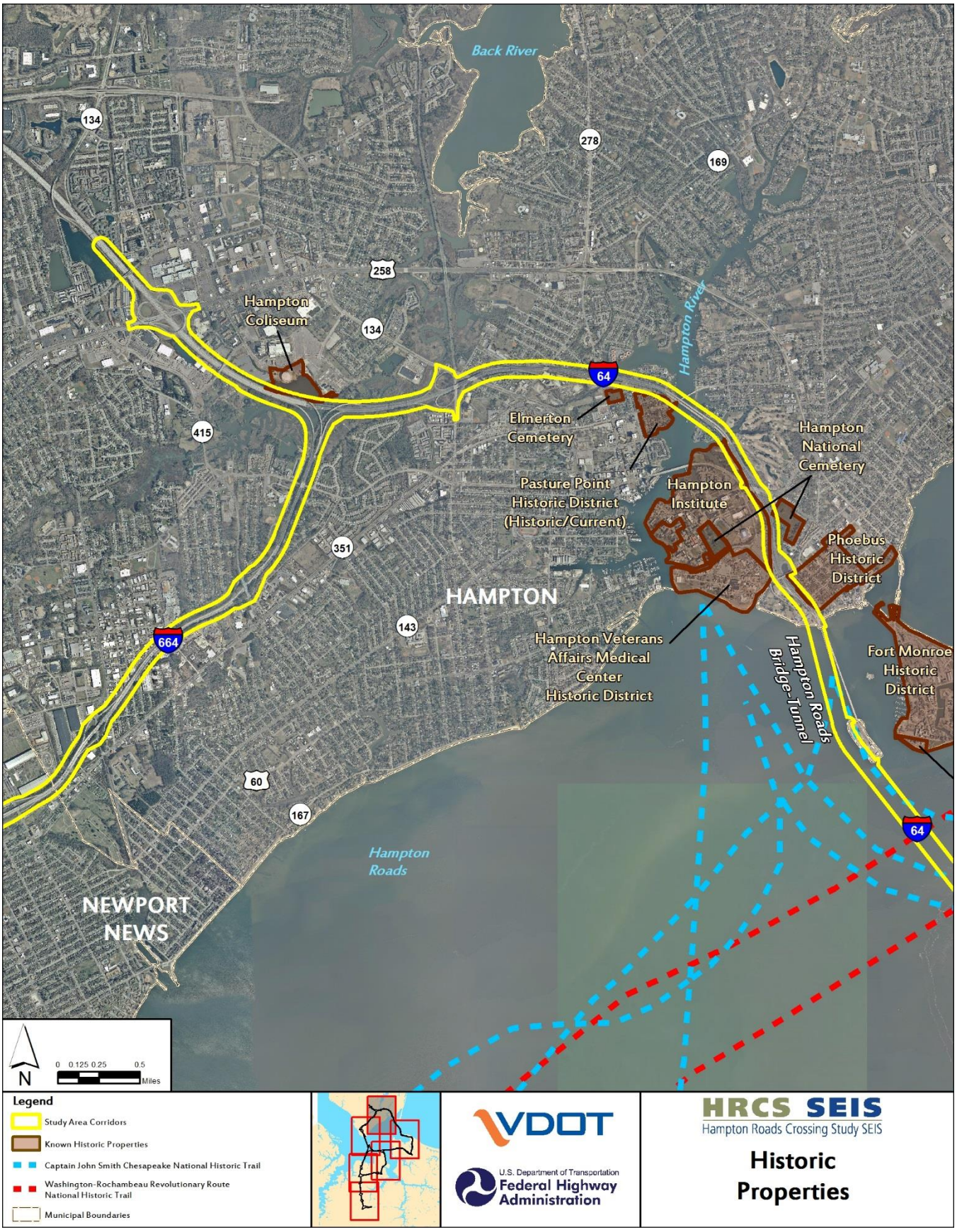


Figure 3-15b: Architectural Historic Properties on Draft SEIS Study Corridors, Alternative A, B, C, & D

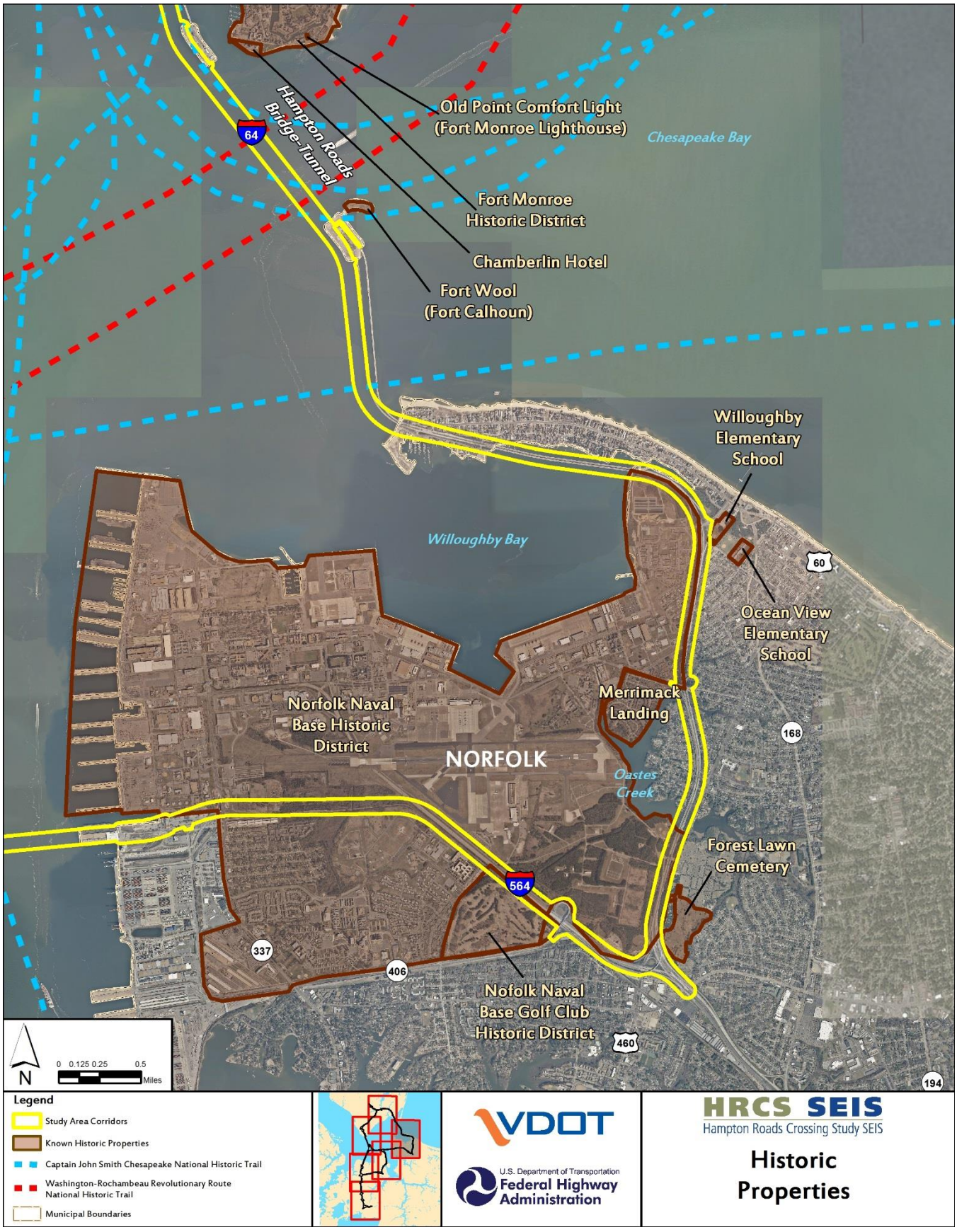


Figure 3-15c: Architectural Historic Properties on Draft SEIS Study Corridors, Alternatives A, B, C, & D

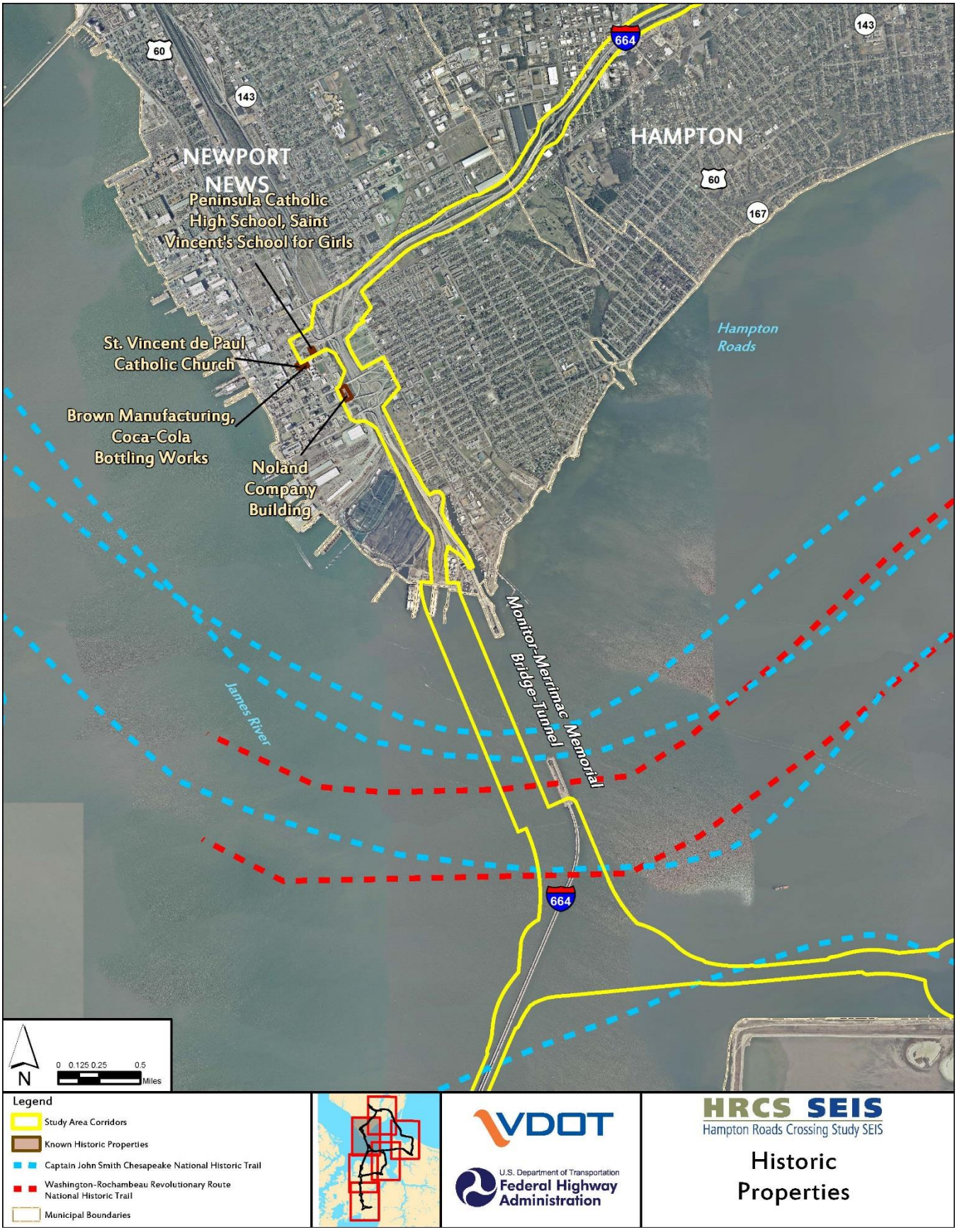


Figure 3-15d: Architectural Historic Properties on Draft SEIS Study Corridors, Alternatives A, B, C, & D

Figure 3-15e: Architectural Historic Properties on Draft SEIS Study Corridors, Alternatives A, B, C, & D

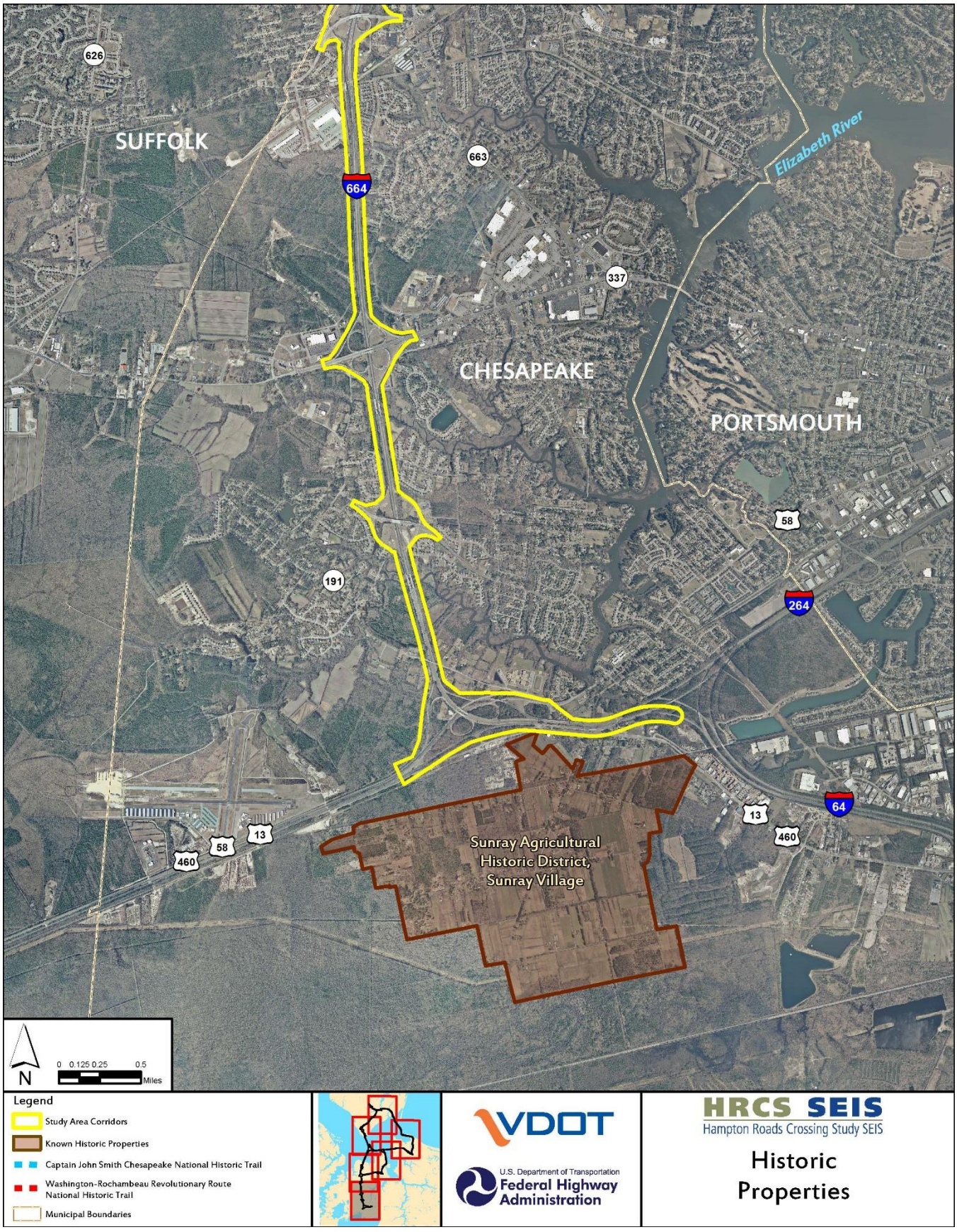


Figure 3-15f: Architectural Historic Properties on Draft SEIS Study Corridors, Alternatives A, B, C, & D

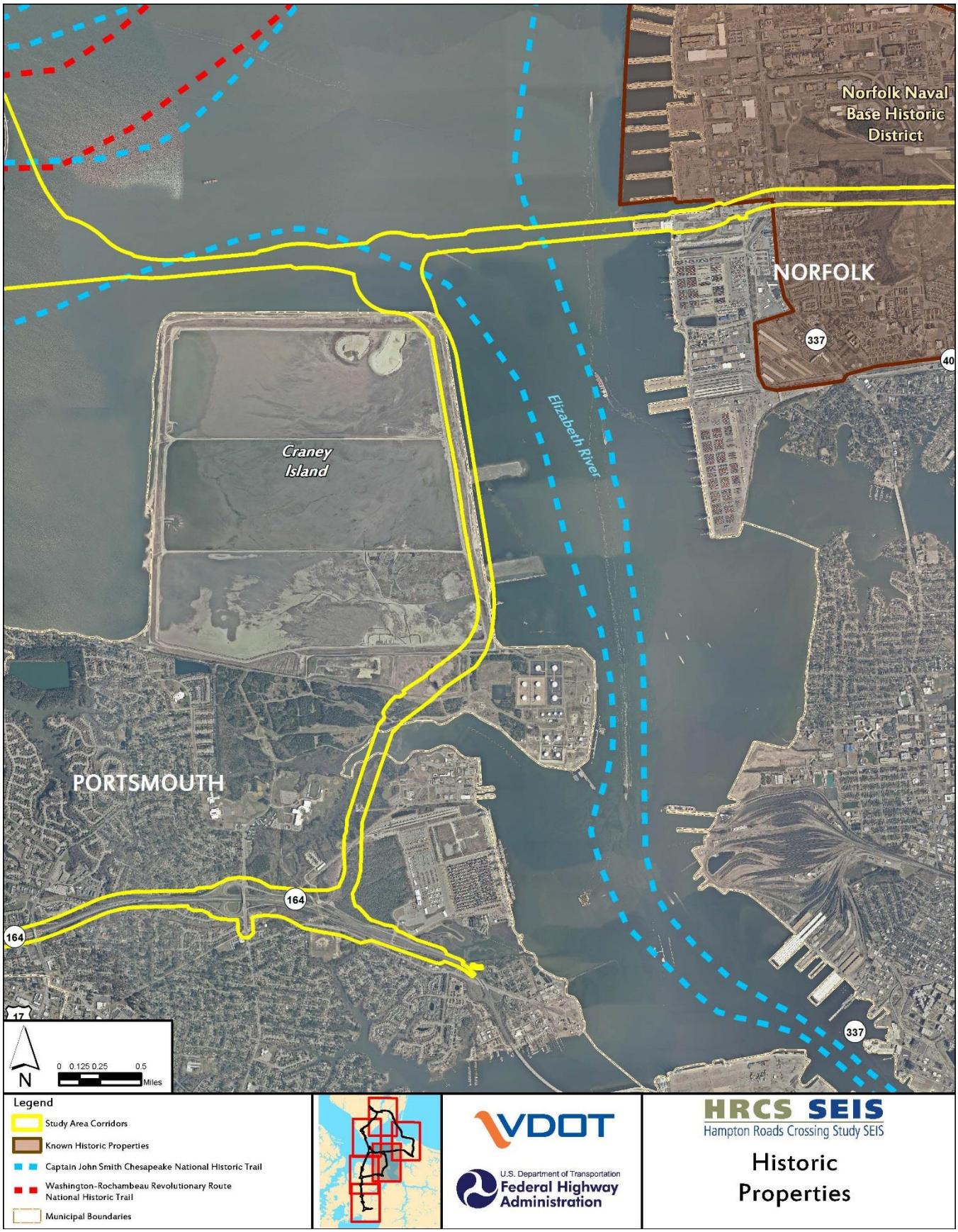


Figure 3-16: Historic Battlefields on Draft SEIS Study Corridors, Alternatives A, B, C, & D

Environmental Consequences

In accordance with the requirements of Section 106 of the NHPA, in preparation of the Draft SEIS VDOT considered how the four proposed Build Alternatives might affect the 27 architectural (above-ground) historic properties located within the direct and indirect APEs. Under the regulations implementing Section 106, an "effect" is an "alteration to the characteristics of a historic property qualifying it for the National Register" [36 CFR §800.16(i)]. An effect is adverse when it alters a qualifying characteristic of the property "in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association" [36 CFR §800.5(a)(1)]. The SHPO provided comments on VDOT's preliminary assessments of effect as presented in the Draft SEIS and in the section immediately below on September 19, 2016 (**Appendix D**). Later, the SHPO also provided clarification on its assessment of the NRHP-eligibility and appropriate NRHP boundaries for the Norfolk Naval Base Historic District during a meeting with VDOT on October 26, 2016. The SHPO's comments and the comments of other parties on the Draft SEIS were taken into account in refinements to the Preferred Alternative. VDOT's assessment of effects on the 20 historic properties located within the direct and indirect APE for the Preferred Alternative, described in the second section below, was provided to the SHPO and other consulting parties to the Section 106 process for review and comment on November 22, 2016. The SHPO concurred with VDOT's assessments on December 29, 2016. Correspondence with the SHPO regarding the assessment of effects is included in **Appendix D**.

Alternatives A, B, C, and D

Fort Monroe (VDHR #114-0002), located in Hampton southeast of the community of Phoebus and east of the HRBT, was conceived as an element of the Third System of coastal defenses outlined by Congress in the aftermath of the War of 1812. The facility guarded the navigational channel between Hampton Roads and Chesapeake Bay. The property, which includes a seven-sided stone fort, was designated a National Historic Landmark (NHL) in 1960 because of its historical significance and the integrity of the associated architecture. The property was listed on the NRHP in 1966. In 1973, the Secretary of the Interior expanded the boundary of the NHL district to include the entirety of Fort Monroe within the floodwall, and in 2011 President Obama designated approximately 325 acres of the property a National Monument within the National Park Service system. Fort Monroe lies outside the direct effects APEs associated with Alternative A, B, and D. The indirect APEs associated with these alternatives were specifically extended to include the historic property; however, all transportation improvements in the vicinity of Fort Monroe under these alternatives as proposed in the Draft SEIS would be constructed on the west side of and in close proximity to the existing HRBT infrastructure. Thus, the proposed improvements should not alter any of the characteristics that contribute to the significance of Fort Monroe, including any features of its viewshed that may still contribute to its historic setting. The *HRCS Noise Analysis Technical Report* (2016: Table 4-2, CNE AX; Figure 4-1, Sheet 9) predicts that under both the No-Build and the Build Alternatives 2040 noise levels would increase only slightly over existing levels in areas of Fort Monroe immediately east of proposed above-water improvements to the west end of the HRBT. Existing noise levels are 55-58 dBA L_{eq}. Under the No-Build, 2040 noise levels are predicted to be 56-59 dBA L_{eq}, while under Alternatives A and B and Alternative D they are predicted to be 57-59 dBA L_{eq} and 56-59 dBA L_{eq}, respectively.

Hampton Institute Historic District (VDHR #114-0006) is located near the mouth of the Hampton River immediately southwest of Interstate 64 on approximately 201 acres now associated with Hampton University. The district was listed on the NRHP in 1969 under Criteria A and C for its importance in history

and its architecture. A smaller area of about 15 acres that includes only the core historic buildings associated with the Institute and the Emancipation Oak was designated a National Historic Landmark in 1974.

The roots of the first historically African-American college in the country are associated with the "Grand Contraband Camp" established to house slaves who had escaped bondage to reach Fort Monroe after Union Major General Benjamin Butler in 1861 declared that escaped slaves reaching Union lines would be considered contrabands of war. Mary Peake, a free Negro, was enlisted to teach the refugee slaves in this community and held her first class under a Live Oak (*Quercus virginiana*). That tree still stands on the Hampton University grounds and is now known as the Emancipation Oak because it was the site of the first reading of the Emancipation Proclamation in the South in 1863. In 1868, Brigadier General Samuel Armstrong, Superintendent of the Freedmen's Bureau of the Ninth District of Virginia, using funds acquired from the American Missionary Association, established the Hampton Normal and Agricultural Institute to train Negro youth. A program of Native American education ran at the Normal School from 1878 to 1923. Following an expansion of the school's curriculum to meet college requirements, Hampton Normal and Agricultural Institute became Hampton Institute in 1930. In 1984, following continued growth and development, Hampton Institute was renamed Hampton University.

Both the direct and indirect effects APEs associated with Alternatives A, B, and D extend into the boundaries of the ca. 201-acre NRHP-eligible historic district. The Emancipation Oak lies within the direct effects APEs of these alternatives, but outside the HRCS Draft SEIS LOD. All other portions of the historic educational institution designated as a NHL lie outside the direct and indirect effects APEs. The proposed improvements minimize encroachment on the property by the use of a retaining wall, but as shown in the Draft SEIS Alternatives A, B, and D, would still involve direct impacts to 1.1 acres within the NRHP property boundaries along narrow strips of ground adjacent to I-64, primarily south of the University baseball field.

In 2012, in relation to its transportation study of the HRBT, VDOT enlisted a certified arborist and tree risk assessor to conduct a condition assessment and site survey of the Emancipation Oak for the purpose of setting construction restrictions with a minimum Tree Limit of Disturbance (Tree LOD) boundary. The arborist defined the Tree LOD along the eastern or I-64 side of the open area containing the oak as the line of an existing chain link fence that runs between a row of loblolly pines and the interstate. In the vicinity of the Emancipation Oak, the proposed HRCS Draft SEIS LOD does not breach the Tree LOD, involves no encroachment on University property, and maintains the existing highway right-of-way line along the existing I-64 access ramp directly east of the tree. However, as recommended by the arborist in 2012, during any construction within the existing interstate right-of-way in this area, the Tree LOD and the Emancipation Oak itself should be monitored because existing trees surrounding the oak contribute to its current condition by creating a micro climate, including shading, wind protection, moisture distribution, and nutrients from fallen leaves, to which the oak has acclimated.

Proposed highway improvements associated with Alternatives A, B, and D should have no adverse effect on Hampton Institute Historic District. Because these alternatives involve proposed improvements to an existing interstate highway, with minimal encroachment on the district boundaries and no direct impacts to any structures within the district, or the Emancipation Oak, none of the alternatives would result in a diminishment of the integrity of the historic setting of the property. The results of the *HRCS Noise Analysis Technical Report* (2016: Table 4-2, CNE AQ, CNE AR; Figure 4-1, Sheet 7) also indicate no diminishment of the existing historic setting of the property due to traffic noise from Alternatives A, B,

and D. Existing noise levels within two defined Common Noise Environment (CNE) areas within Hampton Institute are 61-70 and 70-74 dBA L_{eq}, respectively. Predicted 2040 levels are 62-71 and 71-75 dBA L_{eq} under the No-Build, 62-70 and 71-75 dBA L_{eq} under Alternatives A and B, and 61-70 and 71-75 dBA L_{eq} under Alternative D.

Old Point Comfort Lighthouse (VDHR #114-0021), located within the current bounds of Fort Monroe on Fenwick Road, was constructed at the southern edge of Old Point Comfort at the northern entrance to the Hampton Roads harbor. The lighthouse was constructed in 1802 and is the second oldest lighthouse on the Chesapeake Bay. The Old Point Comfort Lighthouse was listed on the NRHP in 1973 under Criteria A and C. The lighthouse lies roughly 3,000 feet northeast of the HRBT and is well outside the direct effects APEs associated with Alternative A, B, and D. The indirect effects APEs associated these alternatives were specifically extended to include the historic property; however, as shown in the Draft SEIS all transportation improvements under these alternatives would be constructed on the west side of and in close proximity to the existing HRBT infrastructure and should not alter any of the characteristics that contribute to the significance of Old Point Comfort Lighthouse, including any features of its viewshed that may still contribute to its historic setting. As discussed elsewhere in this section in reference to Fort Monroe and Fort Wool, the lighthouse should experience little to no increase in traffic noise levels under the HCRS Build Alternatives.

Fort Wool (VDHR #114-0041) was listed on the NRHP in 1969 under Criteria A and C for its military significance and architecture. Construction of Fort Wool was initiated in 1819 as part of a coastal fortification plan and the fort played a role in the defense of Hampton Roads during the Civil War, World War I, and World War II. The fort is located on a 15-acre island constructed of granite blocks approximately one-mile south of Fort Monroe and immediately east of the eastern entrance to the westbound HRBT tunnel. Despite its proximity to the existing HRBT, Fort Wool lies outside the direct effects APEs associated with Alternatives A, B, and D. The indirect effects APEs associated these alternatives were specifically extended to include the historic property; however, as proposed in the Draft SEIS all transportation improvements under these alternatives would be constructed on the west side of and in close proximity to the existing HRBT infrastructure and should not alter any of the characteristics that contribute to the significance of Fort Wool, including any features of its viewshed that may still contribute to its historic setting. The *HRCS Noise Analysis Technical Report* (2016: Table 4-2, CNE AY; Figure 4-1, Sheet 10) predicts under both the No-Build and the Build Alternatives 2040 noise levels would increase only slightly over existing levels on Fort Wool. Existing noise levels are 56-56 dBA L_{eq}. Under the No-Build Alternative and Alternatives A, B, and D they are predicted to be 57-57 dBA L_{eq}.

Hampton Veterans Affairs Medical Center Historic District (VDHR #114-0101) is located west of I-64 near Mallory Street in Hampton and comprises approximately 266 acres of land on a peninsula immediately south of Hampton University. The historic district is owned and managed by the US Department of Veterans Affairs. The hospital began operations in 1872 and is the fourth oldest military-run hospital in the country. The Hampton Veterans Affairs Medical Center Historic District is a complete medical complex with 82 resources on the campus, 34 of which contribute to the historic district. The Historic District was determined eligible for listing on the NRHP by the Keeper of the National Register in 1981 under Criteria A and C. The indirect effects APEs for Alternatives A, B, and D extend into the medical center property and in one small section each, the direct effects APEs for these alternatives just barely overlaps the historic property boundary. The proposed HRCS Draft SEIS LOD does not extend into the historic property boundaries. In the vicinity of the medical center the LOD is, for the most part,

is contained within the footprint of existing highway infrastructure (e.g., I-64 access ramps). The *HRCS Noise Analysis Technical Report* (2016: Table 4-2, CNE AS; Figure 4-1, Sheet 7) found that the small changes to existing noise levels (60-60 dBA L_{eq}) predicted to occur within the historic property under Alternatives A, B, and D (61-61 dBA L_{eq}) would be no different that the level predicted for the No-Build Alternative (61-61 dBA L_{eq}). For these reasons, Alternatives A, B, and D should have no effect on the historic property.

Chamberlin Hotel (VDHR #114-0114), constructed in 1928, is located at #2 Fenwick Road within the bounds of Fort Monroe and was listed on the NRHP in 2007 under Criterion C for its architecture. Architect Marcellus Wright's building design reflects the colonial heritage of the Peninsula as well as the influence of prominent early twentieth-century Beaux-Arts architects of the firm Warren and Wetmore. The Chamberlin served primarily as a resort hotel but also accommodated WWII officers and their families in the 1940s. The building is nine stories tall, U-shaped, and fronts on the Hampton Roads. The Chamberlain is located approximately 650 feet northeast of the island at the west entrance to the HRBT, outside the direct effects APEs associated with Alternatives A, B, and D. The indirect effects APEs associated with these alternatives were specifically extended to include the historic property; however, as proposed in the Draft SEIS all transportation improvements under these alternatives would be constructed on the west side of and in close proximity to existing HRBT infrastructure and should not alter any of the characteristics that contribute to the significance of Chamberlain Hotel, including any features of its viewshed that may still contribute to its historic setting. The findings of the *HRCS Noise Analysis Technical Report* (2016) discussed earlier in this section in reference to Fort Monroe indicate that only a very small increase above existing noise levels would occur under Alternatives A, B, and D, and these levels would not differ appreciably from those predicted for the No-Build Alternative.

Pasture Point Historic District (VDHR #114-0118) is a late nineteenth/early twentieth century neighborhood located north of the central business district in Hampton and listed on the NRHP in 2012 under Criterion A as an example of an early suburb driven by local transportation developments. The district is also eligible under Criterion C as a collection of significant residential architectural styles with characteristic urban design composition and grid pattern street layout. The period of significance is 1885 to 1938 when streetcars and trolleys dominated local transportation. While both the direct and indirect effects APEs for Alternatives A, B, and D extend into the historic district boundaries, the proposed HRCS Draft SEIS LOD is restricted to existing I-64 right-of-way and does not encroach on the district.

Considering that all improvements proposed under these alternatives would be to an existing interstate highway which, for the most part is 100 or more feet from the district, Alternatives A, B, and D should not alter or diminish any of the characteristics that contribute to the significance of the historic property, including any features of its viewshed that may still contribute to its historic setting. The *HRCS Noise Analysis Technical Report* (2016: Table 4-2, CNE AJ; Figure 4-1, Sheet 5) found that the small changes to existing noise levels (58-68 dBA L_{eq}) predicted to occur within the historic property under Alternatives A, B, and D (59-69 dBA L_{eq}) would be no different that the levels predicted for the No-Build Alternative (59-69 dBA L_{eq}). The noise technical study also indicated that construction of a noise barrier along the south edge of the I-64 right-of-way in the vicinity of the Pasture Point Historic District would be feasible and reasonable, and would benefit the single family residences within the district and other receptors nearby by an average noise reduction of 8.3 decibels. The potential noise barrier would be 15 feet high for sections on structure and 20 feet high for those on the ground (for comparison, the average height of a tractor trailer is on the order of 14 feet). The historic setting along the north side of the Pasture Point

Historic District has already been greatly altered by existing I-64, and the potential addition of a noise barrier in this location should not further degrade the district's setting, provided the aesthetic features of the barrier (e.g., color) are designed to be compatible with the historic property.

Hampton National Cemetery (VDHR #114-0148) is presently comprised of two noncontiguous parcels. The older portion of the cemetery, established in 1866, is located roughly 0.25 mile west of I-64 and outside of the direct and indirect APEs for Alternatives A, B, and D. The Phoebus Section, purchased in 1891, is located on Cemetery Road at Marshall Avenue east of I-64. One corner of the Phoebus Section parcel directly abuts the I-64 highway right-of-way. Hampton National Cemetery was listed on the NRHP in 1996 under Criterion A with a period of significance of 1866 to 1940, and is included in the Multiple Property Document *Civil War Era National Cemeteries.* While the direct and indirect effects APEs for Alternatives A, B, and D extend into the Phoebus Section of the cemetery, the proposed HRCS Draft SEIS LOD on the east side of I-64 in the vicinity of the cemetery maintains the existing interstate right-of-way line. Considering that all improvements proposed under Alternatives A, B, and D would be to the existing roadway, these alternatives should have no effect on any of the characteristics that presently contribute to the historic significance of the cemetery, including any features of its viewshed that may still contribute to its historic setting. The *HRCS Noise Analysis Technical Report* (2016: Table 4-2, CNE AT; Figure 4-1, Sheet 7) supports this finding. Existing noise levels measured within the Phoebus Section are 59-75 dBA L_{eq}; predicted 2040 noise levels under the No-Build Alternative, Alternatives A and B, and Alternative D are 60-76, 60-76, and 59-76 dBA L_{eq}, respectively.

Elmerton Cemetery (VDHR #114-0155), located in Hampton along N. King Street, is recommended potentially eligible for listing on the NRHP and this study assumes it is eligible for the purposes of applying the requirements of Section 106 of the NHPA to the HRCS. The assumed historic property boundaries define a property measuring roughly 475 feet by a maximum of roughly 400 feet. The cemetery contains the grave of Mary S. Peake, the first African-American teacher of free blacks at Fort Monroe, and has been a burial ground for African-Americans since the Emancipation Proclamation. The cemetery lies just outside the direct effects APEs for Alternatives A, B, and D, but within the indirect effects APEs. The proposed HRCS Draft SEIS LOD in this area of these alternatives is confined to the existing I-64 highway right-of-way limits. Thus, Alternatives A, B, and D should have no effect on any of the characteristics that presently contribute to the historic significance of the cemetery, including any features of its viewshed that may still contribute to its historic setting. All of Elmerton Cemetery lies outside the 66 dBA L_{eq} noise contour modeled under the *HRCS Noise Analysis Technical Report* (2016: Figure 4-1, Sheet 5) for the loudest Build Alternative in each area. Cemeteries are defined as Category C land uses under FHWA's noise abatement criteria. For Category C properties, a noise impact is assumed to occur when predicted exterior noise levels approach or exceed 67 dBA L_{eq}.

Phoebus–Mill Creek Terrace Neighborhood Historic District (VDHR #114-5002) is situated in the City of Hampton along Mill Creek. The community was formally incorporated in 1874 when it was named Chesapeake City. In 1900 the name was changed to Phoebus, in honor of Harrison Phoebus, who developed the well-known Hygeia Hotel as a resort adjacent to the town. The town is laid out in a gridiron pattern that was developed in 1874 upon incorporation. The area developed as a stopover point between Hampton and Norfolk due to its close proximity to Old Point Comfort and the ferry crossing. The historic district was listed on the NRHP in 2006 under Criteria A and C for its development as a town in Elizabeth City County (later annexed to the City of Hampton in 1952) during the fourth quarter of the nineteenth

century and for its town planning and architectural character from the period 1874 to 1957, when the HRBT opened.

The southwest border of the district boundary extends in places to the eastern side of I-64 right-of-way and the direct and indirect effects APEs associated with Alternatives A, B, and D extend into the district. The HRCS Draft SEIS LOD extends a maximum of approximately 50 feet into the district at Mallory Street, at the west end of South Hope Street, west of the 100 block of Segar Street, and along a portion of National Avenue; however, the LOD does not extend into any of the tax parcels associated with buildings considered contributing elements of the historic district. It appears that the structure (VDHR # 114-5002-0241) at 121 National Avenue would need to be demolished to construct Alternatives A, B, and D, but this ca. 1960 VDOT administration building is not considered a contributing element of the historic district. A noise barrier presently runs between the shoulder of the I-64 travel lanes and the southwest border of the district boundary; and the barrier is expected to remain or be replaced under the Build Alternatives. The *HRCS Noise Analysis Technical Report* (2016: Table 4-2, CNE AW; Figure 4-1, Sheet 8) found that the small changes to existing noise levels (52-67 dBA L_{eq}) predicted to occur within the historic district under Alternatives A, B, and D (53-68 dBA L_{eq}) would be no different than the changes predicted under the No-Build Alternative (53-68 dBA L_{eq}). In light of these considerations, and the fact that Alternatives A, B, and D only involve changes to an existing interstate highway, it is believed the alternatives would alter but not result in a diminishment of the integrity of any of the characteristics that presently contribute to the significance of the Phoebus–Mill Creek Terrace Neighborhood Historic District, including any features of its viewshed that may still contribute to its historic setting.

The Battle of Hampton Roads (VDHR #114-5471; ABPP #VA008) was a Civil War naval engagement in which the Confederacy attempted to break the Union blockade of Hampton Roads. The battle, which took place over two days, March 8-9, 1862, is also known as the *Battle of the Ironclads* and is significant in the development of navies as it was the first meeting in combat of ironclad warships. After destroying two conventional Union ships, one of which was the USS Cumberland, on the first day of the battle, the ironclad CSS Virginia faced the ironclad USS Monitor on the second day. The ensuing three-hour battle ended inconclusively with neither ship sustaining significant damage.

The National Park Service's American Battlefield Protection Program (ABPP) has defined a Study Area of approximately 46,000 acres associated with the engagement within which they have identified an area covering approximately 35,000 acres as Potentially Eligible for the National Register (PotNR). For the purposes of this study, the ABPP's PotNR is assumed NRHP-eligible. Portions of both the direct and indirect effects APEs of all four HRCS Build Alternatives are located within the ABPP's PotNR boundary, but it is not believed that the alternatives will diminish the integrity of any non-archaeological components of the battlefield that contribute to its significance, including any features that may still contribute to its historic setting. The battlefield is located within what is now a highly industrialized and developed area in which few remnants of the historic landscape survive. Additionally, much of the construction associated with the four HRCS Build Alternatives involve improvements of or improvements immediately adjacent to existing transportation infrastructure, such as the MMMBT and the HRBT. The underwater archaeological remains of the USS Cumberland (44NN0073) have been identified and are located roughly one mile northwest of the centerline of the proposed improvements (Alternatives C and D) to the west side of the existing MMMBT, where it leaves Newport News. The underwater archaeological survey conducted to date for the HRCS has identified no significant archaeological resources, but these studies are still incomplete in the underwater sections of Alternatives A, B, and D in

the vicinity of the HRBT. If any significant underwater resources associated with the Battle of Hampton Roads are eventually identified within the HRCS LOD, they likely would meet the regulatory exception to the requirements of Section 4(f) approval: i.e., the sites likely would be important chiefly for the information they contain, which can be retrieved through data recovery, and would have minimal value for preservation in place [23 CFR §774.13(b)(1)].

Hampton Coliseum (VDHR #114-5600) was constructed in 1970, after initial construction of I-64 in this area of Hampton Roads, and was the first large-scale arena of its type built as a multi-purpose building in Hampton Roads as well as in the state. The building features 96 triangular-shaped concrete wall panels on the exterior to create a unique design. This study assumes that Hampton Coliseum is eligible for listing on the NRHP under Criterion C for its architectural design as it embodies distinctive characteristics of a type and method of construction as well as possesses high artistic value. The assumed historic property boundary coincides with the tax parcel boundary and the property is partially located within both the direct and indirect effects APEs for Alternatives A, B, C, and D. The proposed HRCS Draft SEIS LOD in this area of Alternatives A, B, C, and D is confined within the present right-of-way limits associated with I-64. The *HRCS Noise Analysis Technical Report* (2016: Table 4-2, CNE AC; Table 4-6, CNE AC; Figure 4-1, Sheet 1) showed 2040 predicted noise levels under Alternatives A and B (45-72 dBA L_{eq}) and Alternatives C and D (45-71 dBA L_{eq}) only slightly above existing (44-70 dBA L_{eq}) and predicted No-Build Alternative (45-71 dBA L_{eq}) levels. Therefore, these alternatives should not affect any of the characteristics of the property that contribute to its historic significance, including any features of its viewshed that may still contribute to its historic setting.

St. Vincent de Paul Catholic Church **(VDHR #121-0032),** located at 230 33rd Street in Newport News, roughly 0.25 mile southwest of I-664, is a temple-form brick structure which features a monumental pedimented front portico supported by Composite columns, a heavy denticulated entablature, tall arched stained glass windows, and pilasters along the side elevations. The church was listed on the NRHP in 2005 under Criteria A and C, Criterion Consideration A (Religious Property), for its role as the first Catholic Church in Newport News; its association with Thomas Fortune Ryan and his wife, Ida Mary Berry Ryan, substantial benefactors in donating the funds for the convent and girls school; and its architectural merit as an excellent example of an early twentieth-century Classical Revival, architect-designed church which has remained architecturally intact. The church lies just outside of the direct effects APEs for Alternatives C and D, but within the indirect effects APEs for those alternatives. Because of the distance (approximately 0.25 miles) between the church and existing I-664 mainline and the fact that the proposed HRCS Draft SEIS LOD for Alternatives C and D is contained within the existing highway right-of-way associated with the I-664 mainline, Alternatives C and D are not expected to have an effect on the historic property. St. Vincent de Paul Catholic Church also lies outside the 66 dBA L_{eq} noise contour modeled under the *HRCS Noise Analysis Technical Study* (2016: Figure 4-1, Sheet 55) for the loudest Build Alternative in each area. Places of worship are defined as Category C land uses under FHWA's noise abatement criteria. For Category C properties, a noise impact is assumed to occur when predicted exterior noise levels approach or exceed 67 dBA L_{eq}.

Brown Manufacturing, Coca-Cola Bottling Works, Daily Press Building (VDHR #121-0033), located at 3200 Huntington Avenue in Newport News, is a c. 1940s Art Deco-style and buff-colored brick structure. The facade features cast stone "Drink Coca-Cola in Bottles" rectangular panels between the first and second floor fenestration in each bay and stone pilasters topped with Coca-Cola Contour bottle relief sculptures at the facade corners and flanking the central bay. Although the original c. 1898 section of the

complex (Daily Press Building) has been demolished, the c. 1940 Coca Cola plant (currently housing Brown Manufacturing), previously surveyed as a secondary resource, is a cohesive and architecturally intact resource on its own merit and is assumed for the purposes of this study to be eligible for listing on the NRHP under Criterion A for its association with the mid-twentieth-century commercial/ manufacturing development of Newport News and Criterion C for its architecture. The assumed historic properties boundaries measure roughly 120 feet square and include only the current tax parcel containing the bottling works building. The historic property lies outside the direct effects APEs for Alternatives C and D. Although the building lies within the indirect effects APEs, Alternatives C and D should not affect any of the characteristics that contribute to the significance of the historic property, including any features of its viewshed that may still contribute to its historic setting. The proposed interchange improvements modify the access between I-664 and Jefferson Avenue. The mainline of I-664 lies approximately 0.22 miles northeast of the Coca-Cola Bottling Works, and several buildings and a railroad corridor lie between the interstate and the historic property. Additionally, the historic property lies outside the 66 dBA L_{eq} noise contour modeled under the *HRCS Noise Analysis Technical Report* (2016: Figure 4-1, Sheet 585) for the loudest Build Alternative in each area.

Peninsula Catholic High School/St. Vincent's School for Girls (VDHR #121-0157), located at 332 34th Street in Newport News, was originally constructed in 1903 as a parochial girl's school operated by the Sisters of the Charity of Nazareth. The school is a two-story, seven-bay brick structure laid in four course American bond with a hipped roof and features centrally-located two-leaf wood paneled doors with six-light windows with an arched fanlight above. For the purposes of this study the school is assumed eligible for listing on the NRHP under Criterion A for its association with the early twentieth century educational history of Newport News and under Criterion C for its architecture. The assumed historic property boundary encloses the buildings and yard on the current tax parcel but excludes the parking lot. Although the building lies within both the direct and indirect effects APEs for Alternatives C and D, these alternatives should not affect any of the characteristics that contribute to the significance of the historic property, including any features of its viewshed that may still contribute to its historic setting. The proposed interchange improvements modify the access between I-664 and Jefferson Avenue. The mainline of I-664 lies approximately 0.2-miles northeast of the Peninsula Catholic High School/St. Vincent's School for Girls, and several buildings and a railroad corridor lie between the interstate and the historic property. The historic property lies outside the 66 dBA L_{eq} noise contour modeled under the *HRCS Noise Analysis Technical Report* (2016: Figure 4-1, Sheet 55) for the loudest Build Alternative in each area.

The Noland Company Building **(VDHR #121-0299)**, located at 2600 Warwick Boulevard in Newport News, was purchased in 1920 by Lloyd U. Noland Sr., who utilized the building as a plumbing supply warehouse. The building was renovated in 1938 as a result of continued growth of the business, which expanded into the international market and sold a variety of construction materials. The Noland Company Building was listed on the NRHP in 2010, under Criteria A and B for its importance in broad patterns of history as the headquarters of the Noland Company and for its association with Lloyd U, Noland Sr., a civic leader and prominent self-made entrepreneur. The property is located west of I-664 within the direct and indirect effects APEs for Alternatives C and D, but these alternatives should not have an effect on the characteristics of the property that contribute to its significance, including any features of its viewshed that may still contribute to its historic setting. The Noland Company Building is presently positioned between elevated roadways that carry 26th and 28th Streets over I-664. Under the HRCS, there are no planned improvements to these elevated roadways beyond their current right-of-way limits. A railroad corridor lies between the historic property and the existing interstate, and the proposed HRCS Draft SEIS

LOD along I-664 does not extend west of the railroad corridor. The historic property is crossed by the 66 dBA L_{eq} noise contour modeled under the *HRCS Noise Analysis Technical Report* (2016: Figure 4-1, Sheet 55) for the loudest Build Alternative in each area.

Norfolk Naval Base Historic District (VDHR #122-0410), as currently mapped in the VDHR's Virginia Cultural Resource Information System (V-CRIS) is bounded by Hampton Roads to the west, Willoughby Bay to the north, and the Elizabeth River to the southwest. The mapped boundaries associated with the Norfolk Naval Base Historic District include two distinct installations – Naval Station Norfolk and Naval Support Activity Hampton Roads -- comprising nearly 5,000 acres and the largest Naval installation in the world. The installation was originally commissioned in 1917. Communications between VDOT and cultural resources personnel for the Commander Navy Region Mid-Atlantic (CNRMA) prior to publication of the Draft SEIS indicated that the V-CRIS boundaries associated with the Norfolk Naval Base Historic District are currently in revision and the Navy does not recognize the totality of Naval Station Norfolk and NSA Hampton Roads to be a single historic district eligible for listing on the NRHP. Rather, the Navy recognizes four smaller discontiguous NRHP-eligible historic districts within the bounds of Naval Station Norfolk. Only one of these, the Norfolk Naval Base Golf Club Historic District (VDHR #122-5045), is located within the direct or indirect APEs for Alternatives B, C, and D. (Potential effects on the golf course historic district are discussed below.) This definition of historic properties within Naval Station Norfolk is consistent with the Department of the Navy's Section 106 coordination with the SHPO in 2012 for the transfer of interests in real property of the United States to the Commonwealth of Virginia for construction of the I-564 Intermodal Connector, a project that will construct a new four-lane divided, east-west interstate extension from the existing I-564 to the Norfolk International Terminal.

Forest Lawn Cemetery (VDHR #122-0531) is located in the City of Norfolk west of Granby Street at the I-64/I-564 interchange. The initial, early twentieth century (1906 - c. 1935) portion of Forest Lawn Cemetery, including the associated mausoleum and gatehouse, was determined by the VDHR in 2012 to be eligible for listing on the NRHP under Criterion A, Criteria Consideration D, for its significant association with broad patterns in history. The property reflects the "rural" cemetery movement and embodies the principals of early twentieth-century cemetery planning and design, and professional management and caretaking, while including a diverse but sectioned interment population. The cemetery is also eligible under Criterion C for its architectural merit and integrity of design. The indirect effects APEs for Alternatives A, B, and D extend into the cemetery and the direct effects APEs abut the southwest historic property boundaries. However, Granby Street runs between the cemetery and I-64. The proposed HRCS Draft SEIS LOD would not extend east of Granby Street and would partially preserve a line of trees running between the two roadways. The *HRCS Noise Analysis Technical Report* (2016: Table 4-2, CNE BW; Figure 4-1, Sheets 17 and 18) predicts little change from existing noise levels (61-69 dBA L_{eq}) under Alternatives A, B, and D (62-69 dBA L_{eq}) and the No-Build (62-69 dBA L_{eq}). Thus, Alternatives A, B, and D should have no effect on any of the characteristics that presently contribute to the significance of the cemetery, including any features of its viewshed that may still contribute to its historic setting.

Ocean View Elementary School (VDHR #122-0954), located at 9501 Mason Creek Road in Norfolk, is a 1939 Art Deco style building constructed in two parts and features a long, rectangular main school building and a perpendicular auditorium wing. The school was determined eligible for listing on the NRHP by VDHR in 1998 at a local level of significance under Criteria A for its role in education and under Criterion C for its architectural merit. The historic property boundaries include an area approximately 420 feet by 700 feet containing the main academic building on the educational complex. The historic

property lies outside the direct effects APEs for Alternatives A, B, and D but within the indirect effects APEs. The proposed HRCS Draft SEIS LOD would extend eastward from an existing exit ramp off of I-64 roughly 30 feet beyond an existing highway sound barrier, but the barrier would remain and a residential development lies between the NRHP-eligible boundary of the school property and the interstate. The historic property would lie approximately 750 feet from the footprint of the proposed improvements to the existing interstate. The *HRCS Noise Analysis Technical Report* (2016: Table 4-2, CNE BM; Figure 4-1, Sheet 14) predicts little change at the school's baseball field from existing noise levels (53-59 dBA L_{eq}) under Alternatives A and B (55-60 dBA L_{eq}) and D (54-60 dBA L_{eq}) and the No-Build (54-60 dBA L_{eq}). In sum, Alternatives A, B, and D should have no effect on the characteristics that contribute to the significance of Ocean View Elementary School, including any features of its viewshed that may still contribute to its historic setting.

Norfolk Naval Base Golf Club Historic District (VDHR #122-5045), located on Terminal Boulevard along the southern boundary of Naval Station Norfolk, was determined eligible for listing on the NRHP by VDHR in 1997 at the state and local level under Criterion C as a resource representative of the work of a master. The golf course was first established as part of the Norfolk Yacht and Country Club in 1924 and was purchased by the Navy in 1942. The golf course and associated club house was designed by Donald Ross, a noted golf course designer during the 1920s. Both the direct and indirect APEs for Alternatives B, C, and D encroach upon the Norfolk Naval Base Golf Club Historic District; however, the proposed HRCS Draft SEIS LOD for these alternatives would not. Existing I-564 runs along the northeast side of the golf course and all improvements to I-564 proposed in the Draft SEIS in this area would be confined to existing highway right-of-way and would not extend into the historic property boundary. Plans exist to build a noise barrier, 12 to 16 feet high, along the south side of existing I-564 at the golf course under the I-564 Intermodal Connector Project. The *HRCS Noise Analysis Technical Report* (2016: Table 4-3, CNE CA; Figure 4-1, Sheets 20 to 22), which assumes this barrier will largely remain in place, predicts that the 66 dBA L_{eq} noise contour would run just outside this barrier, along the northeast border of the golf course. Golf courses are defined as Category C land uses under FHWA's noise abatement criteria. For Category C properties, a noise impact is assumed to occur when predicted exterior noise levels approach or exceed 67 dBA L_{eq}. In sum, HRCS Alternatives B, C, and D would not alter any of the characteristics that currently contribute to the significance of the Norfolk Naval Base Golf Club Historic District, including any features of its viewshed that may still contribute to its historic setting.

The Battle of Sewell's Point (VDHR #122-5426; ABPP #VA001) was among the first naval battles between Union and Confederate forces during the Civil War, taking place May 18, 19, and 21, 1861. The battle was inconclusive but involved exchanges of cannon fire between the USS Monticello, supported by the USS Thomas Freeborn, and Confederate batteries on Sewell's Point. The ABPP has defined a Study Area of 11,500 acres for the battle, 10,000 acres of which the ABPP has identified as PotNR. For the purposes of this study, the ABPP's PotNR is assumed NRHP-eligible. Portions of both the direct and indirect effects APEs of Alternatives A, B, and D in the vicinity of the HRBT are located within the ABPP's PotNR boundary, but it is not believed that the alternatives will diminish the integrity of any non-archaeological components of the battlefield that contribute to its significance, including its historic setting. The battlefield is located within what is now a highly industrialized and developed area in which few remnants of the historic landscape survive. Additionally, construction associated with Alternatives A, B, and D within the PotNR boundary would involve improvements to the existing transportation infrastructure of the HRBT. Underwater archaeological investigations in the portions of the LOD adjacent to the HRBT and associated with Alternatives A, B, and D are still incomplete; however, if any significant underwater

resources associated with the Battle of Sewell's Point are eventually identified within the HRCS LOD, they likely would meet the regulatory exception to the requirements of Section 4(f) approval: the sites likely would be important chiefly for the information they contain, which can be retrieved through data recovery, and would have minimal value for preservation in place [23 CFR §774.13(b)(1)].

Merrimack Landing Apartment Complex/Merrimack Park Historic District (VDHR #122-5434) is the first planned, government funded, low-cost defense housing project in the City of Norfolk specifically designed and built to provide military housing during WWII for Naval personnel stationed at Naval Station Norfolk (NSN). The complex retains its curvilinear street pattern, green spaces, and building stock, with no modern in-fill present. Merrimack Park Historic District was determined eligible by the VDHR in 2012 for listing on the NRHP under Criterion A for broad patterns in history as a purpose-built affordable military housing project sponsored in part by the Federal government during WWII and the first such community built in the City of Norfolk to serve the military personnel at the NSN. The historic district is also eligible under Criterion C for community planning and development as well as landscape architecture. The property is located within the indirect effects APEs for Alternatives A, B, and D; the direct effects APEs overlap the historic property boundaries just slightly in the northeast corner of the development where there is open space lacking any structures. In this area of the property, the proposed HRCS Draft SEIS LOD would extend approximately 60 feet east of the existing edge of pavement on I-64 and would be located a minimum of approximately 170 feet east of the boundary of the historic district. All improvements associated with Alternatives A, B, and D in this area would be to an existing roadway, and there is a buffer of trees within the historic district that lines Mason Creek and presently obscures the view of the interstate from the neighborhood. The *HRCS Noise Analysis Technical Report* (2016: Table 4-2, CNE BP; Figure 4-1, Sheet 16) indicates all residences within the historic district lie outside the predicted 66 dBA L_{eq} noise contour, and noise levels under Alternatives A and B (52-64 dBA L_{eq}) and D (51-63 dBA L_{eq}) are predicted to rise only slightly over existing levels (50-63 dBA Leq), comparable to the increase under the No-Build Alternative (51-64 dBA L_{eq}). The *HRCS Noise Analysis Technical Report* shows a potential noise barrier (BQ) along the eastbound I-64 on-ramp at Bellinger Boulevard; but, in light of its cost, this barrier would benefit too few receptors in the neighborhood on the opposite side of Mason Creek from the district to be considered reasonable. In sum, Alternatives A, B, and D should have no effect to any of the characteristics contributing to the significance of the Merrimack Landing Apartment Complex/Merrimack Park Historic District, including any features of its viewshed that may still contribute to its historic setting.

***Willoughby Elementary School (VDHR #122*-5930)**, located at 9500 4th View Street in Norfolk, is a one-story, L-shaped brick building constructed in the International style and retaining a high degree of architectural integrity. Opened in 1967 by the City of Norfolk, the Willoughby Elementary School was one of at least two schools built in rapid succession in response to explosive growth in Norfolk's post-WWII population of school-age children. The building's form embodies the latest in educational theory and practice for its day, with a one-size-fits-all approach to the accommodation of learning. For the purposes of this study, the property is assumed eligible for listing on the NRHP under Criteria A and C for its historical associations and architecture. The historic property boundaries are assumed to comprise three tax parcels together measuring a total of roughly 1,000 feet by a maximum of roughly 425 feet. The property lies outside the direct effects APEs for Alternatives A, B, and D but within the indirect effects APEs. Alternatives A, B, and D should not affect any of the characteristics of the property that contribute to its significance, including any features of its viewshed which may still contribute to its historical setting. The property is located east of I-64 and is separated from the interstate mainline by an exit ramp leading

to 4th View Street from the interstate. Under Alternatives A, B, and D any improvements to this exit ramp would be confined to its existing footprint. Along the mainline, the proposed HRCS Draft SEIS LOD on the east side of the interstate does not extend beyond the existing edge of pavement. The *HRCS Noise Analysis Technical Report* (2016: Table 4-2: CNE BL; Figure 4-1, Sheet 14) also indicates that the vast majority of the historic property lies outside the 66 dBA L_{eq} noise contour. Under Alternatives A, B, and D (38-38 dBA L_{eq}) noise levels are predicted to rise only slightly over existing levels (36-36 dBA L_{eq}).

The Battle of Craney Island (124-5267), has been identified by the National Park Service's ABPP as one of 78 battlefields associated with events that had a demonstrable influence on the course, conduct, and results of the War of 1812. The battle took place on June 22, 1813, when American forces successfully repelled British forces who, as part of their larger plan to attack Norfolk and the Gosport Shipyard in Portsmouth, targeted American fortifications that had been constructed on Craney Island at the mouth of Elizabeth River. The ABPP has defined a boundary for the portion of the battlefield it believes is potentially eligible for listing on the NRHP (PotNR boundary) which includes Craney Island and the narrow neck of land fronting on Hampton Roads at the mouth of Craney Island Creek, as these two features existed in the early 19th century. The PotNR is approximately 90 acres. Portions of the PotNR boundary are within the direct and indirect effects APEs for Alternatives B, C, and D; however, none of the original landmass that comprised Craney Island is within the direct effects APEs and the indirect effects APEs overlap only the far western tip of the original island. While this study assumes that the ABPP's PotNR boundary for the Battle of Craney Island is eligible for listing on the NRHP, the battlefield is located within the bounds of the present day US Navy Fuel Depot. The historic footprint of the 19th-century island has been encompassed by man-made fill and retains little integrity, and the larger setting of the battle is characterized today as a highly developed and industrialized landscape. For these reasons, Alternatives B, C, and D should have no effect on any of the non-archaeological characteristics of the battlefield that contribute to its significance, including its historic setting. If any significant archaeological resources associated with the battle are eventually identified within the HRCS Draft SEIS LOD, they likely would meet the regulatory exception to the requirements of Section 4(f) approval: the sites likely would be important chiefly for the information they contain, which can be retrieved through data recovery, and would have minimal value for preservation in place [23 CFR §774.13(b)(1)]. The *HRCS Noise Analysis Technical Report* (2016: Figure 4-1, Sheets 34 and 35) predicts noise levels greater than or equal to 66 dBA L_{eq} to extend a maximum of approximately 200 feet out from the centerline of the Alternatives B, C, and D where these alternatives cross the historic property boundaries of the Battle of Craney Island.

Sunray Agricultural Historic District (VDHR #131-5325) is located at the southern terminus of Alternatives C and D south of South Military Highway where it runs south of the I-664/I-264 interchange in Bowers Hill. Sunray was a planned agricultural community, developed by Polish immigrants in the early twentieth century, and was listed on the NRHP in 2007 under Criteria A and C for its association with agriculture, community planning and development, its designed landscape, and ethnic heritage from the period 1908-1956. The direct effects APEs for Alternatives C and D abut one corner of the northern boundary of the 1,264-acre historic district, and the indirect effects APE extends further into the historic property boundary in this area. However, the proposed HRCS Draft SEIS LOD for Alternatives C and D would not extend as far south of existing I-664 as South Military Highway. All but a very small portion of the large historic district is located outside of the 66 dBA L_{eq} contour predicted in the *HRCS Noise Analysis Technical Report*. Alternatives C and D should not affect any of the existing characteristics of the historic district that contribute to its significance, including any features of its viewshed which may still contribute to its historic setting.

The Captain John Smith Chesapeake National Historic Trail (CAJO) (Cities of Hampton, Newport News, Norfolk, Portsmouth, and Suffolk) is the first water trail designated under the National Trails System Act [16 U.S.C. 1244(a)]. The trail route extends throughout the Chesapeake Bay and its purpose, as defined by the National Park Service in a draft interpretive plan prepared in 2006, is "to commemorate the exploratory voyages of Captain Smith on the Chesapeake Bay and its tributaries in 1607-1609; to share knowledge about the American Indian societies and cultures of the seventeenth century; and to interpret the natural history of the Bay (both historic and contemporary)." For the purposes of this study, the portion of the CAJO within the vicinity of the four HRCS Build Alternatives is assumed eligible for the NRHP. Although sections of all four Build Alternatives cross one or more water pathways taken by Smith on his voyages, none of the alternatives would be expected to diminish any non-archaeological components of the CAJO that may contribute to its significance, including its historic setting. The CAJO is located within what is now a highly industrialized and developed area in which few remnants of the historic landscape survive. Additionally, much of the construction associated with the four HRCS Build Alternatives would involve improvements of or improvements immediately adjacent to existing transportation infrastructure, such as the MMMBT and the HRBT. Archaeological survey of the LOD associated with the four HRCS Build Alternatives is incomplete, but if any significant archaeological sites associated with the CAJO are eventually identified within the HRCS Draft SEIS LOD, they likely would meet the regulatory exception to the requirements of Section 4(f) approval: the sites likely would be important chiefly for the information they contain, which can be retrieved through data recovery, and would have minimal value for preservation in place [23 CFR §774.13(b)(1)].

The Washington-Rochambeau Revolutionary Route National Historic Trail (W-RNHT) (Cities of Hampton, Newport News, Norfolk, Portsmouth, and Suffolk) was designated a National Historic Trail under the National Trails System Act [16 U.S.C. 1244(a)] in March 2009. The W-RNHT comprises over 680 miles of land and water trails in Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, and Washington, D.C. The trail segments follow the routes taken by General Washington and General Rochambeau to and from the Siege of Yorktown during the Revolutionary War. The purpose of the W-RNHT, as defined by the National Park Service in a draft strategic plan prepared in 2010, is to "identify, preserve, interpret, and celebrate the American and French Alliance in the War for Independence." For the purposes of this study, the portion of the W-RNHT within the vicinity of the four HRCS Build Alternatives is assumed eligible for the NRHP. Although sections of all four Build Alternatives cross the water routes taken by American and French forces, none of the alternatives would be expected to diminish any non-archaeological components of the W-RNHT that may contribute to its significance, including its historic setting. The W-RNHT is located within what is now a highly industrialized and developed area in which few remnants of the historic landscape survive. Additionally, much of the construction associated with the four HRCS Build Alternatives involves improvements of or improvements immediately adjacent to existing transportation infrastructure, such as the MMMBT and the HRBT. Archaeological survey of the LOD associated with the four HRCS Build Alternatives is incomplete, but if any significant archaeological sites associated with the W-RNHT are eventually identified within the HRCS Draft SEIS LOD, they likely would meet the regulatory exception to the requirements of Section 4(f) approval: the sites likely would be important chiefly for the information they contain, which can be retrieved through data recovery, and would have minimal value for preservation in place [23 CFR §774.13(b)(1)].

Preferred Alternative

There are twenty architectural historic properties within the direct and indirect effects APE of the Preferred Alternative. These properties are shown on **Figure 3-17a-b** and **Figure 3-18**. The indirect effects APE is the same as defined for Alternative A. The direct effects APE is the LOD defined for the Preferred Alternative and reflects engineering refinements that eliminate any direct effects to the Hampton Institute Historic District. Other refinements made to avoid permanent impacts to property owned by Hampton University resulted in a LOD for the Preferred Alternative at HRBT that potentially includes an area between and immediately west of existing HRBT infrastructure from the eastbound approach eastward to the south island and immediately west of existing HRBT infrastructure from the south island eastward to Willoughby Spit. VDOT's assessments of the Preferred Alternative's effects on architectural historic properties are discussed below in the order of the locations of the properties from west to east along the corridor as they were provided to the SHPO and other consulting parties on November 22, 2016 (**Appendix D**). The SHPO concurred with these assessments on December 29, 2016. Subsequently, the FHWA, the SHPO, and VDOT executed a Section 106 Programmatic Agreement for the Preferred Alternative that stipulates design commitments and other treatment actions that VDOT will implement to ensure that the project will have either no effect or no adverse effect on each of the architectural historic properties consistent with the following effects assessments.

***Hampton Coliseum (VDHR #114-5600)*:** No change from VDOT's assessment of effects for Alternative A as presented in the Draft SEIS. The Preferred Alternative should not affect any of the characteristics that contribute to the property's historic significance.

***Elmerton Cemetery (VDHR # 114-0155)*:** No change from VDOT's assessment of effects for Alternative A as presented in the Draft SEIS. The Preferred Alternative should not affect any of the characteristics that contribute to the property's historic significance.

***Pasture Point Historic District (VDHR #114-0118)*:** The LOD for the Preferred Alternative is restricted to the existing I-64 right-of-way and does not encroach upon the Pasture Point Historic District, but the district is located within the APE for indirect effects. The *HRCS Noise Analysis Technical Report* (2016: Table 4-2, CNE AJ; Figure 4-1, Sheet 5) found that the small changes to existing noise levels (58-68 dBA Leq) predicted to occur within the historic property under Alternative A, are no different that the levels predicted for the No-Build Alternative (59-69 dBA Leq).

Although the historic district would not experience a noise effect under Section 106 as a result of the HRCS, the noise technical study did indicate that construction of a noise barrier along the eastbound lanes of the I-64 in the vicinity of the Pasture Point Historic District would be feasible and reasonable, and would benefit the single family residences within the district and other receptors nearby by an average noise reduction of 8.3 decibels. The potential noise barrier would be 15 feet high for sections on structure and 20 feet high for those on the ground (for comparison, the average height of a tractor trailer is on the order of 14 feet). To determine what effect the proposed noise wall might have on the historic setting of the Pasture Point Historic District, VDOT modeled what a noise wall would look like, in terms of mass and height, from five different views within the historic district using photographs taken on November 2, 2016. Based on these visualizations, VDOT concluded that the historic setting and feeling along the north side of the Pasture Point Historic District has already been greatly altered by existing I-64, and the proposed noise barrier should have no adverse effect on the district, provided the aesthetic features of the barrier (e.g., color, surface treatment) are designed to be compatible with the historic

Figure 3-17a: Architectural Historic Properties on Preferred Alternative

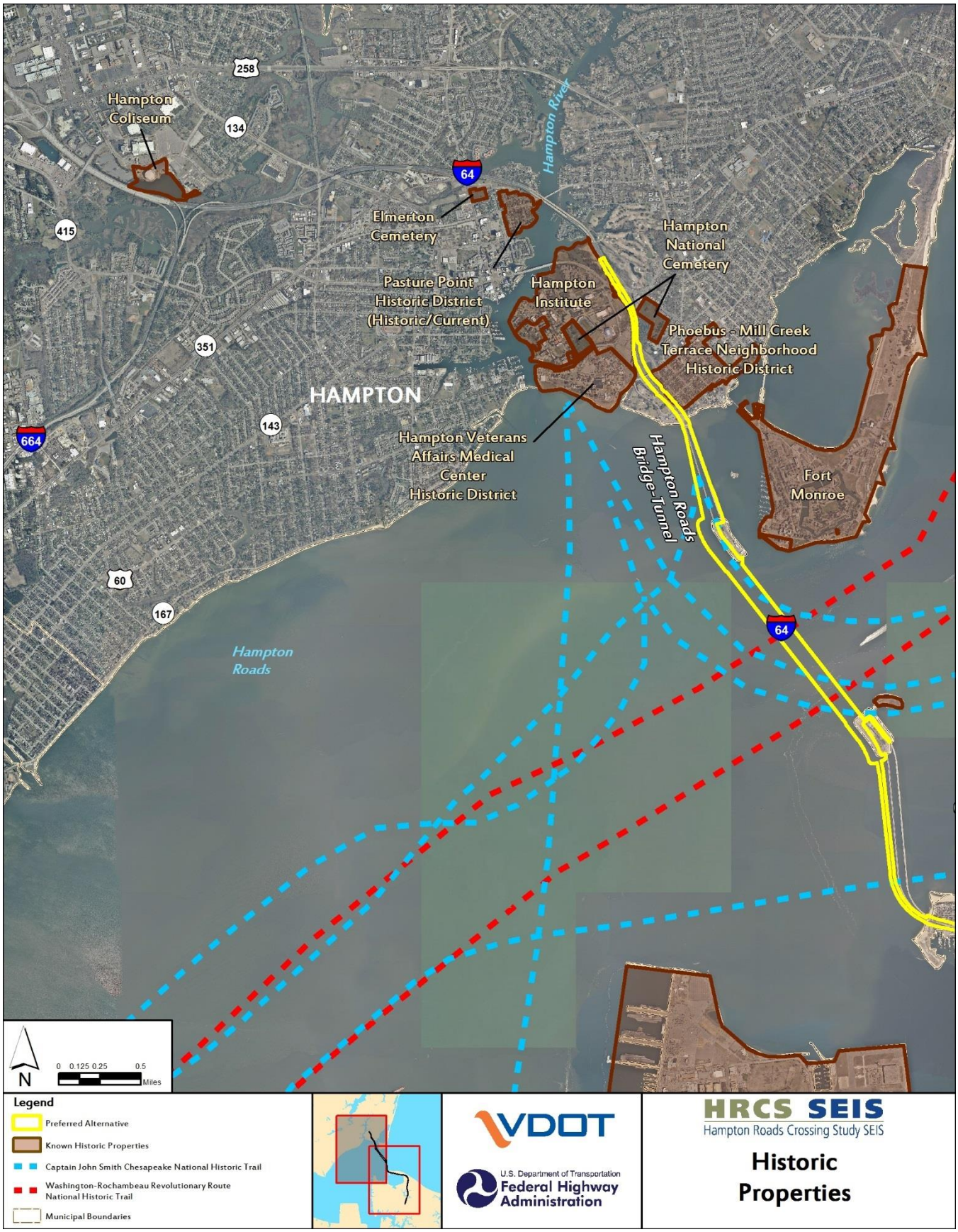


Figure 3-17b: Architectural Historic Properties on Preferred Alternative

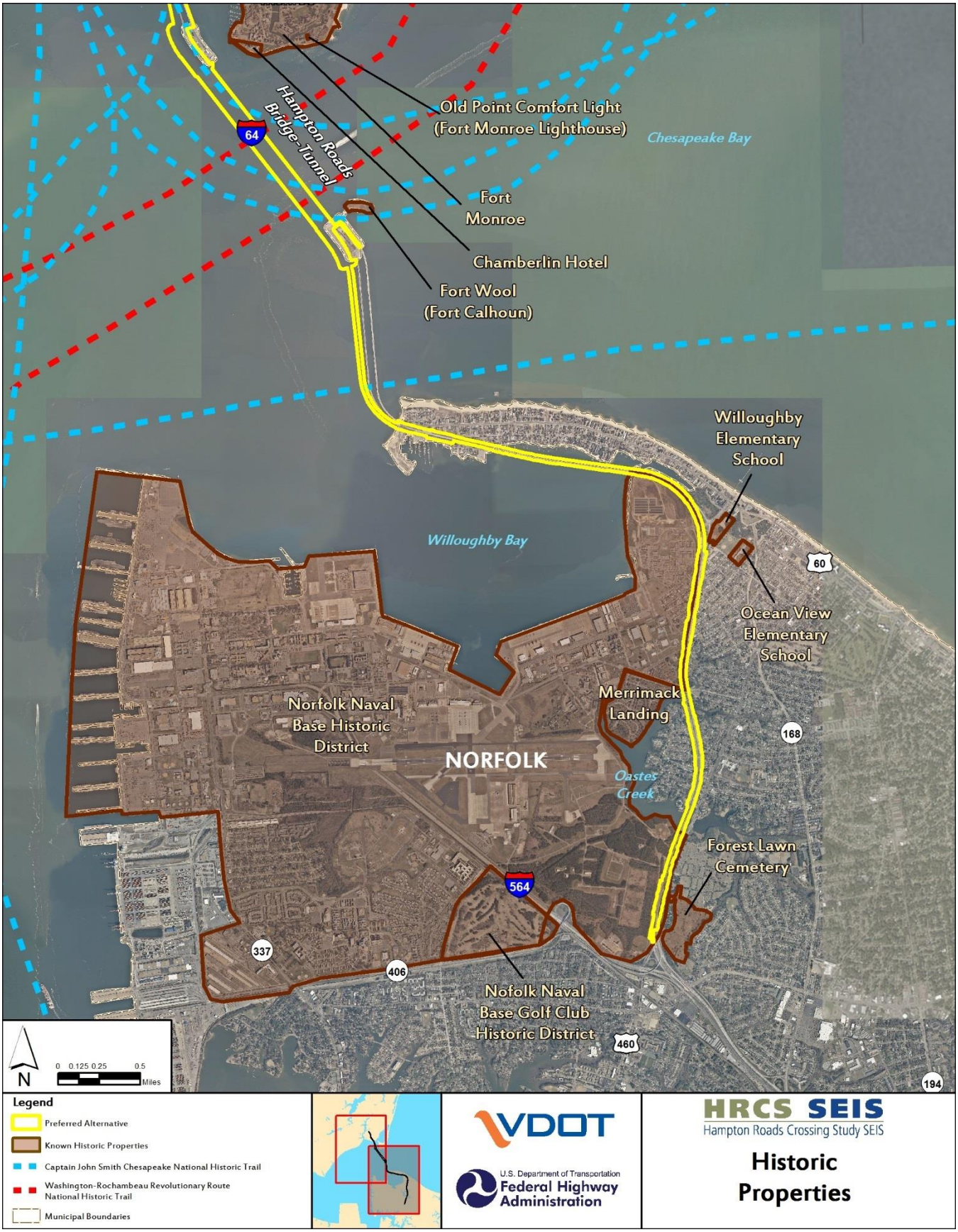
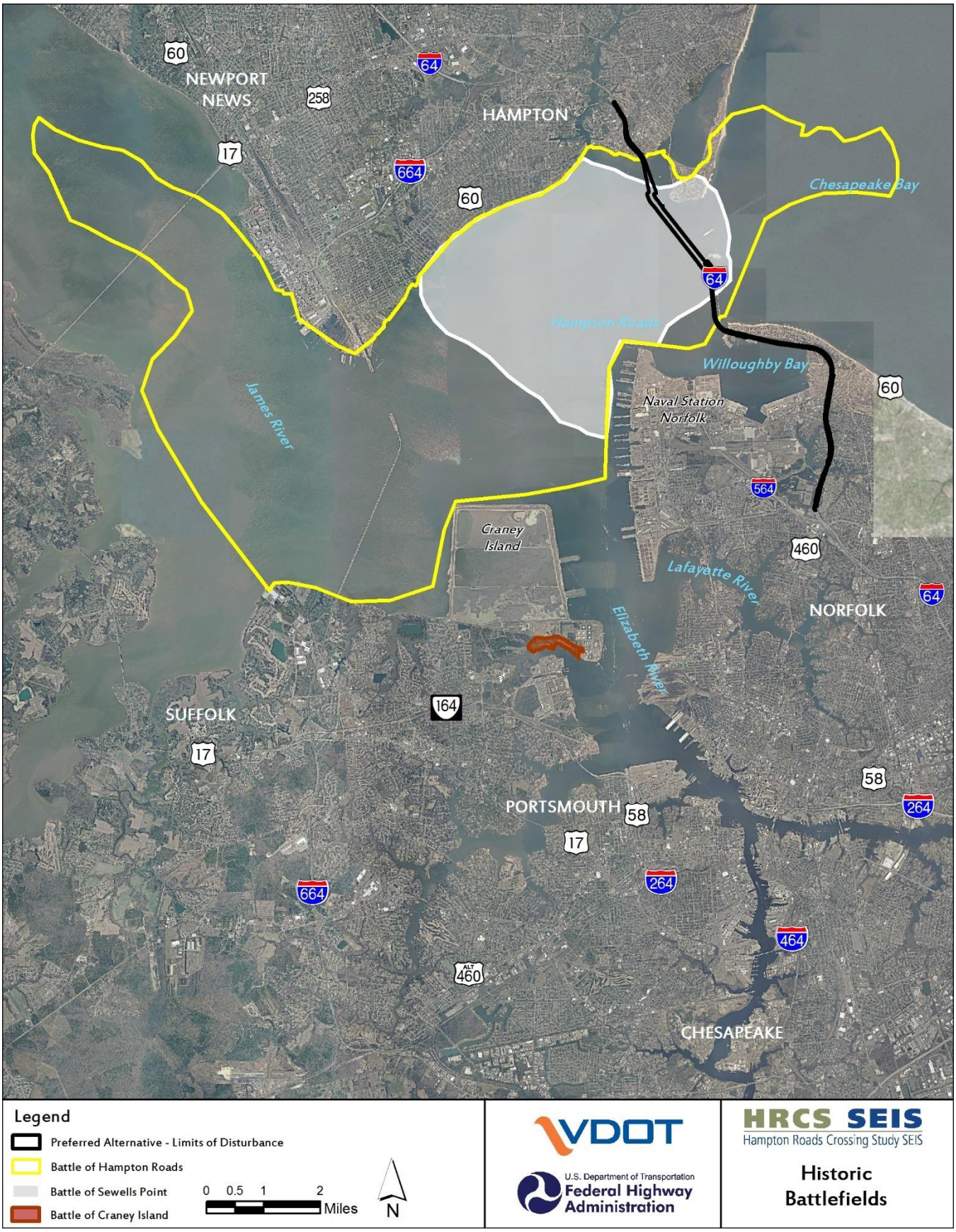


Figure 3-18: Historic Battlefields on Preferred Alternative



property. Design commitments for the avoidance of adverse effects on the Pasture Point Historic District are contained in Stipulation I.B of the Section 106 Programmatic Agreement.

***Hampton Institute Historic District (VDHR #114-0006)*:** In the time since publication of the Draft SEIS VDOT completed thorough deed research to establish the boundaries of highway right-of-way associated with I-64 in the vicinity of Hampton University as of 1957 and subsequently has assumed it is reasonable to conclude that the 1969 NRHP boundaries of the Hampton Institute Historic District along I-64 correspond to the 1957 highway right-of-way line. (As discussed earlier, the boundaries of the Hampton Institute National Historic Landmark are much more constrained.) The Draft SEIS showed 1.1 acres of the historic district located within the LOD for Alternative A, including narrow strips of ground adjacent to I-64 located west of the US60/VA 143 Settlers Landing Road interchange and east of the University baseball field. However, the LOD for the Preferred Alternative is narrower in this area and will not extend beyond the 1957 highway right-of-way line into the historic district's NRHP property boundaries.

Although the Hampton Institute Historic District lies outside of the LOD of the Preferred Alternative, it still lies within the APE for indirect effects. The results of the *HRCS Noise Analysis Technical Report* (2016: Table 4-2, CNE AQ, CNE AR; Figure 4-1, Sheet 7) indicate no diminishment of the existing historic setting and feeling of the property due to traffic noise from Alternative A. Existing noise levels within two defined Common Noise Environment (CNE) areas within Hampton University are 61-70 and 70-74 dBA Leq, respectively. Predicted 2040 levels are 62-71 and 71-75 dBA Leq under the No-Build and 62-70 and 71-75 dBA Leq under Alternative A. VDOT also does not anticipate any adverse visual effects on the historic setting of the Hampton Institute Historic District since Alternative A will involve improvements to an existing interstate highway within existing right-of-way. No noise barriers are presently proposed for the south side of I-64 along the historic property boundaries of the district; however, if final design noise analysis indicates that noise abatement should be considered, a barrier could be proposed if it is found to the feasible and reasonable and fifty percent of benefitted receptors are in favor of it. Should this occur, any potential adverse effects of a barrier on the historic setting of the Hampton Institute Historic District could be minimized by ensuring through consultation with the SHPO and Hampton University that the barrier design is compatible with the district and will not result in a diminishment of the integrity of its historic setting or feeling. In the absence of a barrier, should project construction within VDOT's existing right-of-way require the removal of existing trees east of the Hampton University baseball field, that currently provide a partial visual buffer between Hampton University and I-64, VDOT would be willing to seek agreement with Hampton University on replacement of this vegetation.

VDOT's assessment of the effects of the Preferred Alternative has also taken into account potential effects on the Emancipation Oak. In 2012, in relation to its transportation study of the HRBT, VDOT enlisted a certified arborist and tree risk assessor to conduct a condition assessment and site survey of the Emancipation Oak for the purpose of setting construction restrictions with a minimum Tree LOD boundary. The arborist defined the Tree LOD along the I-64 side of the open area containing the oak as the line of an existing chain link fence that runs between a row of loblolly pines and the interstate and noted that existing trees surrounding the oak contribute to its current condition by creating a micro climate, including shading, wind protection, moisture distribution, and nutrients from fallen leaves, to which the oak has acclimated. In the vicinity of the Emancipation Oak, the LOD for the Preferred Alternative does not breach the Tree LOD, involves no encroachment on Hampton University property, and maintains the existing highway right-of-way line along the existing I-64 access ramp directly east of the tree. To further ensure that the Emancipation Oak is not adversely affected by the Preferred Alternative, VDOT will erect and maintain barrier fencing along the Tree LOD while the highway improvements are under construction and, in consultation with Hampton University, monitor the

condition of the Oak and other trees in its vicinity during construction so that any problems can be addressed immediately. Design commitments for the avoidance of adverse effects on the Hampton Institute Historic District and National Historic Landmark are contained in Stipulation I.A of the Section 106 Programmatic Agreement.

***Hampton National Cemetery (VDHR #114-0148)*:** While the Phoebus Section of the Hampton National Cemetery is located within the Preferred Alternative's APE for indirect effects, the LOD on the east side of I-64 in the vicinity of the cemetery maintains the existing interstate right-of-way line. The *HRCS Noise Analysis Technical Report* (2016: Table 4-2, CNE AT; Figure 4-1, Sheet 7) indicates that there will be no Section 106 noise effects on the Phoebus Section cemetery as a result of the project. Existing noise levels measured within the Phoebus Section are 59-75 dBA Leq; predicted 2040 noise levels under the No-Build Alternative and Alternative A are 60-76. Preliminary noise analysis, however, does call for a potential sound barrier along westbound I-64 extending from the South Mallory Street/I-64 WB on-ramp to the I-64 WB/Woodland Road off-ramp, because the location of the cemetery and nearby single-family residences meets FHWA and VDOT criteria for noise abatement. The most cost-effective barrier that meets the 7-decibel noise reduction design goal for all receptors would be 15 feet high. To determine what effect the proposed noise wall might have on the historic setting and feeling of the Hampton National Cemetery, VDOT modeled what a noise wall would look like, in terms of mass and height, from seven different views within the historic property using photographs taken on November 2, 2016. Based on these visualizations, VDOT concluded that the historic setting along the northwest side of the cemetery has already been altered by existing I-64, and the proposed noise barrier and other highway improvements to I-64 proposed under the Preferred Alternative should have no adverse effect on the Hampton National Cemetery, provided the aesthetic features of the barrier (e.g., color, surface treatment) are designed to be compatible with the historic property. VDOT would also be open to examine with the Department of Veterans Affairs other actions VDOT could take to further minimize the potential effects of the Preferred Alternative on the cemetery, such as reconstruction of several segments of brick cemetery wall to extend their height in the corner closest to the interstate where the wall presently follows a dip in elevation. Commitments for the avoidance of adverse effects on Hampton National Cemetery are contained in Stipulation I.C of the Section 106 Programmatic Agreement.

***Hampton Veterans Affairs Medical Center Historic District (VDHR #114-0101)*:** No change from VDOT's assessment of effects for Alternative A as presented in the Draft SEIS. The Preferred Alternative should not affect any of the characteristics that contribute to the property's historic significance.

***Phoebus-Mill Creek Terrace Neighborhood Historic District (VDHR #114-5002)*:** The southwest border of the Phoebus-Mill Creek Terrace Neighborhood Historic District extends in places to the eastern side of existing I-64 right-of-way and the LOD and indirect effects APE for the Preferred Alternative extends into the district. Under Alternative A, the LOD reached a maximum of approximately 50 feet into the district at Mallory Street, at the west end of South Hope Street, west of the 100 block of Segar Street, and along a portion of National Avenue. Since coordination with the SHPO on November 22, 2016, the LOD for the Preferred Alternative has been modified slightly from that associated with Alternative A, but still does not extend into any of the tax parcels associated with buildings or lots considered contributing elements of the historic district. It appears that the structure (DHR NO. 114-5002-0241) at 121 National Avenue would need to be demolished to construct Alternative A, but this ca. 1960 VDOT administration building is not considered a contributing element of the historic district. A noise barrier presently runs between the shoulder of the I-64 travel lanes and the southwest border of the district boundary; the

barrier is expected to be replaced under Alternative A. The *HRCS Noise Analysis Technical Report* (2016: Table 4-2, CNE AW; Figure 4-1, Sheet 8) found that the small changes to existing noise levels (52-67 dBA Leq) predicted to occur within the historic district under Alternative A (53-68 dBA Leq) are no different than the changes predicted under the No-Build Alternative (53-68 dBA Leq). In light of these considerations, and the fact that Alternative A involves only changes to an existing interstate highway, it is believed the alternative would alter but not result in a diminishment of the integrity of any of the characteristics that presently contribute to the significance of the Phoebus–Mill Creek Terrace Neighborhood Historic District, including any features of its viewshed that may still contribute to its historic setting and feeling, provided that the aesthetic features of the replacement barrier (e.g., color, surface treatment) are designed to be compatible with the historic property. Design commitments for the avoidance of adverse effects on the Phoebus-Mill Creek Terrace Neighborhood Historic District are contained in Stipulation I.D of the Section 106 Programmatic Agreement.

***Fort Monroe (VDHR #114-0002)*:** Fort Monroe lies outside the LOD for the Preferred Alternative but within the indirect effects APE. All transportation improvements in the vicinity of Fort Monroe proposed under the Preferred Alternative will be constructed between the existing HRBT infrastructure or on the west side of and in close proximity to the existing HRBT infrastructure. Thus, the proposed improvements should not alter any of the characteristics that contribute to the significance of Fort Monroe, including any features of its viewshed that may still contribute to its historic setting and feeling. The *HRCS Noise Analysis Technical Report* (2016: Table 4-2, CNE AX; Figure 4-1, Sheet 9) predicts that under both the No-Build and the Build Alternatives 2040 noise levels would increase only slightly over existing levels in areas of Fort Monroe immediately east of proposed above-water improvements to the west end of the HRBT. Existing noise levels are 55-58 dBA Leq. Under the No-Build, 2040 noise levels are predicted to be 56-59 dBA Leq, while under Alternative A they are predicted to be 57-59 dBA Leq. Stipulation 1.F of the Section 106 Programmatic Agreement requires VDOT's coordination of final design plans for adding capacity to the HRBT under the Preferred Alternative with the SHPO and other consulting parties to ensure that the design is consistent with this assessment of effect.

Chamberlin Hotel (VDHR # 114-0114): The Chamberlain is located approximately 650 feet northeast of the island at the west entrance to the HRBT, outside the LOD for the Preferred Alternative but within the indirect effects APE. All transportation improvements proposed under the Preferred Alternative will be constructed between the existing HRBT infrastructure or on the west side of and in close proximity to existing HRBT infrastructure and should not alter any of the characteristics that contribute to the significance of Chamberlain Hotel, including any features of its viewshed that may still contribute to its historic setting and feeling. The findings of the *HRCS Noise Analysis Technical Report* (2016) discussed earlier in reference to Fort Monroe indicate that only a very small increase above existing noise levels would occur under Alternative A and those levels would not differ appreciably from those predicted for the No-Build Alternative. Stipulation 1.F of the Section 106 Programmatic Agreement requires VDOT's coordination of final design plans for adding capacity to the HRBT under the Preferred Alternative with the SHPO and other consulting parties to ensure that the design is consistent with this assessment of effect.

***Old Point Comfort Lighthouse (DHR NO.114-0021)*:** Old Point Comfort Lighthouse lies roughly 3,000 feet northeast of the HRBT and is well outside the LOD for the Preferred Alternative but within the indirect effects APE. All transportation improvements proposed under the alternative will be constructed between the existing HRBT infrastructure or on the west side of and in close proximity to the existing HRBT infrastructure and should not alter any of the characteristics that contribute to the significance of

Old Point Comfort Lighthouse, including any features of its viewshed that may still contribute to its historic setting. As discussed previously in in reference to Fort Monroe, the lighthouse should experience little to no increase in traffic noise levels under Alternative A. Stipulation 1.F of the Section 106 Programmatic Agreement requires VDOT's coordination of final design plans for adding capacity to the HRBT under the Preferred Alternative with the SHPO and other consulting parties to ensure that the design is consistent with this assessment of effect.

***Fort Wool (DHR NO.114-0041)*:** Fort Wool is located on a 15-acre island constructed of granite blocks approximately one-mile south of Fort Monroe and immediately east of the eastern entrance to the westbound HRBT tunnel. Despite its proximity to the existing HRBT, Fort Wool lies outside the LOD for the Preferred Alternative, but it is within the indirect effects APE. All transportation improvements proposed under the Preferred Alternative will be constructed either between the existing HRBT infrastructure or on the west side of and in close proximity to the existing HRBT infrastructure and should not alter any of the characteristics that contribute to the significance of Fort Wool, including any features of its viewshed that may still contribute to its historic setting and feeling. The *HRCS Noise Analysis Technical Report* (2016: Table 4-2, CNE AY; Figure 4-1, Sheet 10) predicts under both the No-Build and Alternative A that 2040 noise levels would increase only slightly over existing levels on Fort Wool. Existing noise levels are 56-56 dBA Leq. Under the No-Build Alternative and Alternative A noise levels are predicted to be 57-57 dBA Leq. Stipulation 1.F of the Section 106 Programmatic Agreement requires VDOT's coordination of final design plans for adding capacity to the HRBT under the Preferred Alternative with the SHPO and other consulting parties to ensure that the design is consistent with this assessment of effect.

***The Battle of Hampton Roads (VDHR #114-5471; ABPP #VA008)*:** No change from VDOT's assessment of effects for Alternative A as presented in the Draft SEIS. The Preferred Alternative may alter but not diminish any of the characteristics that contribute to the historic significance of the Battle of Hampton Roads.

***The Battle of Sewell's Point (VDHR #122-5426; ABPP #VA001)*:** No change from VDOT's assessment of effects for Alternative A as presented in the Draft SEIS. The Preferred Alternative may alter but not diminish any of the characteristics that contribute to the historic significance of the Battle of Sewell's Point.

***The Captain John Smith Chesapeake National Historic Trail (CAJO)*:** No change from VDOT's assessment of effects for Alternative A as presented in the Draft SEIS. The Preferred Alternative may alter but not diminish any of the characteristics that contribute to the historic significance of the CAJO.

***The Washington-Rochambeau Revolutionary Route National Historic Trail (W-RNHT)*:** No change from VDOT's assessment of effects for Alternative A as presented in the Draft SEIS. The Preferred Alternative may alter but not diminish any of the characteristics that contribute to the historic significance of the W-RNHT.

***Norfolk Naval Base Historic District (VDHR #122-0410)*:** Subsequent to publication of the Draft SEIS the SHPO clarified that it recognizes a NRHP-eligible Norfolk Naval Base Historic District that encompasses the two distinct installations, Naval Station Norfolk and Naval Support Activity Hampton Roads, and comprises nearly 5,000 acres. I-64 runs generally along the east boundary of the historic district although portions of the two naval installations extend east of the interstate. VDOT, however, holds the

right-of-way associated with I-64, the right-of-way is not considered contributing to the district, and the LOD for the Preferred Alternative is confined to the existing right-of-way.

The historic district is located within the Preferred Alternative's APE for indirect effects. The *HRCS Noise Analysis Technical Report* (2016: Table 4-2, CNEs BI, BJ, BK, BS, BT; Figure 4-1, Sheets 14-18) predicts that under Alternative A that 2040 noise levels would increase only slightly over existing levels. Predicted noise levels under Alternative A for CNEs BI, BJ, BK, BS, and BT, respectively, as compared to existing noise levels, are 60-67 dBA Leq (59-66 existing), 61-75 dBA Leq (60-73 existing), 42-70 dBA Leq (41-69 existing), 60-67 dBA Leq (60-67 existing), 60-67 dBA Leq (61-67 existing). Although the historic district would not experience a noise effect under Section 106 as a result of the HRCS, the noise technical study did indicate that construction of four noise barriers along the eastbound side of the I-64 right-of-way in the vicinity of the Norfolk Naval Base Historic District would be feasible and reasonable. I-64 is already a major element of the historic setting of these areas of the district and the proposed noise barriers and other highway improvements associated with the Preferred Alternative should have no adverse effect on Norfolk Naval Base Historic District, provided the aesthetic features of the barriers (e.g., color, surface treatment) are designed to be compatible with the historic property. Design commitments for the avoidance of adverse effects on the Norfolk Naval Base Historic District are contained in Stipulation I.E of the Section 106 Programmatic Agreement.

***Willoughby Elementary School (VDHR #122-5930)*:** No change from VDOT's assessment of effects for Alternative A as presented in the Draft SEIS. The Preferred Alternative should not affect any of the characteristics that contribute to the property's historic significance.

***Ocean View Elementary School (VDHR #122-0954)*:** No change from VDOT's assessment of effects for Alternative A as presented in the Draft SEIS. The Preferred Alternative should not affect any of the characteristics that contribute to the property's historic significance.

***Merrimack Landing Apartment Complex/Merrimack Park Historic District (VDHR #122-5434)*:** No change from VDOT's assessment of effects for Alternative A as presented in the Draft SEIS. The Preferred Alternative should not affect any of the characteristics that contribute to the property's historic significance.

***Forest Lawn Cemetery (VDHR #122-0531)*:** No change from VDOT's assessment of effects for Alternative A as presented in the Draft SEIS. The Preferred Alternative should not affect any of the characteristics that contribute to the property's historic significance.

3.9.2 Archaeological Resources

Affected Environment

The direct effects APE for the Draft SEIS Build Alternatives has been the subject of several previous terrestrial and underwater archaeological technical studies conducted by VDOT to support the 2001 HRCS FEIS, the 2011 HRCS Re-evaluation, and the 2012 Draft Environmental Impact Statement prepared for the HRBT Study. Thus, VDOT prepared the technical report, *HRCS Archaeological Assessment* (April 2016; revised July 2016), for the purpose of determining where additional archaeological survey would still be needed to ensure that all archaeological sites eligible for listing on the NRHP and potentially affected by the Build Alternatives were taken into account. The technical report reviews the geographic coverage and findings of previous archaeological survey undertaken by VDOT and others in relation to

the direct effects APE of the Build Alternatives and describes present land use conditions within the APE in order to assess the land's potential to contain intact archaeological remains. Section 5 of the assessment report identifies several areas of the direct effects APE which VDOT determined warrant additional archaeological survey. The SHPO concurred with these findings on April 28, 2016, and on December 5, 2016.

To date, 50 previously recorded archaeological sites have been documented within the direct effect APEs of the Draft SEIS Build Alternatives. Forty-one of the sites have not been formally evaluated against NRHP eligibility criteria, five have been determined not eligible for the NRHP, three have been determined potentially eligible for the NRHP, and one has been listed on the NRHP. **Table 3-55** summarizes the previously identified archaeological resources that have been listed on or determined potentially eligible for listing on the NRHP.

Table 3-56: Previously Identified Archaeological Resources Listed On or Potentially Eligible for Listing on the NRHP

VDHR #	Resource	NRHP Eligibility Status	Draft SEIS Alternative
44CS0042	Camp, Temporary	VDHR: Potentially Eligible 2003	C & D
44HT0009 (44HT0089)	Native American Village; Roseland Manor	VDHR: Potentially Eligible 2012	A, B, & D
44HT0090	Dwelling	VDHR: Potentially Eligible 2012	A, B, & D
44SK0194	Knotts Creek	NRHP Listed 2008	C & D

Eight previously recorded archaeological sites are located within or in close proximity to the LOD of the Preferred Alternative (see **Table 3-57**). The SHPO has previously determined two of the sites potentially eligible for the NRHP.

Table 3-57: Previously Identified Archaeological Resources Within the Preferred Alternative LOD

VDHR #	Resource	NRHP Eligibility Status
44HT0009	Woodland Period Native American; Late 19th into 20th Century Roseland Manor dwelling (located within 44HT0089)	VDHR: Potentially Eligible 2012
44HT0031	Indeterminate function; 18th and 19th century	Not evaluated; likely destroyed
44HT0033	Indeterminate function; Late Archaic Native American; 2nd half 19th century	Not evaluated; likely destroyed
44HR0034	Indeterminate function; 19th century	Not evaluated; likely destroyed
44HT0062	Refuse scatter; 19th century	Not evaluated; likely destroyed
44HT0089	Woodland Period Native American; 2nd half 19th into 20th century (see also 44HT0009)	Not evaluated
44HT0090	Mid 19th to early 20th century dwelling	VDHR Potentially Eligible 2012
44NR0015	Shipwreck, tentatively identified as U.S. torpedo boat launched in 1899 and sold for scrap in 1923	Not evaluated

Environmental Consequences

As allowed under the Section 106 regulations [36 CFR Part 800.4(b)(2)], VDOT has deferred the remaining work necessary to complete the identification and evaluation of archaeological sites eligible for the NRHP and potentially affected by the Preferred Alternative until the design and engineering of the Preferred Alternative has been further refined. Stipulation II of the Section 106 Programmatic Agreement executed by FHWA, the SHPO, and VDOT prescribes the process VDOT will follow, in consultation with the SHPO and other parties, to complete efforts to identify terrestrial and underwater archaeological sites within the LOD (direct effects APE) of the Preferred Alternative; assess the effect of the Preferred Alternative on archaeological historic properties; and determine and implement appropriate treatment actions for any sites that would be adversely affected. Based on the information contained in the report, *HRCS Archaeological Assessment (April 2016; revised July 2016)*, VDOT concluded that, in relation to their historical significance, any archaeological historic properties that might be affected by the HRCS would meet the regulatory exception to the requirements of Section 4(f) approval: the sites likely would be important chiefly for the information they contain, which can be retrieved through data recovery, and would have minimal value for preservation in place [23 CFR §774.13(b)(1)]. The SHPO concurred with this finding on April 28, 2016, and on December 5, 2016.

3.9.3 Completion of the Section 106 Process

FHWA has fulfilled its responsibilities under Section 106 of the NHPA for the Preferred Alternative by executing with the SHPO and VDOT a legally binding Programmatic Agreement (**Appendix I**). The Programmatic Agreement incorporates by reference design parameters for the Preferred Alternative and VDOT's assessments of the effects of the alternative on individual historic properties, as conveyed by VDOT to the SHPO on November 22, 2016 (**Appendix D**). The Programmatic Agreement stipulates the additional design commitments VDOT will implement to ensure that the effects of the Preferred Alternative on the following historic properties will not be adverse: Pasture Point Historic District, Hampton Institute Historic District and Hampton Institute National Historic Landmark, Hampton National Cemetery, Phoebus-Mill Creek Terrace Neighborhood Historic District, and Norfolk Naval Base Historic District. Review of final design plans for adding capacity to the HRBT under the Preferred Alternative is also required to ensure that the design is consistent with VDOT's determination, concurred in by the SHPO on December 29, 2017 **(Appendix D**), that the alternative will not affect Fort Monroe, Chamberlain Hotel, Old Point Comfort Lighthouse, and Fort Wool. Finally, the Programmatic Agreement also stipulates a process VDOT will follow to complete efforts to identify terrestrial and underwater archaeological sites within the LOD (direct effects APE) of the Preferred Alternative; assess the effect of the Preferred Alternative on archaeological historic properties; and determine and implement appropriate treatment actions for any sites that would be adversely affected.

3.10 HAZARDOUS MATERIALS

Methodology

For the purposes of this hazardous materials analysis the Study Area Corridors were used to define the boundary within which hazardous materials were investigated. A search for potential recognized environmental conditions (RECs) was performed using a database search prepared by Environmental Data Resources, Inc. (EDR). Due to the dense concentration of industrial sites within the Study Area Corridors, a search distance of ¼-mile was set as the boundary for investigation. Field verification of

database-identified RECs was performed by conducting a windshield survey of sites within the Study Area Corridors. A windshield survey was performed along public roadways to verify sites identified by the EDR search. Sites that were identified with "Open" Pollution Complaint cases were verified to determine current site conditions, potential corrective action efforts or site remediation. Sites with secured access were not included in the field verification.

Affected Environment

The EDR report identified 399 single sites or clusters of multiple sites of environmental concern or regulation within a ¼-mile search area of the Study Area Corridors (due to the density of the area, EDR often grouped nearby sites into clusters, issuing one EDR ID number to multiple addresses).

No visual evidence of ongoing corrective action, remediation or addition RECs were observed with any of the sites during the field verification.

Environmental Consequences

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

There are 179 identified sites within ¼-mile of **Alternative A**, 306 identified sites within ¼-mile of **Alternative B**, 511 identified sites within ¼-mile of **Alternative C**, 739 identified sites within ¼-mile of **Alternative D**, and 179 identified sites within ¼ mile of the **Preferred Alternative**. **Table 3-58** summarizes the results of the searched regulatory databases within ¼-mile search radius by alternative.

Table 3-58: Identified Sites by Alternative

Database Type	Alternative A	Alternative B	Alternative C	Alternative D	Preferred Alternative
LUST/ LTANKS	53	73	100	159	53
RGA LUST	-	5	4	7	-
SPILLS	4	19	28	39	4
ERNS	-	3	8	8	-
VCP	5	5	2	6	5
BROWNFIELDS	6	6	5	11	6
NPL	-	1	2	2	-
UST	45	70	102	159	45
AST	5	8	15	22	5
RCRA	19	30	85	105	19
HMIRS	-	1	1	2	-
INST CONTOLS	2	3	3	4	2
ENG CONTROLS	1	3	2	4	1
FINDS	13	22	65	82	13
AIRS	4	6	13	19	4

Database Type	Alternative A	Alternative B	Alternative C	Alternative D	Preferred Alternative
TIER 2	3	5	4	8	3
HIST AUTO STATION	7	14	25	37	7
DRY CLEANER	2	5	5	9	2
HIST DRY CLEANERS	1	2	3	5	1
ICIS	1	2	5	6	1
TRIS	-	1	3	3	-
VA ENF	-	2	3	3	-
VA SWF/LF	-	2	3	3	-
NPDES	1	3	3	6	1
MANIFEST	5	8	8	14	5
CERCLIS	2	4	5	7	2
CEDS	-	-	3	3	-
CORRACTS	-	1	1	1	-
EDR MGP	-	-	1	1	-
ROD	-	1	1	1	-
FUDS	-	-	1	1	-
PADS	-	1	1	1	-
RGA LF	-	-	1	1	-
Total	**179**	**306**	**511**	**739**	**179**

Based on the EDR Database information, 15 "Open" Pollution Complaint (PC) cases are associated with nine sites within the ¼-mile search area. Seven of the 15 "Open" cases located within the Study Area Corridors are associated with one site, the Craney Island Fuel Depot in Portsmouth.

In total, four "Open" sites are located within ¼ mile of the **Alternative A** Study Area Corridor, five sites are located within ¼ mile of the **Alternative B** Study Area Corridor, six sites are located within ¼ mile of the **Alternative C** Study Area Corridor, nine sites are located within ¼ mile of the **Alternative D** Study Area Corridor, and four sites are located within ¼ mile of the **Preferred Alternative**. Sites with "Open" cases are currently undergoing corrective action, remediation and/or monitoring due to documented petroleum releases or spills. Additionally, four Brownfields and one NPL site were also identified within the Study Area Corridors. All sites that were publicly accessible with "Open" Pollution Complaint case statuses were visited during the Field Verification. No obvious corrective action, site remediation or additional RECs were observed during the field verification.

Mitigation

Prior to acquisition of right-of-way and construction, thorough site investigations would be conducted to determine whether any of the sites are actually contaminated, and, if so, the nature and extent of that

contamination would be assessed. Sites that are identified to include potential contamination should be assessed on a site-by-site basis to determine applicable measures prior to design, acquisition and/or construction. Sites should be characterized by conducting thorough site investigations (i.e. Phase I Environmental Site Assessments (ESAs) and, if necessary, Phase II ESAs) to determine the presence of and/or the extent of contamination. Undocumented hazardous materials that are encountered during construction efforts shall be managed, handled and disposed of in accordance with federal, state and local regulations.

3.11 VISUAL RESOURCES

Visual resources are those physical features that comprise the visual landscape, including land, water, vegetation, and man-made elements. These elements are the stimuli upon which a person's visual experience is based. Notable visual and aesthetic resources within the Study Area Corridors include historic structures, parks, and undeveloped open space/natural areas.

Methodology

Site visits, reviews of local planning documents, and reviews of satellite imagery and Geographic Information Systems (GIS) data were conducted to identify the potential effects of the proposed Build Alternatives on the surrounding viewshed. Both static (such as what neighbors of the road see) and dynamic viewsheds (what travelers on the road see) have been considered in determining the Area of Visual Effect (AVE) of the proposed alternatives. Because the Study Area Corridors are within developed urban and suburban areas, the AVE for this visual and aesthetic resource assessment is primarily limited to adjacent land uses (**Figure 3-19**). Within the open areas of bridge approaches, the AVE was determined to extend one mile from a proposed alignment to incorporate land uses across water features. The AVE for alternatives that propose new water crossings incorporates Hampton Roads Harbor between the HRBT and the MMMBT. It also extends one mile from the HRBT toward the Chesapeake Bay and from the MMMBT up the James River to the west.

The visual impact of the alternatives is determined by assessing the change in visual resources due to the alternatives and predicting viewer response to that change. The magnitude of impacts to the visual resources within the AVE from specific vantage points is described as minor, moderate or major. Minor impacts would be those which are not detectable, slightly detectable, or localized within a relatively small area. Moderate impacts would be those that are readily apparent but do not contribute to a change in the character of the landscape. Major impacts would be substantial, highly noticeable, and/or result in changing the character of the landscape.

Affected Environment

The AVE encompasses a mix of residential, industrial, institutional, commercial, government/military, and open space land and water uses. The AVE varies greatly, from limited suburban-type views with the interstate visible to large expansive water views of the Chesapeake Bay, Hampton Roads Harbor, and the James River from the HRBT and MMMBT bridges and the shorelines of these waterbodies. Generally, topography in the region is fairly flat with landward viewsheds limited by vegetation or structures. Sound walls limit the AVE from the interstate in many areas along the Study Area Corridors. Several visually sensitive resources such as historic properties are located within the AVE. Visual impacts to historic properties are assessed under Section 106 of the National Historic Preservation Act reported in the *HRCS Cultural Resources Management Report*.

Figure 3-19: Area of Visual Effect

Environmental Consequences

The **No-Build Alternative** could diminish the existing visual character in the AVE. Since this alternative does not address congestion issues at any of the Study Area Corridors, congestion would continue to deteriorate and result in an increase in views of traffic by motorists and nearby residences and businesses in all landscape units. The exception would be where the I-664 Connector, I-564 Connector, and VA 164 Connector are proposed, as no roadways currently exist in those areas. A summary of the visual results for each **Build Alternative** and the **Preferred Alternative** is provided in **Table 3-59.**

Alternative A includes portions of Landscape Units I, II, and III along I-64. Visual impacts for all viewer sensitivity groups throughout this alternative are minor to moderate. None of the viewer sensitivity types would experience major visual impacts. Moderate visual impacts would occur for two viewer sensitivity types (community residents and regular motorists/students/park and recreational visitors). Minor impacts would occur for all viewer sensitivity types.

Minor impacts would be those which are not detectable, slightly detectable, or localized within a relatively small area. Moderate impacts would be those that are readily apparent but do not contribute to a change in the character of the landscape. Widened roadways, increased amounts of pavement, and new bridge-tunnel structures adjacent to the existing HRBT are the most pronounced effects to the visual character throughout this alternative. However, views outside of the roadway corridor and to the periphery would not be effected.

Table 3-59: Summary of Visual Impacts

Alternatives	Viewer Sensitivity Type	Visual Impacts (# of locations)		
		Major	Moderate	Minor
A	High	0	1	3
	Moderate	0	1	3
	Low	0	0	4
B	High	0	1	5
	Moderate	0	1	5
	Low	0	0	6
C	High	0	2	1
	Moderate	0	1	3
	Low	0	0	4
D	High	0	2	3
	Moderate	0	1	4
	Low	0	0	5
Preferred Alternative	High	0	1	3
	Moderate	0	1	3
	Low	0	0	4

Alternative B includes portions of Landscape Units I, II, III, and IV. Visual impacts for all viewer sensitivity types throughout this alternative are minor to moderate. None of the viewer sensitivity types would

experience major visual impacts. Moderate visual impacts would occur for two viewer sensitivity types (community residents and regular motorists/students/park and recreational visitors). Minor impacts would occur for all viewer sensitivity types.

Widened roadways, increased amounts of pavement with potential loss of vegetated areas, new bridge-tunnel structures, and new roadway corridors are the most pronounced effects to the visual character throughout this alternative. Minor impacts would be those which are not detectable, slightly detectable, or localized within a relatively small area. Moderate impacts would be those that are readily apparent but do not contribute to a change in the character of the landscape. Community residents and regular motorists would be most susceptible to changes in the visual character under Alternative B.

Alternative C includes portions of Landscape Units I, II, IV, and V. Visual impacts for all viewer sensitivity groups throughout this alternative are minor to moderate. None of the viewer sensitivity types would experience major visual impacts. Moderate visual impacts would occur for two viewer sensitivity types (community residents and regular motorists/park and recreational visitors). Minor impacts would occur for all viewer sensitivity types.

Widened roadways, increased amounts of pavement with potential loss of vegetated areas, new bridge-tunnel structures, and new roadway corridors would be the most pronounced effects to the visual character under this alternative.

Alternative D includes portions of all five Landscape Units. The visual impacts under Alternative D would include all of the effects previously mentioned for Alternatives A, B, and C.

The **Preferred Alternative** includes portions of Landscape Units I, II, and III along I-64. Visual impacts for all viewer sensitivity groups throughout this alternative are minor to moderate and nearly identical to those described under Alternative A. None of the viewer sensitivity types would experience major visual impacts. Moderate visual impacts would occur for two viewer sensitivity types (community residents and regular motorists/students/park and recreational visitors). Minor impacts would occur for all viewer sensitivity types.

Minor impacts would be those which are not detectable, slightly detectable, or localized within a relatively small area. Moderate impacts would be those that are readily apparent but do not contribute to a change in the character of the landscape. Widened roadways, increased amounts of pavement, and new bridge-tunnel structures adjacent to the existing HRBT are the most pronounced effects to the visual character throughout this alternative. However, views outside of the roadway corridor and to the periphery would not be effected.

Mitigation

Several measures could be undertaken to minimize the potential effects of the Build Alternatives to visual quality. Specific measures would be identified and implemented once the selected alternative or OIS is advanced for design and construction. These measures could be implemented where potential construction impacts of alternatives to visual quality would be the same within and among the five landscape units analyzed.

Measures to minimize or mitigate visual quality effects often include landscaping and modifications to enhance the aesthetics of topography, structure, and lighting design. VDOT would coordinate with affected communities to identify specific approaches that would best address concerns of highly sensitive viewers such as residential communities. Visual quality impacts to moderately sensitive viewer types including parks and historic sites could also be similarly treated. Restoration of wetlands, streams, and tidal shorelines, if required, would address diminished visual quality from construction impacts to these resources.

3.12 SECTION 4(F) AND SECTION 6(F) PROPERTIES

3.12.1 Section 4(f)

Section 4(f) of the US Department of Transportation Act of 1966 (49 USC 303(c)) is a federal law that protects publicly-owned parks, recreation areas, wildlife and/or waterfowl refuges, or any significant historic sites, whether privately- or publicly-owned. Section 4(f) requirements apply to all transportation projects that require funding or other approvals by the USDOT. As a USDOT agency, FHWA must comply with Section 4(f), which includes describing Section 4(f) lands identified within the HRCS Study Area Corridors and potential use of the lands. If a Section 4(f) use is determined necessary, avoidance alternatives to use of the lands, preliminary identification of the alternative with the least overall harm, and a discussion of all possible planning to minimize harm must be conducted. The Section 4(f) Review in this document (**Appendix E**) follows established USDOT regulations and references 23 CFR Part 774 and the 2012 Section 4(f) Policy Paper prepared by the FHWA as guidance.

Section 4(f) of the US Department of Transportation Act of 1966 as amended (49 USC Section 303) stipulates that the US Department of Transportation (USDOT), including the FHWA, cannot approve the use of land from a publicly owned park, recreation area, wildlife or waterfowl refuge, or public or private historic site unless the following conditions apply:

- The FHWA determines that there is no feasible and prudent avoidance alternative to the use of land from the property, and the action includes all possible planning to minimize harm to the property resulting from such use (23 CFR §774.3(a)); or
- The FHWA determines that the use of the Section 4(f) properties, including any measures to minimize harm committed to by the applicant, will have a *de minimis* impact on the property (23 CFR §774.3(b)).

Temporary use of the established Section 4(f) properties has been assessed in the overall determination of use for each property. Temporary occupancy of Section 4(f) lands will be determined during later stages of design and would not be considered a use if all of the following conditions exist:

- The land use is of short duration (defined as less than the time needed for the construction of the project).
- There is no change in ownership of the land.
- The scope of the work must be minor.
- There are no temporary or permanent adverse changes to the activities, features, or attributes of the property.
- The land must be fully restored to a condition at least as good as prior to the project.
- There must be documented agreement from the official(s) with jurisdiction over the property with the above conditions.

Nine historic properties and public parks eligible for Section 4(f) protection would be potentially impacted by one or more of the HRCS Build Alternatives. The Preferred Alternative would require *de minimis* impacts to two historic sites, the Battle of Hampton Roads and Battle of Sewell's Point. The Preferred Alternative would also impact the Phoebus-Mill Creek Terrace Neighborhood Historic District, but the impact would not constitute a Section 4(f) use of the property. As a result of avoidance and minimization efforts on Alternative A since the Draft SEIS, the Hampton Institute Historic District and Willoughby Boat Ramp would be avoided and not incur any Section 4(f) use from the Preferred Alternative. The properties are summarized in **Table 3-60**. A complete review of all Section 4(f) properties is provided in **Appendix E**. Additional information on historic properties is located in **Section 3.9** of this Final SEIS and in the *HRCS Architectural Survey: Management Summary*.

Table 3-60: Section 4(f) Use

Section 4(f) Property	Acreage of Use from Draft SEIS Alternative				Intent to Pursue *de minimis* (all Draft SEIS Build Alternatives)	Acreage of Use from Preferred Alternative	*De minimis* Impact (Preferred Alternative)
	A	B	C	D			
Hampton Institute Historic District	1.1	1.1	0	1.1	Yes	0	No; No Section 4(f) Use
Phoebus-Mill Creek Terrace Neighborhood Historic District (no contributing elements)	0.7	0.7	0	0.7	No; No Section 4(f) Use	0.7	No; No Section 4(f) Use
Battle of Hampton Roads[1]	144.9	201.8	541.9	625.6	Yes	164.2	Yes
Battle of Sewell's Point[1]	130.2	130.2	0	130.2	Yes	137.2	Yes
Battle of Craney Island[1]	0	6.7	6.7	6.7	Yes	0	No; No Section 4(f) Use
Willoughby Boat Ramp	0.1	0.1	0	0.1	Yes	0	No; No Section 4(f) Use
Hampton High School	0	0	0.7	0.7	Yes	0	No; No Section 4(f) Use
Park Place Park	0	0	0.2	0.1	Yes	0	No; No Section 4(f) Use
Norfolk Naval Base Historic District[2]	29.4	46.7	60.0	46.7	No; No Section 4(f) use	0	No; No Section 4(f) Use

Note: The historic district boundary of the Norfolk Naval Base overlaps with portions of existing right-of-way for I-564 and I-64 and right-of-way for the I-564 IC, under construction, which accounts for the acreage noted in the table.

1. Acreage within historic district; impact to contributing properties cannot be determined.

2. More refined right-of-way files have been compiled since the Draft SEIS, confirmed with the US Navy, and used to calculate impacts for the Preferred Alternative relative to the Norfolk Naval Base Historic District. Impacts for other Build Alternatives are presented as they were calculated for the Draft SEIS. Additionally, communications between VDOT and cultural resources personnel for the Commander Navy Region Mid-Atlantic (CNRMA) prior to publication of the Draft SEIS indicated the Navy does not recognize the entirety of this district as NRHP-eligible. Instead it recognizes four discontiguous smaller historic districts as NRHP-eligible, none of which is located within the LOD for the Build Alternatives. Subsequent to publication of the Draft SEIS the SHPO clarified that it considers all of Naval Station Norfolk and Naval Support Activity Hampton Roads to be an historic district eligible for listing on the NRHP, but does not

consider the highway right-of-way associated with existing I-64 and I-564 to be contributing to the district. This interpretation would also reduce the amount of historic district acreage within the LOD of the Draft SEIS Build Alternatives.

Based on the Section 4(f) review, all impacts to Section 4(f) properties are anticipated to either not be considered a Section 4(f) use, or are considered a *de minimis* use, per 23 CFR 774 and the Section 4(f) Policy Paper. More information on Section 4(f) Properties, including maps of impacted parks and historic properties, is provided in **Appendix E**.

Appendix E also provides FHWA's final Section 4(f) *de minimis* impact finding for two historic sites, the Battle of Hampton Roads and the Battle of Sewell's Point, which would incur a direct impact from the Preferred Alternative (Alternative A). For historic sites, a *de minimis* impact means that the project will have no effect or no adverse effect on the historic property. Each *de minimis* determination is based upon the anticipated level of impact from the Preferred Alternative. The SHPO, the relevant official with jurisdiction, concurred on December 29, 2016, that these battlefield properties would incur no adverse effect from the Preferred Alternative. VDHR was notified of with FHWA's intent to make *de minimis* impact findings in a letter dated April 10, 2017 (see **Appendix D**).

3.12.2 Section 6(f)

Section 6(f) of the Land and Water Conservation Fund (LWCF) Act protects recreation lands created which were developed using LWCF grant funding. Pursuant to 36 CFR Part 59, no property acquired or developed with LWCF assistance shall, without the approval of the Department of Interior, be converted to uses other than public outdoor recreation. Conversion can be approved only if it is in accordance with an existing comprehensive outdoor recreation plan and only upon such conditions deemed necessary to assure substitution of other recreation properties of at least equal fair market value and of reasonably equivalent usefulness and location. The requirement applies to all parks and other sites that have been the subject of LWCF grants of any type. One property within the Study Area Corridors, the Willoughby Boat Ramp (formerly the Norfolk Boat Ramp), was established using a grant from the LWCF and thus qualifies for protection under Section 6(f).

The No-Build Alternative and Alternative C would have no impact on Section 6(f) properties. Alternatives A, B, and D would each have 0.1 acres of impact on the Willoughby Boat Ramp, and would displace a communications tower and ancillary building located on the property. Had acquisition of land or impacts to facilities of the Willoughby Boat Ramp been required as part of the Preferred Alternative, VDOT would have coordinated with DCR and NPS to determine appropriate replacement mitigation of equal value per the requirements of Section 6(f).

No acquisition of land or impacts to facilities of the Willoughby Boat Ramp would be required as part of the Preferred Alternative.

3.13 CHILDREN'S HEALTH AND SAFETY

Assessment of children's health has been performed in accordance with Executive Order 13045, *Protection of Children from Environmental Health Risks and Safety Risks*, which directs federal agencies to identify and assess environmental health and safety risks that may disproportionately affect children. The most likely locations of potential effects on children (other than at residences abutting right-of-way)

would be at schools where there are outdoor activity areas for children. There are eight schools and universities within the Study Area Corridors, five of which are elementary, middle, or high schools:

- Hampton High School
- Willoughby Elementary
- Jolliff Middle School
- Believer's Day School
- Booker T. Washington Middle School

No schools or universities would be directly impacted as a result of the implementation of the project. Willoughby Elementary School is located approximately 120 feet east of I-64 in Norfolk. However, the proposed widening along I-64 at this location would be to the west; therefore, no changes would occur adjacent to the school property. Two other school facilities are proximal to I-64: Ocean View Elementary School is approximately 300 feet from I-64 and Northside Middle School is approximately 530 feet from I-64. The I-64 corridor exists today and improvements would not cause additional impact to these facilities. As indicated in **Appendix G** the worst case scenario for air quality and noise impacts related to health have been analyzed as part of this study.

The most likely health and safety risks would be associated with the study's air quality and noise impacts, as discussed above. Comprehensive analyses of air quality and noise impacts have been conducted for the project (**Sections 3.6** and **3.7**). The air quality analysis provided in **Section 3.6**, as well as the *HRCS Air Quality Technical Report*, showed that the project would not cause any violations of national ambient air quality standards established by USEPA to protect human health and welfare, including children.

As described in **Section 3.7**, measured noise levels showed that traffic was the dominant source of noise at most locations within the Study Area. Sound level increases from Existing Conditions to the 2040 build conditions are similar to those for the No-Build Alternative, except in places where there are proposed improvements that would bring roadways closer to noise receptors. There are no projected future interior noise impacts at any of the schools with the Study Area Corridors. Two schools, Hampton High School and Booker T. Washington Middle School would experience benefit from reasonable and feasible barriers. More detail is provided in the *HRCS Noise Analysis Technical Report*.

Another potential concern may be traffic safety as it relates to pedestrian and bicycle travel by children. Each of the corridors in the study are limited-access highways that prohibit pedestrians and bicycle travel. All pedestrian and bicycle crossings are at grade-separated interchanges. Furthermore, fencing and noise barriers along the highways provide a physical barrier to pedestrian and bicycle entry onto the highway.

Based on the above discussion, none of the Build Alternatives nor the Preferred Alternative would pose health or safety risks that would disproportionately affect children.

3.14 SHORT-TERM CONSTRUCTION IMPACTS

This section provides a general overview of temporary short-term impacts that could occur during construction of the Build Alternatives. The LOD that has been developed for the study to define the potential area of impact take into account potential construction limits. Specific construction staging and access locations have not been determined at this time. Development of the Limits of Construction (LOC) for the Preferred Alternative, identification of potential staging areas, and more specific impacts and

mitigation will be provided for the Preferred Alternative during the final design and permitting phases of the study, after the issuance of a ROD.

Short-term impacts would primarily consist of changes to traffic patterns, physical modifications to land use from earth moving, increases in turbidity resulting from dredging activities and other underwater activities, and vegetation removal for the development of construction staging areas and equipment storage. Project construction activities could include:

- Excavation and fill activities related to road widening/construction;
- Drilling shafts and driving piles for bridge piers and other structures;
- Underwater construction activities; and
- Delivery and storage of equipment and materials.

Throughout construction, impacts would be controlled by the commitments made in this SEIS, standard construction practices (upheld by the project contractor), as well as the Joint Permit Application and Erosion and Sediment Control plan which will be developed for the Preferred Alternative.

The assessment of temporary construction impacts is preliminary and based on the current conceptual level of design developed at this phase of the project. The types and levels of potential impacts from construction are subject to revision through the design and development review processes, with a goal to further avoid or minimize impacts to the maximum extent practicable. Mitigation will be considered for any adverse impact that cannot be avoided, including temporary impacts during construction.

3.14.1 Traffic

Construction activities would result in temporary interruptions to vehicular traffic patterns, including the potential temporary closure of roads. During various stages of construction, additional traffic would be generated by hauling of construction debris, excavation and building materials. Specific trucking routes, frequency of trips, or waste disposal destinations will be identified as part of the construction documents for the Preferred Alternative and after issuance of the ROD.

3.14.2 Air Quality

Temporary air quality impacts from construction would consist primarily of emissions produced during the construction of this project by heavy equipment and vehicle travel to and from the construction areas. Earthmoving and ground-disturbing operations would also generate airborne dust. Construction emissions would be temporary in nature.

In order to mitigate these emissions, construction activities will be performed in accordance with the *VDOT Road and Bridge Specifications*. The project lies in an area designated by VDEQ as an emissions control area for volatile organic compounds and nitrogen oxides (9 VAC 5-20-206), and as such, all reasonable precautions will be taken to limit the emissions of these pollutants. In addition, for work in this area, the following VDEQ air pollution regulations must be adhered to during the construction of this project:

- 9 VAC 5-45-760, Cutback Asphalt restrictions;
- 9 VAC 5-130, Open Burning restrictions; and
- 9 VAC 5-40-90, Fugitive Dust precautions.

3.14.3 Noise

Construction activities would cause intermittent fluctuations in noise levels throughout the construction area. The degree of noise impact would vary, as it is directly related to the types of equipment used and the proximity to the noise-sensitive land uses within the project area. Based on a review of the project area, no considerable, long-term construction-related noise impacts are anticipated. Any noise impacts that do occur as a result of roadway construction measures are anticipated to be temporary in nature and would cease upon completion of the project construction phase.

The following would be utilized to help minimize potential construction-related noise impacts. A detailed discussion of VDOT's construction noise policy can be viewed in Section 107.16(b) 3 Noise of *VDOT's Road and Bridge Specifications.*

- The Contractor's operations shall be performed so that exterior noise levels measured during a noise-sensitive activity shall not exceed 80 decibels. Such noise level measurements shall be taken at a point on the perimeter of the construction limit that is closest to the adjoining property on which a noise-sensitive activity is occurring. A noise-sensitive activity is any activity for which lowered noise levels are essential if the activity is to serve its intended purpose and not present an unreasonable public nuisance. Such activities include, but are not limited to, those associated with residences, hospitals, nursing homes, churches, schools, libraries, parks, and recreational areas.
- VDOT may monitor construction-related noise. If construction noise levels exceed 80 decibels during noise sensitive activities, the Contractor shall take corrective action before proceeding with operations. The Contractor shall be responsible for costs associated with the abatement of construction noise and the delay of operations attributable to noncompliance with these requirements.
- VDOT may prohibit or restrict certain work activities that produce objectionable noise so that they would not occur between 10 PM and 6 AM. If other hours are established by local ordinance, the local ordinance shall govern.
- Equipment shall in no way be altered so as to result in noise levels that are greater than those produced by the original equipment.
- When feasible, the Contractor shall establish haul routes that direct his vehicles away from developed areas and ensure that noise from hauling operations is kept to a minimum.
- These requirements shall not be applicable if the noise produced by sources other than the Contractor's operation at the point of reception is greater than the noise from the Contractor's operation at the same point.

3.14.4 Soils and Erosion

Construction of any of the Build Alternatives would result in soil disturbance, soil exposure and compaction that could cause potential adverse effects on shallow soil permeability, and soil erosion caused by water and wind.

An Erosion and Sediment (E&S) Plan will be developed as part of the construction documents for the Preferred Alternative after issuance of the ROD. The plan will identify measures to minimize impact to the construction sites and surrounding water bodies as a result of construction-related soil erosion. Access driveways will be needed during construction. Once graded and established, access driveways are

typically covered with stone or rock used to disperse stormwater sheet flows and minimize soil erosion from wind. Other erosion control measures include engineering controls such as drainage culverts and filter fabric to protect the integrity of the temporary access driveways and minimize impacts to the existing site drainage patterns and water quality. Silt fence would also be required as part of the E&S Plan to prevent stormwater runoff.

The soil erosion and control measures would be inspected periodically and replenished as necessary throughout construction. After construction is complete, all temporary impact areas, including access driveways, will be restored to their previous use. The restoration will include removal of fill to prior grade, amelioration of soil compaction, and revegetation to ensure soils are restored. With the development and implementation of the E&S Plan, short-term impacts on soils from excavation and fill activities are expected be minor.

3.14.5 Water Quality

Construction of any of the Build Alternatives would potentially result in short-term impacts to water quality such as increased sedimentation, increased turbidity from in-stream work, and possible spills or non-point source pollutants entering groundwater or surface water from stormwater runoff. Dredging for bridge and tunnel construction would result in generation of suspended solids and a release of nutrients and potential contaminants within overlying waters.

To minimize these impacts, appropriate erosion and sediment control practices would be implemented in accordance with the Virginia Erosion and Sediment Control Regulations, the Virginia Stormwater Management Law and regulations, and VDOT's Road and Bridge Specifications. Implementation of BMPs such as filtration of discharge water from barges/scows, eliminating overflow from barges during dredging or transport, reducing the speed of loaded buckets or cutterheads, will minimize increases in turbidity of waters downstream of dredging activities. Preconstruction sediment quality assessments and water quality monitoring during construction may be required to address potential re-suspension of contaminants and nutrients into overlying water.

During construction, contractors will be prohibited from discharging any contaminant that may impact water quality. In the event of accidental spills, the contractor is required to immediately notify all appropriate local, state, and federal agencies and to take immediate action to contain and remove the contaminant. Additionally, the requirements and special conditions of any required permits for work in and around surface waters would be incorporated into construction contract documents, so that the contractor would be required to comply with such conditions.

The project must be consistent with Virginia's CZMP concerning impacts to coastal resources. Such actions require a consistency determination that receives concurrence from the VDEQ. The project must comply with the enforceable regulatory programs administered by the network of state agencies and local governments. These programs pertain to fisheries, subaqueous lands, wetlands, dunes, non-point source pollution, point source pollution, shoreline sanitation, air pollution, and coastal lands management.

3.14.6 Waters of the US and Wetlands

All of the Build Alternatives would require construction within the James River, Hampton Roads, or Elizabeth River. Under Alternatives A, B, and D, construction would require expansion of the existing islands to accommodate the new bridge-tunnel structures. Alternatives C and D would require a new island to be constructed at the mouth of the James River to accommodate the new bridge-tunnel structure. Channel conditions within the James River would be maintained in accordance with Virginia Port Authority requirements, including a 55-foot depth at mean low water (MLW) with a width of 1,000 feet (top of tunnel would be 60 to 65 feet MLW), and the preservation of existing deep water anchorages.

A more detailed assessment of stream and wetland impacts and avoidance and minimization efforts would be performed following a formal jurisdictional delineation and further design.

3.14.7 Wildlife and Habitat

Water Bird Nesting

Construction of new bridge-tunnels under all Build Alternatives and proposed expansion of the tunnel portal islands would require direct disturbance of beaches used as nesting areas by water birds. While placing fill material on the existing beaches may make these areas temporarily unsuitable for nesting water birds, the total beach area would be increased with expansion of the island providing an opportunity to increase the amount of suitable nesting habitat on the islands. However, displacement of nesting waterbirds by disturbances to sites used prior to construction may not be a short-term impact.

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 distance of the construction to the colony. Construction of new beach areas would include materials (e.g., sand and stones), which provide suitable conditions for water bird nesting habitat. Specific time restrictions and the appropriate materials for beach construction would be developed in coordination with the VDGIF.

Benthic Communities

Dredging for tunnel installations, bridge construction access, and within potential aquatic borrow sites would temporarily result in the disruption of benthic communities and generation of suspended solids and release of nutrients and potential contaminants within overlying waters. The disruption of benthic communities for construction of the Build Alternatives is not expected to impact the sustainability of commercially important species including oysters, blue crabs, or clams within Hampton Roads. The Study Area Corridors are almost entirely within a Condemnation Zone for shellfishing, are unsuitable for shellfish aquaculture, and no longer support commercial harvest of oysters or clams.

The potential temporary impact to benthic communities would be a result of the loss of SAV which would be replaced. Hardshell clam would be the most vulnerable of the three known area benthic species to dredging impacts; however, clams would be expected to re-establish following construction due to the extensive presence of benthic habitat within the study area. Clam habitat is widespread in the area since all the substrate in Hampton Roads is suitable clam habitat. The greatest clam densities occur within the

Newport News Channel and along the shoreline corresponding to the Hampton Flats Hard Clam Harvest Area public clamming grounds along the Hampton shoreline. Benthic infauna would begin to recolonize the disturbed substrate in a matter of days or weeks with higher trophic level species expected to reestablish within months to a year and a half or more (Rhoads and Germano, 1982 and Nichols et al., 1990).

Suspended solids may be deposited within benthic communities downstream of dredging activities. The aerial extent of suspended solids is expected to be limited due to the coarse sandy texture of sediments within Hampton Roads. Implementation of dredging BMPs, including filtration of discharge water from barges/scows, eliminating overflow from barges during dredging or transport, reducing the speed of loaded buckets or cutterheads, and sheet-pile enclosures, would minimize increases in turbidity of waters downstream of dredging activities. Pre-construction sediment quality assessments and water quality monitoring during construction may be required to address potential re-suspension of contaminants and nutrients into overlying water.

Essential Fish Habitat, Habitat Areas of Particular Concern, and Anadromous Fish Use Areas

The Build Alternatives would potentially impact EFH, Habitat Areas of Particular Concern (HAPC), and Anadromous Fish Use Areas. However, much of the impact would be temporary given the limited footprint of the bridge piers and because the tunnels would be submerged.

Dredging required for construction of any of the Build Alternatives within potential aquatic borrow sites would temporarily result in the disruption of benthic communities that provide food sources for fish. The temporary loss of benthic communities would have minimal impacts on prey availability given the limited area of disturbance and widespread availability of benthic habitat within the Study Area Corridors and foraging habitat throughout Hampton Roads and the southern Chesapeake Bay.

Temporary increases in turbidity and releases of nutrients and potential contaminants from dredging activities are not expected to substantially impact juvenile or adult fish because of their mobility and because construction would be spread out over time and would occur within discrete areas. Spawning, eggs and larvae, however, would be more vulnerable to these impacts.

Time-of-year restrictions would be implemented to avoid or minimize impacts on fish during early life stages. VDGIF typically recommends restrictions on all in-stream work within Anadromous Fish Use Areas and their tributaries between February 15 and June 30, though no time-of-year restrictions are recommended on the James River and its tributaries below the Route 17 Bridge or on the Elizabeth River unless the project spans the width of the River to an extent that it significantly impedes fish passage. Exact restrictions may vary depending on the species, type of work, and location. In addition, erosion and sediment control measures would minimize potential impacts to water quality during construction. Specific measures for avoidance, minimization, and mitigation of impacts to aquatic wildlife would be developed in consultation with VDGIF and NMFS.

Submerged Aquatic Vegetation

Construction of Alternatives A, B, D, and the Preferred Alternative would temporarily disturb SAV. Removal of SAV from State bottom would require prior approval by VMRC. Areas of temporary disturbance to SAV would be replanted. A request to remove SAV from or plant SAV upon State bottom

would be submitted with a Joint Permit Application to the VMRC. The application will include specific information that is critical to properly evaluate the probabilities of transplantation success, with minimization of impacts to established donor bed populations. Construction within or adjacent to SAV areas would avoid the growing season for representative plant species to the extent practicable. Further efforts to avoid and/or minimize disturbance and removal of 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 SAV loss would be developed in coordination with VMRC and may include enhancement or restoration of existing or historic SAV beds.

Invasive Species

All of the Build Alternatives could increase the spread of invasive species. Construction equipment used in the study area could carry seeds or propagative plant parts from other construction projects or infested areas. Removal of sediment and soil to offsite locations could spread invasive species and placement of fill from borrow sites could introduce invasive species to the study area. Exposed soil also allows invasive species to spread, which could contribute to encroachment of invasive species on vegetation communities.

The potential for the establishment of invasive animal or plant species during construction would be minimized by following provisions in VDOT's Road and Bridge Specifications. These provisions require prompt seeding of disturbed areas with seeds that are tested in accordance with the Virginia Seed Law and VDOT's standards and specifications. Specific seed mixes that are free of noxious or invasive species may be required for environmentally sensitive areas and would be determined during the design and permitting process. In addition, in order to prevent the introduction of or spreading of invasive species, BMPs would be followed, including washing machinery before it enters the area, minimizing ground disturbance, and reseeding of disturbed areas. While the right-of-way is vulnerable to colonization by invasive plant species from adjacent properties, implementation of the stated provisions would reduce the potential for the establishment and proliferation of invasive species within highway right-of-way.

Threatened and Endangered Species

Information collected from the USFWS, NMFS and VDGIF indicate that the habitat for up to 16 species listed by Virginia or the Federal government as threatened or endangered. Coordination with the USFWS and NMFS is ongoing pursuant to Section 7 of the Endangered Species Act of 1973, as amended, to address potential impact and identify appropriate mitigation measures. Mitigation during construction could include measures such as time of year restrictions, specified by the regulatory agencies, which limit construction activities. Threatened and endangered species within the study corridors are further described in **Section 3.8.3**.

3.14.8 Hazardous Materials

Sites containing hazardous or contaminated materials may exist within the Study Area Corridors of the Build Alternatives. These include sites regulated by the Resource Conservation and Recovery Act (RCRA), petroleum release sites and facilities registered with the VDEQ, and sites that participate in the Virginia Voluntary Remediation Program. Prior to the acquisition of right-of-way and construction, a Phase I Environmental Site Assessment (ESA) as well as Phase II ESA (as needed) will be conducted for the

Preferred Alternative to determine whether any of the sites are actually contaminated, and, if so, the nature and extent of that contamination. Any additional hazardous material sites discovered during construction of a Build Alternative or demolition of existing structures will be removed and disposed of in compliance with all applicable federal, state, and local regulations. All necessary remediation would be conducted in compliance with applicable federal, state, and local environmental laws and would be coordinated with the EPA, VDEQ, and other federal or state agencies as necessary.

3.14.9 Visual

Temporary changes to the visual quality throughout the Study Area Corridors would occur during construction. These changes would primarily occur in the form of large construction equipment such as cranes and barges, as well as and materials, storage and yarding areas, construction fences/barriers, traffic control devices, and changes to the landscape associated with land clearing and earth moving operations. These visual changes from construction equipment would occur only during the construction period and would be removed at the completion of construction.

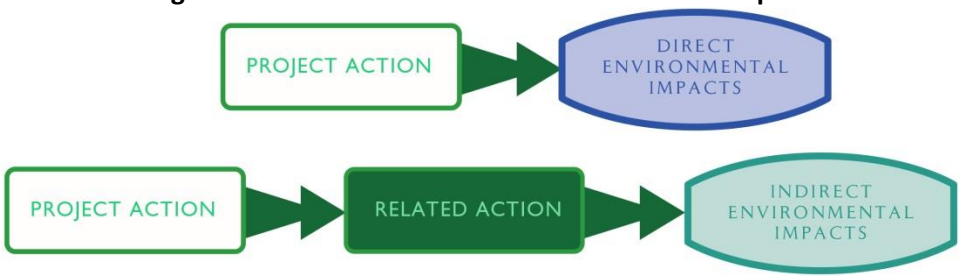
3.15 INDIRECT AND CUMULATIVE EFFECTS

3.15.1 Regulatory Context and Methodology

NEPA legislation does not mention indirect or cumulative effects (ICE); however, the Council on Environmental Quality (CEQ) regulations for implementing NEPA address federal agency responsibilities applicable to indirect and cumulative considerations, analysis, and documentation requirements (40 CFR 1508.25) for the environmental consequences section of an EIS (40 CFR 1502.16) (FHWA, 2014). In addition to CEQ's regulations, indirect and cumulative effects assessment is conducted in accordance with the requirements and processes outlined in 23 CFR Part 771, FHWA Interim Guidance: Indirect and Cumulative Impacts in NEPA (2003), FHWA Position Paper on Secondary and Cumulative Impact Assessment (1992), FHWA's Questions and Answers on Considering Indirect and Cumulative Impacts in the NEPA Process (2015), FHWA's Technical Advisory T 6640.8A (1987), the Transportation Research Board's (TRB) National Cooperative Highway Research Program (NCHRP) Report 466: Desk Reference for Estimating the Indirect Effect of Proposed Transportation Projects (TRB, 2002), NCHRP Project 25-25 Task 22: Land Use Forecasting for Indirect Impacts Analysis (TRB, 2005), NCHRP Project 25-25 Task 11: Secondary/Indirect and Cumulative Effects Analysis (TRB, 2006), as well as CEQ's Considering Cumulative Effects under the National Environmental Policy Act (1997) and Guidance on the Consideration of Past Actions in Cumulative Effects Analysis (2005).

CEQ defines indirect effects as "…effects which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable (40 CFR 1508.8[b]). Indirect effects may include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems" (40 CFR 1508.8[b]). These induced actions are those that may or may not occur with the implementation of the proposed project, as illustrated in **Figure 3-20**.

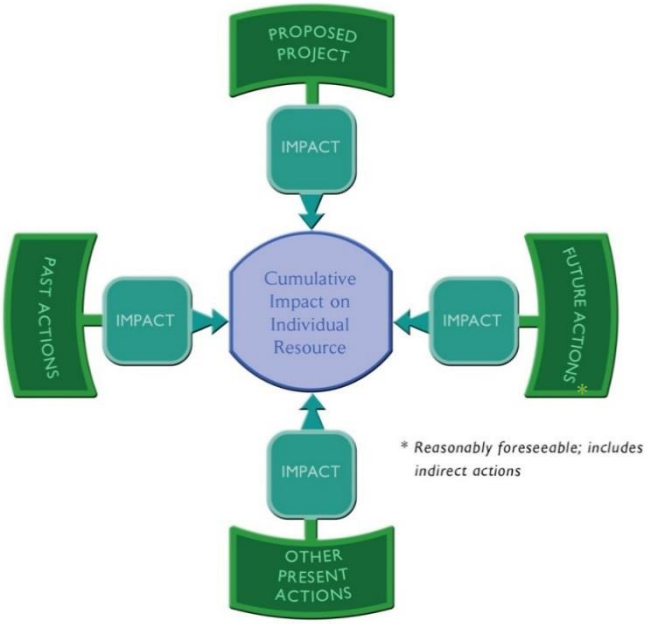
Figure 3-20: Direct vs. Indirect Environmental Impact



Source: Questions and Answers Regarding the Consideration of Indirect and Cumulative Impacts in the NEPA Process, FHWA (2014).

CEQ defines cumulative effects (or impacts) as, "…the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time" (40 CFR 1508.7). Cumulative effects include the total of all impacts, direct and indirect, experienced by a particular resource that have occurred, are occurring, and/or would likely occur as a result of any action or influence, including effects of a federal activity (EPA, 1999), as illustrated in **Figure 3-21**.

Figure 3-21: Cumulative Impacts



Source: Questions and Answers Regarding the Consideration of Indirect and Cumulative Impacts in the NEPA Process, FHWA (2014).

Indirect and cumulative effects of the No-Build and Build Alternatives A-D were analyzed in the HRCS Draft SEIS. Participating agencies reviewed and commented upon the draft ICE methodology and ICE Technical Report. The Draft SEIS and the supporting final ICE Technical Report were circulated for agency and public review and comment in August of 2016. Comments regarding the Draft SEIS ICE analysis were received from the Southern Environmental Law Center, the USEPA, and HRTPO are summarized in (see Appendix H). The following section has been updated to consider comments received on the Draft SEIS ICE analysis.

Figure 3-22 presents the Induced Growth ICE Study Area boundaries within which the potential impacts of induced growth from implementation of the Build Alternatives are most likely to occur, as described in the indirect effects section. Specific ICE Study Areas were developed for each of the following resources:

- **Socioeconomic Resources:** The Socioeconomic Resources ICE Study Area was established to analyze indirect effects to land use, socioeconomics, and parks/recreational resources/open space. The Socioeconomic Resources ICE Study Area includes those Census Block Groups that lie directly within or partially within the direct impacts study area and the Induced Growth ICE Study Area (**Figure 3-23**).
- **Natural Resources:** The Natural Resources ICE Study Area was established to analyze indirect effects to water resources, wildlife habitat, and threatened and endangered species. The Natural Resources ICE Study Area is based on the Virginia Department of Conservation and Recreation (VDCR) Virginia Hydrologic Unit Explorer subwatershed 12-digit Hydrologic Unit Code (HUC) within the direct impact area (**Figure 3-24**).
- **Historic Resources:** The Historic Resources ICE Study Area was established to analyze indirect effects to architectural and archaeological resources. The Historic Resources ICE Study Area includes the area within which indirect effects to historic properties could occur from altering the setting, feeling, and association contributing to the integrity of the historic property (**Figure 3-25**). Indirect effects such as altering the setting, feeling and association of archaeological and architectural historic properties are considered under Section 106 of the National Historic Preservation Act (NHPA) as reported in the *HRCS Archaeological Assessment* and *Architectural Survey: Management Summary* technical reports. Indirect effects analyzed in this ICE document are those related to potential changes in access and induced growth.

Figure 3-22: Induced Growth ICE Study Area

Figure 3-23: Socioeconomic Resources ICE Study Area

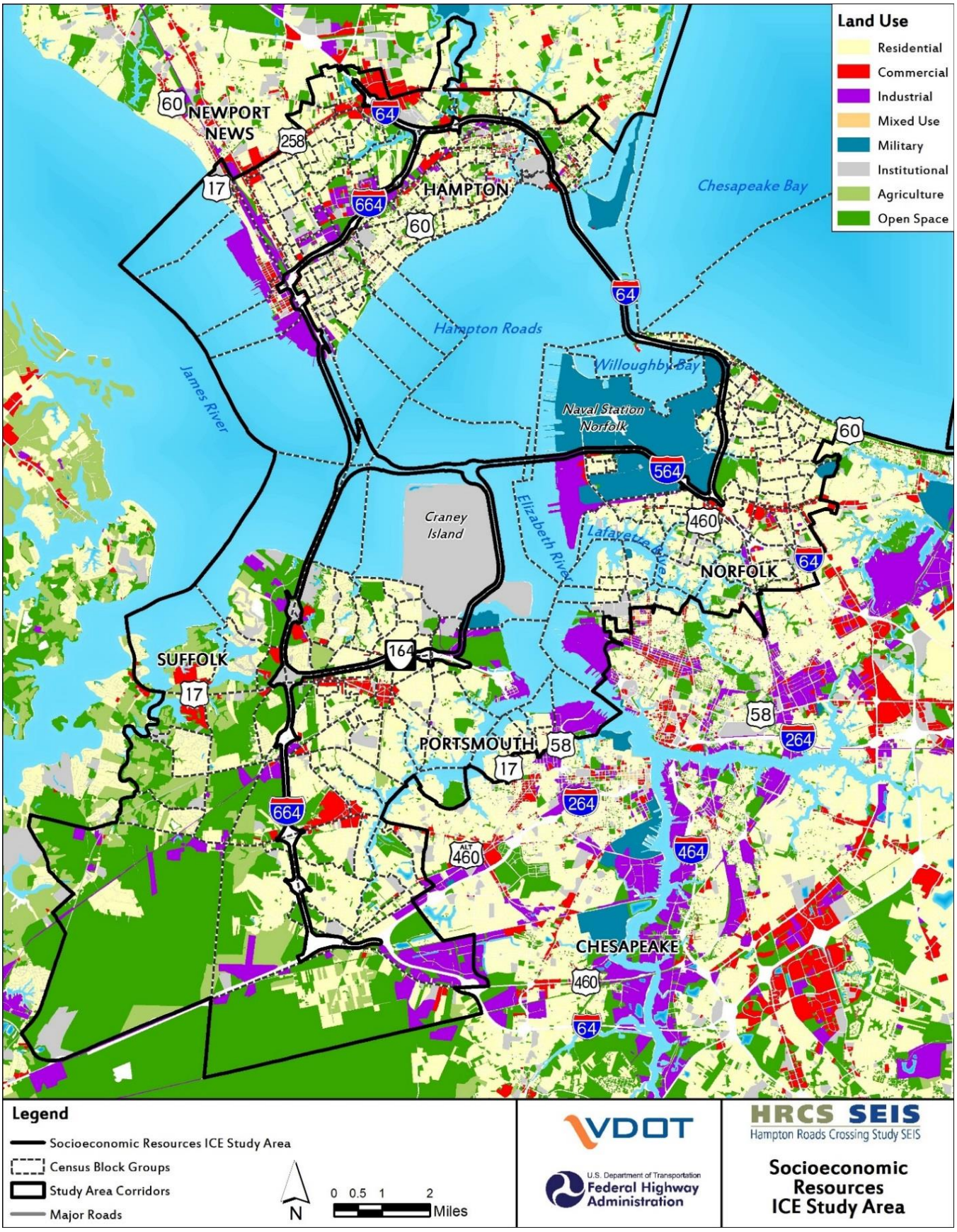


Figure 3-24: Natural Resources ICE Study Area

3.15.2 Indirect Effects

This section summarizes the indirect effects analysis focusing on the potential for socioeconomic and ecological impacts that could occur outside of the area of direct impact as a result of the alternatives. Indirect effects of Build Alternatives A-D are reported in detail in the *HRCS Indirect and Cumulative Effects Technical Report* prepared in support of the Draft SEIS. This section also evaluates the indirect and cumulative effects of the Preferred Alternative developed after circulation of the Draft SEIS. In NCHRP Report 466, TRB states that indirect effects can occur in three broad categories:

- **Encroachment-Alteration Impacts** – Alteration of the behavior and functioning of the affected environment caused by project encroachment (physical, biological, socioeconomics) on the environment;
- **Induced Growth Impacts** – Project-influenced development effects (land use); and,
- **Impacts Related to Induced Growth** – Effects related to project-influenced development effects (impacts of the change of land use on the human and natural environment).

In general, with regard to induced growth, transportation improvements often reduce time and cost of travel, as well as provide new or improved access to properties, enhancing the attractiveness of surrounding land to developers and consumers. Important characteristics for induced growth include existing land use conditions in the project area, increased accessibility that may result from new transportation improvements, local political and economic conditions, the availability of other infrastructure and the rate of urbanization in the region (NCDOT, 2001). The NCDOT guidance indicates induced growth impacts are most often found up to 1 mile around a freeway interchange and 2 to 5 miles along major feeder roads. Two principal factors influencing the likelihood of induced growth noted are the extent and maturity of the existing transportation infrastructure and land availability. The Study Area Corridors are mature transportation infrastructure that have been in place for decades. Hampton, Newport News, Norfolk, and Portsmouth are highly urbanized cities with little vacant land, while Chesapeake and Suffolk have more undeveloped land. Areas over 1-mile distant from the existing interchanges in Norfolk, Hampton, City of Newport News (Newport News) and City of Portsmouth (Portsmouth) have been settled with well-established residential neighborhoods, commercial, and industrial areas; the induced growth effects from transportation improvements of the alternatives would not likely extend to these more distant locations.

The area of influence for induced growth impacts (**Figure 3-22**) and the impacts to other resources related to induced growth are discussed together in the following sections. When the term "induced growth effects" is used in this study, it is specifically referring to potential growth along feeder roads a distance of 1 mile from existing interchanges on all study corridors and a 1,000-foot buffer either side of the feeder roads. The exception is I-64 interchanges west of Settlers Landing interchange in Hampton where there is limited potential for induced development because no mainline improvements are proposed there. With respect to I-664 on the Southside, induced growth effects have been considered up to 2 miles from existing interchanges along feeder roads with a 1,000-foot buffer along either side of the feeder road. This is to assess the greater potential for induced growth in Chesapeake and Suffolk that have more undeveloped land near I-664 interchanges.

Figure 3-25: Historic Resources ICE Study Area

The HRCS SEIS study routes and existing interchanges have been in place for many decades; for example, I-64 was constructed in 1957, I-64 and the HRBT were expanded in the 1970s, I-564 was built from 1971 to 1977, the VA 164 Western Freeway was opened in 1992, and I-664 and the MMMBT were constructed in the early 1990s. Other important transportation events for growth in the region (Kozel, 2007) included:

- completion of the Downtown Tunnel in 1952 that was expanded to four lanes in 1989;
- opening the Midtown tunnel on US 58 in 1962;
- the High Rise Bridge opening in 1969 and construction of I-64 through Chesapeake to Bowers Hill by 1969;
- opening I-264 in 1972 with additional connections to the Downtown Tunnel and Berkley Bridge in 1991; and
- replacement of the 1928 two-lane James River Bridge on US 17 with a four-lane bridge in 1982.

As previously discussed in **Section 1.2.1**, the lands adjacent to existing interchanges along I-64 through Norfolk, I-564, I-664 north of the MMMBT and VA 164 are in an advanced stage of development, and the cities of Hampton, Newport News, Norfolk, and Portsmouth are largely built-out. It is therefore expected the greatest potential for induced growth in these areas would be in the form of infill or redevelopment where the natural environment has already been degraded. Lands along I-664 on the Southside are at a slightly lower level of land use intensity and development, resulting in more undeveloped land near the existing I-664 interchanges. Growth along major feeder roads to these interchanges would still be largely infill but potentially could occur slightly further out (up to 2miles) along feeder roads from existing I-664 interchanges. Using these limits to identify the location of potential induced development and associated indirect effects is an attempt to identify where those indirect effects are most probable and could occur as a result of the project. It does not mean that indirect effects from the project would not occur elsewhere, rather, it means that those effects are less reasonably foreseeable.

Indirect and induced growth effects potentially resulting from each alternative were analyzed using planning judgement. Each alternative is comprised of operationally independent sections; however, the assessment of indirect effects has been prepared for the full alternative. As a result, the potential total indirect effects may not be realized until all operationally independent sections of an alternative are implemented. Potential indirect effects that may occur by the year 2040 are considered for all alternatives, including the No-Build Alternative.

3.15.2.1 No-Build Alternative- Encroachment Effects

Socioeconomic Resources

Under the No-Build Alternative, continued and increasing traffic delays and traffic unreliability along and beyond the Study Area Corridors could cause some individuals or businesses to leave the area and locate elsewhere to reduce transportation-related overhead. Increasing congestion and travel unreliability impedes the delivery of and access to goods and services and results in lost economic productivity due to workers being delayed in traffic and increased fuel consumption from increased idling. A recent study of congestion at the HRBT by the Transportation Research Institute at ODU reports congestion and delays are costing the traveling public approximately 1.13 million vehicle hours or $33.2 million annually in lost productivity, vehicle operation cost, and lost fuel (based on 2013 data) (Cetin et al., 2015). Given increasing gridlock in the Socioeconomic Resources ICE Study Area, it is uncertain whether individuals or businesses could be attracted to the area to replace those that may move away. Increased gridlock would

cause more visual, noise, and air impacts that could reduce community cohesion and reduce access to community facilities and recreation areas.

The indirect effects to transportation on the Study Area Corridors under the No-Build Alternative are examined in the *HRCS Transportation and Traffic Technical Report*. Under the No-Build Alternative, increased congestion on the larger regional transportation network would occur, leading drivers that would otherwise use the severely congested HRBT crossing to use other Hampton Roads crossings and/or other routes around the region to avoid congestion while trying to reach their destinations.

Natural Resources

The No-Build Alternative would not improve the existing HRCS Study Area Corridors. Although stormwater management along the Study Area Corridors has been updated over the past 25 years and retrofitted with more modern systems as improvements have been made, there are still sections where there are not any stormwater management features or the features are outdated and would not be improved under the No-Build Alternative. Existing indirect effects associated with untreated or poorly treated stormwater runoff would continue.

Terrestrial wildlife habitat adjacent to the Study Area Corridors is highly fragmented in most areas and this would continue under the No-Build Alternative. VIMS assessment of wetland condition within the Natural Resources ICE Study Area indicates NWI wetland habitat is somewhat severely stressed and wetland water quality is severely stressed (VIMS, 2016). No HRCS project-related construction or changes to wetlands would occur in the Study Area Corridors under the No-Build Alternative, thus, no project-related effects to wetlands would result under this alternative. However, existing and planned developments would continue to degrade these wetlands.

Historic Resources

Increasing traffic congestion under the No-Build Alternative could make access to certain historic properties that are open to public visitation more difficult such as the Hampton National Cemetery, Emancipation Oak Tree, and Fort Monroe, making them less attractive to visit.

3.15.2.2 No-Build Alternative- Induced Growth

No induced growth is expected under the No-Build Alternative, as no changes would be made to the Study Area Corridors. Land near existing interchanges may become less desirable due to continued traffic congestion and diminishing travel reliability.

3.15.2.3 Alternative A- Encroachment Effects

Socioeconomic Resources

Direct residential displacements under Alternative A would be relatively few (nine), and no commercial, industrial or community facilities would require relocation. Alternative A would widen I-64 by adding a lane in the eastbound direction for a short distance. Therefore, the residential relocations would be located along the edge of communities that border the I-64 Study Area Corridor. Consequently, Alternative A would have minor indirect effects on community cohesion in the cities of Norfolk and Hampton. The relocation assistance process does not require that a relocated resident locate in a certain area or to a specific structure; however, community cohesion impacts are generally minimized when there is sufficient replacement housing available and relocated residents are able to relocate and remain

within or in close proximity to their existing communities. Under Alternative A, the effects to community cohesion would be minor as relatively few displacements would occur, and adequate replacement housing exists.

Widening I-64 in the Study Area Corridors would relocate some residences, exposing second row homes that were previously "buffered" from the interstate. This could cause some residents or businesses in the new "first row" closest to the interstate to leave the area. However, given the limited improvements to regional connectivity and reduction in congestion realized under Alternative A, others may be attracted to the area, resulting in minimal effects to community cohesion.

Widening I-64 would also marginally increase the separation distance between communities located on either side, but because the relationship between the interstate and the adjoining communities has been established for nearly 60 years and all local road crossings would be maintained, indirect effects to community cohesion would be minor.

Improvements to I-64 under Alternative A would marginally improve access to transportation while reducing congestion along a limited section of the corridor. This would benefit people and businesses by reducing lost productivity from sitting in congested traffic. An improved corridor may make the area more attractive for new businesses or make it more conducive for existing businesses to expand, increasing long-term employment opportunities in the Socioeconomic Resources ICE Study Area.

Generally, when capacity is added, traffic volumes would increase on that facility as it becomes more attractive for travelers. Parallel facilities such as the MMMBT would see traffic divert to the roadway with newly added capacity. Under Alternative A, traffic volumes on the HRBT would increase and traffic volumes on the MMMBT would decrease. Regional traffic patterns would change in concert with the shift in traffic between the HRBT and MMMBT. Additionally, local roadways that parallel the improved I-64 Study Area Corridor and have accommodated excess travel demand could see traffic volume reductions as drivers divert from existing surface streets to the improved corridor where they would find better travel conditions Tolling could also influence the diversion of traffic. While the indirect effects of tolling on traffic cannot be reliably determined at this time because of a number of unknowns (e.g., which facilities would be tolled, the toll rate, etc.), the *HRCS Traffic and Transportation Technical Report* includes a basic toll diversion analysis. Tolling scenarios are based on those developed by the HRTAC (HRTAC, 2015). See the *HRCS Traffic and Transportation Technical Report* for details on the assumptions used for the toll diversion analysis. For Alternative A, one toll scenario was considered, and that scenario involved the implementation of managed lanes (i.e., HOT lanes) on the HRBT; no toll was placed on any other crossing such as the MMMBT that would not be improved as part of the alternative. **Table 3-61** presents the assumed toll-per-mile rates for HOT lanes. The results indicate a slight overall reduction in traffic volumes on the HRBT, with some of the traffic shifting to the MMMBT.

Table 3-61: Modeled HOT Toll Rates (in dollars per mile) for All Build Alternatives

Passenger Car		Commercial Vehicles (3+ axles)	
Peak	Off Peak	Peak	Off Peak
0.33	0.15	1.32	0.45

Potential indirect effects of tolled lanes (HOT) on EJ populations were evaluated as part of this study. Low-income persons that want to use HOT lanes may not have access to credit cards to realize the cost benefits of using the E-ZPass as opposed to paying higher by-plate rates. With the new cash-based system

created by E-ZPass, families that previously could not obtain an E-ZPass transponder due to the lack of a credit card, can now purchase an E-ZPass Reload Card and reload it for a small fee at local convenience and grocery stores (see http://www.ezpassva.com/reloadcard for more details). The Reload Card is a wallet-size re-useable card that can be linked to your Virginia E-ZPass account. You can use it to manually replenish your account with cash at any participating retailer for $1.50 fee per reload. The cashier will scan it and enter the initial reload amount from $10 to $500. HOT lanes could indirectly benefit EJ populations and all other users of General Purpose lanes by improving travel time and reliability from diverting some traffic to the HOT lanes. The existing General Purpose lanes would remain free for all users. Accordingly, no disproportionately high and adverse indirect impacts to low-income populations from tolling would occur.

During construction, short-term road closures, detours, and loss of parking could indirectly affect residents, businesses and the local economy by potentially increasing commute times and emergency vehicle response times and limiting or restricting access to neighborhoods, community facilities or businesses. These effects would be short-term, ending once construction was completed. Conversely, hiring for construction could increase local employment and money spent by workers could benefit local businesses over the short-term.

Natural Resources

Alternative A would widen an existing interstate in a highly urbanized area. Alternative A would cause some habitat loss, particularly in the vicinity of water crossings which tend to have greater integrity than land areas along either side of the I-64 Study Area Corridor that have fewer legal protections. Habitat fragmentation is associated with habitat loss. Habitat fragmentation can have wide-ranging indirect effects to wildlife, resulting in species shifts associated with greater edge habitat and less interior habitat (smaller patch size); lower diversity due to smaller habitat patches; potential isolation of populations; increased vulnerability of species to external competition and predation; potential decreased flow of genetic material through the landscape; restricting wildlife movements that disrupt foraging, breeding/nesting, and migration; increased risk of invasive species establishment; and generally, reduced biological diversity. Roadway noise can result in altered habitat utilization, strained communication, and heightened metabolic rates on wildlife, especially avian communities, indirectly causing wildlife abandonment of the area, increased predation, reduced foraging success, decreased breeding success, and decreased wildlife health.

The most intact habitat within the Study Area Corridor tends to be riparian corridors. Widening of existing bridges and lengthening culverts under Alternative A could indirectly restrict wildlife movement through the riparian corridors crossed by these structures and alter up and downstream hydrologic flow. Direct effects to wetlands, streams, and floodplains may indirectly change hydrologic flow dynamics through adjacent natural communities up or downstream, which sometimes alters these dynamics at the ecosystem level such that the ability of the system to maintain itself is altered. Preserving the hydrodynamic flow systems is important because they are a major pathway for energy flow and dissipation in the Coastal Plain, an area of flat, low-lying land with many rivers, marshes and swampland.

Some of the potential effects that may occur because of changes to natural processes in the wetlands of the Natural Resources ICE Study Area include changes to floodwater storage capacity and retention times, vegetative community composition and structure, nutrient cycling, and aquatic life movement. These indirect effects can alter wetland functions such as habitat, plant community, and carbon cycling

as described in the *HRCS Natural Resources Technical Report*. For example, an increase in sunlight in riparian areas due to a new roadway removing forest canopy can alter vegetation community composition (introduction of invasive species, changes in light regime which favor full-sun plants) and water chemistry (decrease in dissolved oxygen and increase in temperature, both which impact nutrient cycling and aquatic life). The obverse could occur as widening existing or constructing new bridges and overpasses can shadow wetlands, altering the plant community, wildlife habitat, and carbon cycling.

Direct impacts from cut/fill would result in loss of all wetland functions within the immediate footprint of the impact and indirectly contribute to habitat fragmentation effects described above. The magnitude of the effects to wetland functions directly and indirectly impacted from conversion and hydrologic alteration/isolation is generally less than effects from cut/fill. However, hydraulic alteration can remove all wetland function if the site is converted to an upland. Filling floodplains would also result in loss of floodplain functions. Floodplain encroachment could alter the hydrology of the floodplain that could increase the severity of flooding in terms of flood height, duration and erosion (FEMA, 2016).

The indirect impacts of Alternative A to hydrology associated with any given stream, wetland, floodplain or open water crossing would be limited as this alternative is confined to widening an existing corridor. Existing culverts would be extended or resized where appropriate and bridges widened or replaced in accordance with design standards. Mitigation efforts discussed later in this document would offset much of the potential indirect impact.

The increased impervious surface of the widened Interstate could indirectly increase the amount and velocity of runoff, amplifying the severity of flooding and erosion. Runoff would also pick up more sediment from disturbed soils and contaminants that could be deposited downstream, reducing water quality that impairs both human and wildlife uses. Runoff from roadways could contain heavy metals, salt, and associated materials, organic compounds, and nutrients. When runoff enters waters that are already impaired, the impacts are cumulative and can result in accelerated changes in the macrobenthic community structure and composition, which in turn, can affect the fish and amphibian populations that rely on them as a food source, as well as the birds and aquatic mammals that prey on the fish and amphibians. The effects can result in changes in community structure at a local level, but may also extend further to include changes in ecosystem structure and function in the absence of proper mitigation.

Threatened and endangered species habitat within the I-64 Study Area Corridor includes the Hampton Roads Bridge-Tunnel Island Conservation Site that is habitat for federally listed shorebirds. As described earlier in this chapter and the *HRCS Natural Resources Technical Report*, this habitat is already fragmented by the existing HRBT and surrounding development. Furthermore, the widespread occurrence of common reed has rendered much of this habitat unsuitable for shorebird foraging. The majority of these estuarine areas would be bridged under Alternative A, limiting the direct loss of habitat, and thereby, indirect effects associated with additional habitat fragmentation. Due to the presence of higher quality foraging habitat outside the Study Area Corridor but within the vicinity of Alternative A, disruption during construction activities should have little to no impact on the shorebird species. Additionally, summer roosting habitat has been confirmed for bat species within Alternative A (NLEB, Little brown bat, Tri-colored bat), and forested habitat is very fragmented. Alternative A would not further degrade the quality of this habitat. Furthermore, no confirmed maternity roosts or hibernacula are located within a 2-mile radius of the I-64 Study Area Corridor, further limiting the potential indirect effects on the species from encroachment.

The design for the tunnels would substantially affect the amount of dredging and fill needed which, in turn, could affect aquatic species, cause habitat loss, and degrade water quality. As Alternative A would construct one additional bridge-tunnel at the HRBT, it would have fewer dredging indirect effects to natural resources and water quality than the other Build Alternatives, except the Preferred Alternative that would have the same impacts. It is estimated that Alternative A would generate approximately 1.2 million cubic yards of dredge material requiring disposal. Alternative A would also have fewer indirect effects to regional dredge material capacity than the other Build Alternatives. Several options are available to dispose of dredge material that requires testing to evaluate its suitability for various alternative uses and disposal sites. Therefore, the exact effects to dredge material disposal on natural resources and the regional capacity for dredge material disposal from building Alternative A are not known at this time. However, with the exception of the initial impacts to benthic communities at the disposal site, the potential for other indirect effects to possibly occur as a result from disposal operations will be site-specific, depending on the characteristics of the dredged material, whether disposal is on land or in water, and the hydrodynamic conditions at the disposal site. These include indirect impacts from increased or decreased light penetration and potential release of toxicants that may alter feeding, breeding, and nursery habitat as well as affect the life and health of nearby wildlife. These potential effects at the disposal site are minimized as part of the USACE permitting process for the disposal site approval.

Construction and post-construction discharges of stormwater, as well as dredging, potentially 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. Drainage design for the new proposed bridge structures would be developed in later design phases and is expected to be in conformance with current stormwater regulations to minimize downstream effects to natural resources and water quality. Alternative A is not expected to disturb soils with *Enterococcus* or fecal coliform, which impair several waterbodies in the area. Therefore, Alternative A is not expected to substantially contribute to the further impairment of any impaired waterbodies from these sources.

Construction can increase the presence of invasive plant species enabled by earth disturbance and spreading from contaminated vehicles, clothing, and shoes. The spread of invasive species would be minimized by following provisions in VDOT's Road and Bridge Specifications. While the I-64 Study Area Corridor would be vulnerable to the colonization of invasive plant species from adjacent properties, implementation of the stated provisions would reduce the potential for the establishment and proliferation of invasive species.

Historic Resources

All effects to archaeological and historic architectural properties, including indirect effects, will be considered under Section 106 of the NHPA as described in **Section 3.9** of this SEIS. Portions of the Area of Potential Effects with a high potential for archaeological remains that have not been previously intensively inventoried will be intensively surveyed in accordance with the executed PA for the selected alternative after issuance of the ROD, during the permitting phase of the project. It is not expected that any archeological sites that have not been intensively surveyed would embody characteristics important for preservation in place.

Potentially easier access to historic properties within Norfolk and Hampton from an improved I-64 under Alternative A could foster increased visitation to historic properties. This would be beneficial if access to

historic properties is controlled, as increasing historic tourism provides incentives and means for preservation. While not expected, uncontrolled increased visitation may result in overuse to the point of adversely affecting their integrity. Major historic property attractions in the Historic Resources ICE Study Area close to I-64 include Fort Monroe, Fort Wool, the Emancipation Oak Tree at the Hampton University campus, and the Hampton National Cemetery. Access to Fort Monroe, a National Historic Monument, is controlled. Visitation to Fort Wool is naturally limited as its only access is by water. The Emancipation Tree is fenced but otherwise access is not controlled. Access to Hampton National Cemetery is controlled by gates and fencing.

During construction, access to historic properties could be temporarily impacted by temporary road closures, detours, and loss of parking, potentially affecting visitation. These construction effects would be short-term and therefore, minor.

3.15.2.4 Alternative A- Induced Growth Impacts

Figure 3-26 shows the Induced Growth ICE Study Area for Alternative A. **Table 3-62** contains the interchange key map. Induced growth could occur under Alternative A because it would increase capacity and reduce congestion, making it more attractive for users and increasing access to surrounding land. It would also improve regional accessibility for customers as well as the delivery of goods and services that facilitates growth. As previously discussed, induced growth would most likely occur around existing interchanges along an improved corridor.

Consideration of induced growth in Hampton along the I-64 Study Area Corridor focused on the Mallory and Settlers Landing interchanges since, under Alternative A, improvements to I-64 would be limited to Settlers Landing interchange. From there westward, I-64 would not be improved.

Table 3-62: Alternative A Induced Growth ICE Study Area Interchange Map Key

Key #	Interchange Description	Key #	Interchange Description	Key #	Interchange Description
1	Exit 267 - US Rt 60/VA143 Settlers Landing Rd & Woodland Rd	**5**	Exit 274 - West Bay Ave to I-64 East/ I-64 to WB West Ocean View Ave	**9**	I-64/I-564
2	Exit 268 - VA 169 South Mallory St	**6**	I-64 WB Entrance Ramp from Granby St/Norfolk Naval Station Gate 22/ Forest Lawn Cemetery	**10**	VA 165/VA 170 Little Creek Rd
3	Exit 272 - West Ocean View Ave/Willoughby Spit	**7**	Exit 276 - I-564 & Granby St/VA 460	**11**	VA 406/Terminal Blvd to Hampton Blvd
4	Exit 273 - Rt 60 4th View St	**8**	I-64 EB Entrance Ramp from Norfolk Naval Station Gate 22		

Figure 3-26: Interchanges and Alternative A Induced Growth ICE Study Area

Under Alternative A, the potential for induced growth is limited by the restricted availability of undeveloped land in both Hampton and Norfolk that are virtually built-out, the amount of protected lands present (e.g., RPAs, wetlands, parks), and inaccessible land within military installations like NAVSTA Norfolk, which is controlled by the federal government. In addition, west of the I-64 Study Area Corridor in Norfolk is Chambers Field on NAVSTA Norfolk that includes runway approaches and clear zones outside the boundary of the installation, where the type of development is specifically regulated in the Induced Growth ICE Study Area. **Figure 3-27** shows the extent of developed land within Norfolk and Hampton based on the NLCD. Lands classified as developed or undeveloped in the NLCD could include military or other inaccessible government-controlled lands. Approximately 93 percent of lands are developed within the Induced Growth ICE Study Area of Alternative A. With the lack of undeveloped land, induced growth in built-out areas would therefore be in the form of infill or redevelopment.

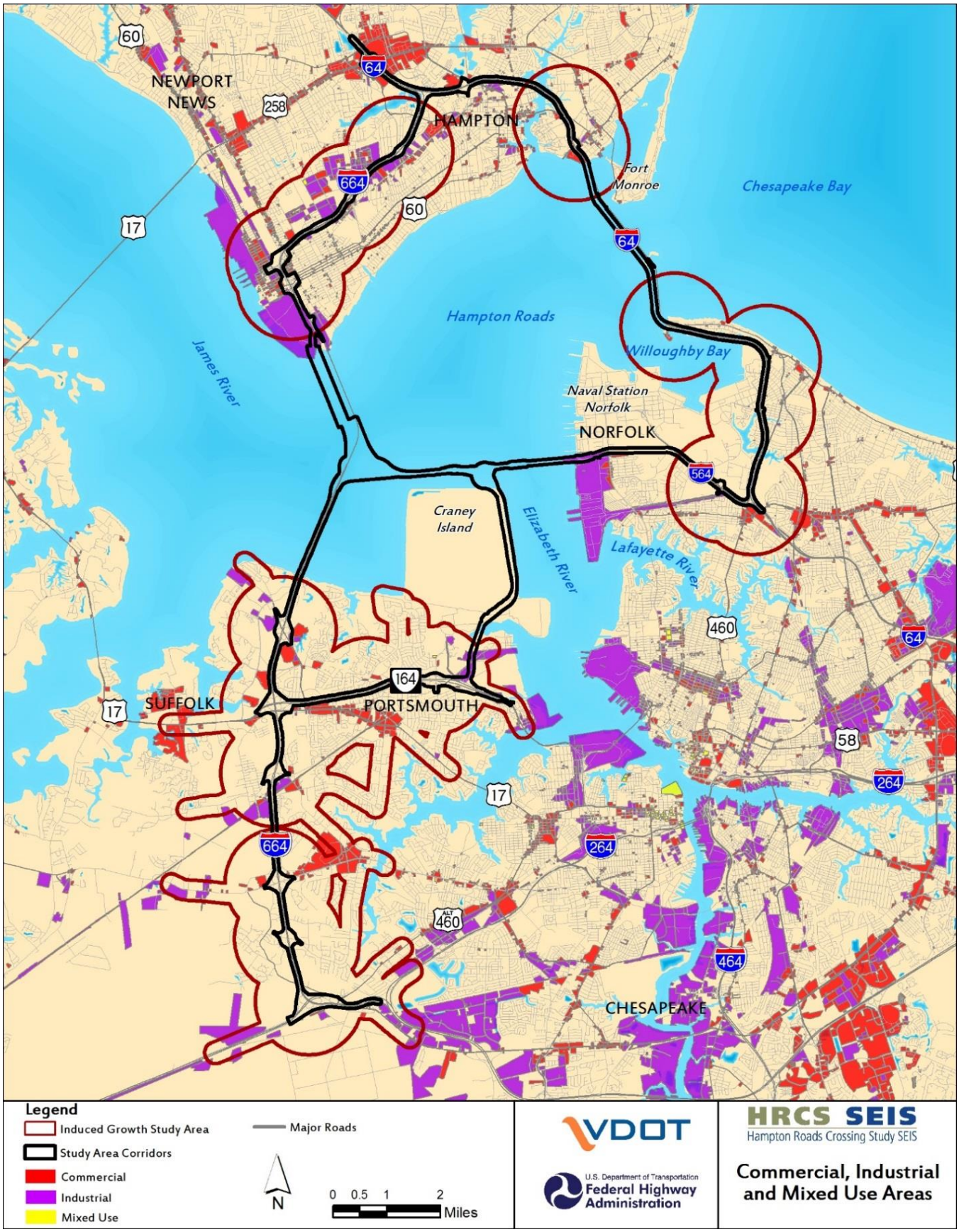
Alternative A's improvements to I-64 would most likely lead to growth in the Induced Growth ICE Study Area based on the factors previously discussed. One of these factors is local land use policies and guidance. Areas designated by Hampton and Norfolk as suitable for such growth within the Induced Growth ICE Study Area would likely experience the most growth. **Figure 3-28** shows the designated growth areas, redevelopment areas, and Urban Enterprise Zones in Hampton and Norfolk, and **Figure 3-29** depicts the designated commercial, industrial and mixed use areas in both cities. The Induced Growth ICE Study Area also extends outside of designated growth areas. The *HRCS Indirect and Cumulative Effects Technical Report* summarizes characteristics by land use category of the Induced Growth ICE Study Area for Alternative A that extends beyond designated growth areas. Land use is based on HRTPO 2011 regional data. Approximately 40 percent (4,193 acres) of the total Induced Growth ICE Study Area acres extend beyond designated growth areas in Hampton and Norfolk, including areas over water. Of the total acres outside of designated growth areas, the majority are military (38 percent) and residential (36 percent). Induced growth associated with Alternative A is not expected on military lands or areas over water.

Induced growth associated with Alternative A could create pressure on city councils and boards of supervisors to make changes to their land use plans to allow types of development in areas not currently approved for it or to allow greater development densities. This is anticipated to occur at limited levels for several reasons. Improvements to Hampton Roads crossings have been studied for several decades. Area planning (such as comprehensive plans for Norfolk) have considered potential crossing improvements or widening of I-64 (see the *HRCS Indirect and Cumulative Effects Technical Report*), and developed their land use policies with these improvements in mind. Further, the largest acreage of potential induced growth associated with Alternative A outside of designated growth areas is in residential areas where infill would be expected to increase density. The extent of induced residential, commercial, industrial and mixed use growth that could occur under Alternative A is uncertain because many factors other than transportation accessibility affect the decision to develop, such as local development policies and incentives, favorable economic conditions, and ease of financing. Land use policies and guidelines are set by local governments, and Code of Virginia § 15.2-2223 requires updating comprehensive plans for the physical development of land within their jurisdiction every five years. Comprehensive plans are developed in consultation with stakeholders and citizens. These processes reduce the potential for unplanned growth.

Figure 3-27: Developed Lands in the Induced Growth ICE Study Area

Figure 3-28: Designated Growth Areas in the Induced Growth ICE Study Area

Figure 3-29: Designated Industrial, Commercial, and Mixed-use Areas



Induced growth could benefit socioeconomic resources by increasing business and service providers that lead to increased long-term employment. It could also be negative for others. For example, induced growth could be both beneficial and adverse to low-income populations. New employment opportunities could occur, but gentrification associated with induced growth and development could increase property values and reduce available low-income housing stock.

Development associated with induced growth can adversely affect water quality, impacting human use and ecosystem functions as discussed in the natural resources indirect effects assessment of Alternative A. Approximately 91 waterbodies are impaired within the Natural Resources ICE Study Area, including Hampton Roads. However, federal, state, and local regulations addressing stormwater runoff and protecting water quality could reduce potential adverse impacts associated with induced growth.

Development associated with induced growth under Alternative A in the Induced Growth ICE Study Area could impact wetlands, streams, and floodplain areas. Based on the NWI and National Hydrography Dataset, an estimated 31 acres of wetlands[14], 63,192 linear feet of streams, and 3,090 acres of floodplain are throughout the Induced Growth ICE Study Area of Alternative A. The potential effects of induced growth to wetlands, streams, and floodplains under Alternative A cannot be quantified as the exact impacts of a specific development are unknown at this time. However, should future induced growth and development in the vicinity of Alternative A interchanges impact regulated waters, wetlands, streams, or floodplains, that individual development could be subject to review, approval, and / or permits from local, state, or federal agencies (including the USACE) before any impacts would occur. New development, in already developed areas, could be required to replace outdated stormwater control and drainage systems and replace impervious surfaces with more permeable surfaces, lessening impacts to water quality that may otherwise occur.

Impacts of induced growth under Alternative A to terrestrial and aquatic wildlife and wildlife habitat would include wildlife loss; habitat loss, fragmentation and degradation; disruption of resting, feeding, movement, breeding and nursery sites; changes in wildlife population density and species richness; alterations of hydrology and species interaction; and imperil protected species. Because the induced growth area of Alternative A is largely built-out, it is highly disturbed, thus the potential adverse effects to wildlife and wildlife habitat from induced growth development would still occur but may be reduced. Any federal or state-sponsored development or development on federal or state land would be regulated to minimize potential impacts to protected wildlife and wildlife habitat. Potential impacts to federally protected species on private property are also regulated as previously described. Proposed modifications to shorelines and wetlands would be federally and state regulated as well, reducing potential adverse effects of induced growth to wildlife and wildlife habitat.

New construction or rehabilitation associated with induced growth has the potential to adversely affect archaeological and architectural historic properties. This could occur from:

- Demolition, excavation, or vibration effects;
- Changing the design, materials, or workmanship
- Altering the setting, feeling and association of historic properties

[14] Approximate based on NWI: some wetlands may have been already impacted.

Development projects funded, permitted, or on lands controlled by federal and state agencies must take into account effects on historic properties by complying with Section 106 of the NHPA and the Virginia Antiquities Act and Burial Law, respectively. Additionally, both the cities of Hampton and Norfolk have historic architectural preservation committees that review and approve individual development projects within historic districts or historic overlay zones under their jurisdictions that apply to private property. These processes would reduce the potential adverse effects to historic properties from induced growth associated with constructing Alternative A.

3.15.2.5 Alternative B- Encroachment Effects

Socioeconomic Resources

Alternative B includes all of the improvements considered under Alternative A. The indirect effects on socioeconomic resources therefore would be similar to those described for Alternative A along the I-64 Study Area Corridor. The area along the I-564 and VA 164 Connector Study Area Corridors is largely controlled by the military and Port of Virginia (POV). While these agencies would realize the benefits related to reduced congestion, increased port access, and improved travel reliability, it is unlikely that there would be a potential for changes in land use or ownership as there is for the private properties described under Alternative A. Alternative B would result in nine residential displacements (the same as Alternative A) and no commercial relocations of properties bordering I-64, I-564, the I-564 and VA 164 Connectors, and VA 164. Along VA 164, the type of encroachment effects to socioeconomic resources would be similar to those described under Alternative A, as the existing facility is primarily bordered by private properties. Although indirect effects would occur over a larger area than Alternative A, those effects would be distributed along a narrow corridor along existing transportation infrastructure through several different communities, limiting adverse effects to community cohesion in an individual neighborhood or city.

Alternative B indirect effects on the larger regional transportation network would consist of decreases in congestion and improved travel reliability. The alternative would also offer a new crossing of the Elizabeth River and a more direct connection between the HRBT and the MMMBT, further improving travel reliability and connectivity in the region. Under Alternative B, traffic volumes on the HRBT would increase and traffic volumes on the MMMBT would decrease. Congestion at peak travel times at Hampton Roads crossings would still occur. Regional traffic patterns would shift as described for Alternative A, because increased capacity of the widened Study Area Corridors would reduce excess travel demand on parallel local streets, resulting in traffic volume reductions on those roads. Tolling could also influence how traffic is diverted to other crossings. While the indirect effects of tolling on traffic cannot be reliably determined at this time because of a number of unknowns (e.g., which facilities would be tolled, the toll rate, etc.), the *HRCS Traffic and Transportation Technical Report* includes a basic toll diversion analysis. Tolling scenarios are based on those developed by the HRTAC (HRTAC, 2015). See the *HRCS Traffic and Transportation Technical Report* for details on the assumptions used for the toll diversion analysis. Two toll scenarios were considered for Alternative B. Under the first scenario, a toll was placed on the new Elizabeth River crossings (i.e., the I-564 and VA 164 Connectors). Under the Elizabeth River toll-only scenario, a fixed toll of $1 was coded on the I-564 and VA 164 connectors. However, because vehicles would always need to travel on at least two of these connectors to cross the Elizabeth River, the effective toll on the crossing is $2. The results indicate that volumes on the HRBT and MMMBT may increase slightly, as tolls on the new Elizabeth River connectors improve the attractiveness of the HRBT and MMMBT to drivers. A slight shift in traffic to the James River Bridge is indicated as well.

Volumes on the I-564 and VA 164 Connectors would decline substantially, indicating that the additional cost of a toll may not outweigh travel time savings provided by these new connections. Under the second scenario, a managed lane scenario (i.e., HOT Lanes with the toll rates shown in **Table 3-61**) was considered where widening occurs; the fixed toll on the Elizabeth River crossing was retained as well. Under this scenario for Alternative B, the volume reduction on the HRBT would be slightly larger, with almost the entire volume shift being absorbed by the MMMBT. Traffic volumes on the I-564 and VA 164 Connectors would be essentially unchanged from the volumes under the first scenario. For the same reasons as discussed for Alternative A, Alternative B would not have disproportionately high and adverse indirect impacts to EJ populations under either of the above tolling scenarios.

Alternative B construction would occur over a larger area than Alternative A. Much of the additional work under this alternative would occur over water or within or around lands managed by government agencies. Therefore, indirect effects to socioeconomic resources during construction would be short-term and are not expected to be much greater than Alternative A.

Natural Resources

Alternative B would have similar types of indirect effects to natural resources as described for Alternative A. However, Alternative B would also construct on new alignment the I-564 and VA 164 Connectors. The I-564 Connector would involve constructing a tunnel extending from the Norfolk shoreline across the mouth of the Elizabeth River, a tunnel portal island north of CIDMMA, and trestle bridges. The hydrodynamic indirect effects related to the new tunnel have been evaluated by VIMS and are provided in **Section 3.8.1.6**. The design for the tunnels would substantially influence the amount of dredging and fill needed which, in turn, could affect aquatic species, cause habitat loss and degrade water quality from sedimentation, resuspension of sediment in the water column (turbidity), and potential release of toxicants from water bottom disturbance. As Alternative B would construct two new tunnels (alongside HRBT and the I-564 Connector), it would have more dredging indirect effects to natural resources and raise regional dredge material disposal capacity issues than Alternatives A and C, but fewer than Alternative D. It is estimated that Alternative B would generate approximately 4.1 million cubic yards of dredge requiring disposal. Several options are available to dispose of dredge material that requires testing to evaluate its suitability for various alternative uses and disposal sites. Therefore, the exact effects of dredge material disposal on natural resources, and the regional capacity for dredge material disposal is not known at this time. However, with the exception of the initial impacts to benthic communities at the disposal site, which is inevitable, the potential for other effects to possibly occur as a result from disposal operations will be site-specific, depending on the characteristics of the dredged material, whether disposal is on land or in water, and the hydrodynamic conditions at the disposal site. These include impacts from increased or decreased light penetration and potential release of toxicants that may alter feeding, breeding, and nursery habitat as well as affect the life and health of nearby wildlife. These potential effects at the disposal site are minimized as part of the USACE permitting process for the disposal site approval. Unlike the I-564 Connector, the VA 164 Connector would be constructed on new alignment, but it is being proposed that it not be on structure and over water. The potential for the VA 164 Connector to be placed on structure was not considered for the ICE analysis, but if had been included in the Preferred Alternative, the possibility would have been evaluated, if needed, to accommodate US Navy and US Coast Guard security requirements.

In the absence of an elevated facility, the VA 164 Connector under Alternative B could result in habitat loss and fragmentation. The *HRCS Natural Resources Technical Report* describes the habitat, species

diversity, protected species and wetland functions found in this area. Habitat loss resulting in habitat fragmentation may have wide-ranging effects to wildlife and biological diversity as described under Alternative A. The Craney Island Conservation Site is also habitat for federally protected shorebirds (Piping plover, gull-billed tern, Wilson's plover, and Red knot). The VA 164 Connector would be constructed on the eastern edge of the CIDMMA with more suitable habitat to the west. Therefore, the potential indirect effects of habitat fragmentation to wildlife and protected shorebird species is expected to be minimal in the vicinity of the VA 164 Connector. However, the alignment south of the island through government-controlled lands to its connection with VA 164 would have more severe habitat fragmentation indirect effects to wildlife. Summer roosting habitat for federally protected bats occurs there and, although some larger tracts of forest do exist in the Study Area Corridor along Coast Guard Boulevard north of VA 164, the potential indirect effects of Alternative B to bat roosting and foraging habitat would be similar to the types described for Alternative A. Canebrake rattlesnake habitat is located in forest habitat on the Coast Guard property; however, the habitat area is isolated, and it is believed that the area is not able to support a viable population of the species long term. This area of the VA 164 Connector was clear cut in the 1990s which likely eliminated any Canebrake rattlesnake population at that time. Therefore, Alternative B is not expected to have any indirect effects to the Canebrake rattlesnake.

Palustrine wetlands within CIDMMA are routinely disturbed. Those along the proposed VA 164 Connector south of CIDMMA are generally in better condition but still altered. A large palustrine wetland north and south of Coast Guard Boulevard on the Station would be fragmented by Alternative B, disconnecting the northern portion from estuarine wetlands, and substantially reducing the overall function of the wetland, especially plant communities. Under Alternative B, a large palustrine wetland would be fragmented on the Station south of Coast Guard Boulevard, resulting in a small western fragment with substantially reduced plant community function. These direct effects would reduce and fragment wetland habitat that indirectly impacts wetland-dependent species.

Alternative B could increase impacts to water quality from highway runoff and increased impervious surfaces. Replacing outdated stormwater and drainage systems and constructing new facilities designed to achieve minimal increases in stormwater runoff should reduce adverse indirect effects to water quality under Alternative B.

Historic Resources

Similar to Alternative A, improved access to historic properties open to the public could occur as a result of the Alternative B improvements with similar benefits and impacts as discussed under Alternative A. In addition to those historic properties mentioned for Alternative A, the Norfolk Naval Base Historic District, the Battle of Craney Island, the Battle of Sewell's Point, the Captain John Smith Chesapeake National Historic Trail and the Washington Rochambeau Revolutionary Route National Historic Trail are found along the I-564 and the I-564 and VA 164 Connectors portions of Alternative B.

Temporary indirect effects from the construction of Alternative B would be similar to those discussed for Alternative A, namely, access to historic properties could be temporarily impacted. These impacts would be short term and therefore minor.

3.15.2.6 Alternative B- Induced Growth

Figure 3-30 presents the Induced Growth ICE Study Area for Alternative B and **Table 3-63** contains the interchange map key. Alternative B would have the same type of induced growth effects along existing I-64 and VA 164 described for Alternative A.

Induced growth of Alternative B would be constrained along I-564 by the extent of military lands and crash and noise zones associated with Chambers Field. Induced growth would be further constrained through CIDMMA, the US Naval Supply Center, Coast Guard Station, and the VIG that are under government control. **Figure 3-28** shows the extent of developed land within the Induced Growth ICE Study Area of Alternative B. Lands classified as developed or undeveloped in the NLCD could include military or other inaccessible government-controlled lands. Approximately 87 percent of lands are developed within the Induced Growth ICE Study Area of Alternative B. With the lack of undeveloped land, induced growth in built-out areas would more likely be in the form of infill or redevelopment.

Alternative B improvements to VA 164 would most likely lead to growth in the Induced Growth Study Area based on the factors discussed for Alternative A. For the reasons discussed for Alternative A, areas designated by Hampton, Norfolk, and Portsmouth as suitable for such growth within the Induced Growth ICE Study Area would likely experience the most growth. **Figure 3-28** shows the designated growth areas, redevelopment areas, and Urban Enterprise Zones in these cities, and **Figure 3-29** depicts the designated commercial, industrial and mixed use areas.

Table 3-63: Alternative B Induced Growth ICE Study Area Interchange Map Key

Key #	Interchange Description	Key #	Interchange Description	Key #	Interchange Description
1	Exit 267 - US Rt 60/VA143 Settlers Landing Rd & Woodland Rd	**8**	I-64 EB Entrance Ramp from Norfolk Naval Station Gate 22	**15**	Cedar Ln
2	Exit 268 - VA 169 South Mallory St	**9**	I-64/I-564	**16**	Towne Point Rd
3	Exit 272 - West Ocean View Ave/Willoughby Spit	**10**	VA 165/VA 170 Little Creek Rd	**17**	VA 135/College Dr
4	Exit 273 - Rt 60 4th View St	**11**	VA 406/Terminal Blvd to Hampton Blvd	**18**	Exit 9A - US Route 17 North/Bridge Rd/ James River Bridge
5	Exit 274 - West Bay Ave to I-64 East/ I-64 to WB West Ocean View Ave	**12**	I-564 Connector	**19**	I-664/VA164 Interchange
6	I-64 WB Entrance Ramp from Granby St/Norfolk Naval Station Gate 22/ Forest Lawn Cemetery	**13**	VA-164 Connector	**20**	Exit 9B - VA 164 East /US Rt 17 South/Portsmouth

Key #	Interchange Description	Key #	Interchange Description	Key #	Interchange Description
7	Exit 276 - I-564 & Granby St/VA 460	**14**	Virginia International Gateway Blvd		

The Induced Growth ICE Study Area of Alternative B also extends outside of designated growth areas. The *HRCS Indirect and Cumulative Effects Technical Report* summarizes characteristics by land use category of the Induced Growth ICE Study Area for Alternative B that extends beyond designated growth areas. Land use is based on HRTPO 2011 regional data. Approximately 38 percent (6,896 acres) of the total Induced Growth Ice Study Area acres extend beyond designated growth areas in Hampton and Norfolk, including areas over water. Of these, the majority are residential (47 percent) and military lands (24 percent). As seen in **Figure 3-26**, much of the open space (14 percent) in the Induced Growth ICE Study Area of Alternative B is on military and other government-controlled lands such as CIDMMA. Induced growth associated with Alternative B is not expected on military or government lands, nor areas over water. Similar to Alternative A, transportation improvements of Alternative B may increase pressure on city councils and boards of supervisors to make changes to their land use plans to allow development in areas not currently authorized for it or to allow greater development densities. Similar to Alternative A, most of the Induced Growth ICE Study Area outside of designated growth areas are within residential areas. Induced growth in these residential areas would most likely be infill or redevelopment that increases residential density. However, the extent of induced residential, commercial, industrial and mixed use growth that could occur under Alternative B is also uncertain, as many factors other than transportation accessibility affect the decision to develop. Land use policies and guidelines are set by local governments, and Code of Virginia § 15.2-2223 requires updating comprehensive plans for the physical development of land within their jurisdiction every five years. Comprehensive plans are developed in consultation with stakeholders and citizens. These processes reduce the potential for unplanned growth.

Alternative B would not provide a new crossing over the entire Hampton Roads as would occur under Alternatives C and D. Therefore, it would have fewer beneficial indirect socioeconomic effects from induced growth than Alternatives C and D. The planned Craney Island Marine Terminal on eastern CIDMMA would connect to the VA 164 Connector that is proposed under Alternative B. Plans for the development of the new port terminal have been ongoing for some time. The facility is not dependent upon implementing Alternative B; rather, it is contingent on funding that is projected to be available in the 2030/2040 timeframe. While plans for this expansion have set aside right–of-way for the alignment of the VA 164 Connector, that expansion is not considered induced growth of Alternative B.

Based on the NWI and NHD, 370 wetland acres, 98,932 linear feet of streams, and 3,656 floodplain acres are throughout the Induced Growth ICE Study Area of Alternative B. Although induced growth associated with Alternative B could potentially adversely affect more aquatic resources than Alternative A, this potential should be minimized over much of the corridor by the government-controlled land use along I-564 and the proposed VA 164 Connector, as well as water regulations that apply to private land. Induced growth along VA 164 would primarily be in developed neighborhoods, which reduces the potential adverse effects to wildlife and wildlife habitat.

Figure 3-30: Interchanges and Alternative B Induced Growth ICE Study Area

The types of potential effects to historic properties from induced growth associated with Alternative B would be similar to those described for Alternative A. In addition, no city-designated historic districts are within the Portsmouth portion of the Induced Growth ICE Study Area of Alternative B; therefore, no City regulation of development impacts to historic properties from induced growth under Alternative B would apply there. However, regulation of potential impacts to historic properties that apply to federal and state undertakings would still apply.

Both the potential beneficial and adverse effects of induced growth would be greater under Alternative B than Alternative A because the construction of Alternative B would occur over a larger area. Similarly, because the potential induced growth area of Alternative B is smaller than either Alternative C or D, the relative potential indirect effects to land use, socioeconomic resources, natural resources, and historic properties from induced growth would be fewer under Alternative B than those alternatives.

3.15.2.7 Alternative C- Encroachment Effects

Socioeconomic Resources

The indirect effects to socioeconomic resources under Alternative C would be similar to those described for Alternatives A and B. The types of impacts along I-664 would be similar to those described along I-64 for Alternative A. Up to 11 residential and 5 commercial relocations would occur in areas adjacent to the Alternative C corridor. In some locations, the I-664 corridor on land is not as developed and mature as the I-64 corridor. Therefore, impacts to community cohesion may be less of a concern and the factors that influence individuals leaving or coming into the area may also be different. The socioeconomic impacts along the I-664, I-564, and VA 164 Connectors would be similar to those described for the connectors under Alternative B.

The increased capacity with the associated reduction in congestion and increase in the reliability of the regional transportation system achieved under Alternative C would have similar types of indirect effects and benefits to socioeconomic resources as described for Alternatives A and B. But because construction would occur over a larger area relative to Alternatives A and B, these effects would be experienced over a larger area, impacting more socioeconomic resources. Increased transit capacity and the competitive travel time advantage achieved through the transit-only lanes included in Alternative C relative to the other Build Alternatives would benefit transit-dependent populations more than Alternatives A and B.

Alternative C effects on the larger regional transportation network would consist of decreases in congestion and improved travel reliability. This alternative would also include a new crossing over the entire Hampton Roads and a more direct connection between the HRBT and the MMMBT, further improving travel reliability and connectivity in the region. Traffic would increase on the MMMBT and decrease on the HRBT under this alternative. Congestion at Hampton Roads crossings at peak travel times would still occur. Regional traffic patterns would shift as described for Alternative A, because increased capacity of the widened Study Area Corridors would reduce excess travel demand on parallel local streets, resulting in traffic volume reductions on those roads. Tolling could also influence how traffic is diverted to other crossings. While the indirect effects of tolling on traffic cannot be reliably determined at this time because of a number of unknowns (e.g., which facilities would be tolled, the toll rate, etc.), the *HRCS Traffic and Transportation Technical Report* includes a basic toll diversion. Two toll scenarios were considered for Alternative C. Tolling scenarios are based on those developed by the HRTAC (HRTAC, 2015). Under the first scenario, a toll was placed on the new Elizabeth River crossings (i.e. the I-564, I-664, and VA 164 Connectors). A fixed toll of $1 was coded on the I-564, I-664 and VA 164 connectors.

However, because vehicles would always need to travel on at least two of these connectors to cross the Elizabeth River, the effective toll on the crossing is $2. See the *HRCS Traffic and Transportation Technical Report* for details on the assumptions used for the toll diversion analysis. The results indicate that traffic volumes on the MMMBT would decline slightly while traffic volumes on the HRBT would increase. This pattern occurs despite the relatively larger capacity increase on the MMMBT. This indicates that the HRBT is the preferred means of crossing Hampton Roads, in particular when the trip between the Peninsula and the Norfolk area via the HRBT remains toll-free compared to a trip travelling via the MMMBT that would involve the (tolled) I-664 and I-564 Connectors.

Traffic volumes on the VA 164 Connector would likely see the largest decline with the implementation of a toll, indicating that travelers using the VA 164 Connector would find alternate, lower cost routes to and from the Norfolk area from areas to the south. Under the second scenario, a managed lane scenario (i.e., HOT Lanes with the toll rates shown in **Table 3-61**) was considered where widening occurs; the fixed toll on the Elizabeth River crossing was retained as well. HOT lanes would cause volumes on the MMMBT to be substantially less under Alternative C. This is likely due to the longer distance that drivers would experience traveling between the Peninsula and Norfolk and the higher toll cost they would incur. It is also an indication that congestion on the MMMBT is projected to be lower under Alternative C because the toll scenario assumed that four general purpose lanes would remain, and the fifth lane would be converted from a transit-only lane to a HOT lane. When congestion in the general purposes lanes is relatively low, there is little incentive for drivers to pay for a trip using the HOT lanes.

For the same reasons as discussed for Alternative A, Alternative C would not have disproportionately high and adverse indirect impacts to EJ populations under either of the above tolling scenarios.

Short-term indirect effects to socioeconomic resources from the construction of Alternative C would be similar to those described for Alternative A, but would be experienced over a larger area and in more communities than for Alternatives A and B. Conversely, as Alternative C is shorter than Alternative D, it would have fewer temporary indirect effects to socioeconomic resources.

Natural Resources

Alternative C would be constructed in the highly urbanized area of Norfolk along I-564 and highly urbanized and industrialized portions of Newport News. However, areas along I-664 in Suffolk and Chesapeake (the Southside) are less developed. Indirect effects to natural resources along I-664 in Hampton and Newport News would be similar to the types of impacts along I-64 under Alternative A. Impacts from widening the MMMBT and the I-564, I-664, and the VA 164 Connectors over the water and on the CIDMMA would be similar to the types of impacts described under Alternative B.

Much of the undeveloped land to either side of I-664 on the Southside is forested wetland, swamps, and marshes. South of the VA 164 interchange, a rail line enters the median of I-664 and continues south to the end of the Study Area Corridor. Alternative C would widen I-664 on the Southside from four to six lanes. This alternative would improve existing I-664 where habitat has been fragmented from previous road and rail infrastructure. It would impact the edge of the forested habitat bordering the interstate right-of-way and thus would have limited habitat fragmentation effects in this area. These impacts would be greater than experienced under Alternative A, as some of the areas surrounding I-664 on the Southside are less developed. However, as I-664 is an existing interstate facility with a rail line running through the median, the impacts would not be as great as those described under Alternative B for the VA 164 Connector south of CIDMMA.

Alternative C would have similar types of indirect effects to protected shorebirds along I-664 as described for I-64 / HRBT under Alternative A. It would also have similar effects to threatened and endangered species as Alternative B near the VA 164 Connector. Alternative C would have increased habitat fragmentation effects to Mabee's salamander habitat present on either side of I-664 on the Southside from reduction of forested buffers, and alteration of a pond that is habitat for this species. This would result in indirect effects to light and temperatures from forest loss. An impact to the Mabee's salamander would not occur if two consecutive years of survey document the species is not present. Although more summer roosting bat habitat is present in the Alternative C Study Area Corridor, potential indirect effects on bat roosting and foraging habitat would be similar to those described for Alternative B. Canebrake rattlesnake habitat to either side of I-664 on the Southside would not likely experience increased fragmentation as no habitat corridors currently connect these areas. Peregrine falcons have no documented use of the Alternative C Study Area Corridor for breeding, thus this alternative would have no indirect effects on this species.

Alternative C is estimated to require disposal of approximately 7.1 million cubic yards of dredge material. This amount would be more than all the other Build Alternatives, thus Alternative C would have the most indirect dredging effects to natural resources and raise greater regional dredge material disposal capacity issues. Several options are available to dispose of dredge material that require testing to evaluate its suitability for various alternative uses and disposal sites. Therefore, the exact effects of dredge material disposal on natural resources and the regional capacity for dredge material disposal is not known at this time. However, with the exception of the initial impacts to benthic communities at the disposal site, which is inevitable, the potential for other effects to possibly occur as a result from disposal operations will be site specific, depending on the characteristics of the dredged material, whether disposal is on land or in water, and the hydrodynamic conditions at the disposal site. These include impacts from increased or decreased light penetration and potential release of toxicants that may alter feeding, breeding, and nursery habitat as well as affect the life and health of nearby wildlife. These potential effects at the disposal site are minimized as part of the USACE permitting process for the disposal site approval.

Alternative C would also construct the I-664 Connector comprised of trestle bridges over the open waters of Hampton Roads north of CIDMMA, between the I-564 Connector and the MMMBT. The indirect effects to aquatic resources related to this over-water structure are being addressed in the hydrodynamic study in development by VIMS and are included in **Section 3.8.1.6**.

Indirect effects of Alternative C to wetlands would be the same as Alternatives A and B where they overlap. Wetland habitat would not be substantially altered along I-664 in Hampton and Newport News because the few wetlands present have been previously altered or fragmented. Thus, indirect effects to wildlife and wildlife habitat in these areas would be reduced. More unaltered wetlands are present in the Suffolk portion of the I-664 corridor, but because direct effects would occur to a narrow fringe along existing right-of-way, limited indirect impacts to wetland habitat would occur there to accommodate the proposed widening of the interstate. Indirect effects to estuarine wetlands would be similar as described for Alternatives A and B.

Historic Resources

Alternative C would improve access to historic properties better than Alternatives A or B. As discussed for Alternative A, greater access may benefit historic properties by increasing visitation that supports historic preservation. In addition to the historic properties noted under Alternative B in the I-564, I-564

and VA 164 Connectors areas, the St. Vincent de Paul Catholic Church, the Noland Company Building, Brown Manufacturing Coca-Cola Bottling Works-Daily Press Building, and Sunray Agricultural Historic District are located within the Historic Resources ICE Study Area along I-664 through Newport News and the Southside.

3.15.2.8 Alternative C- Induced Growth

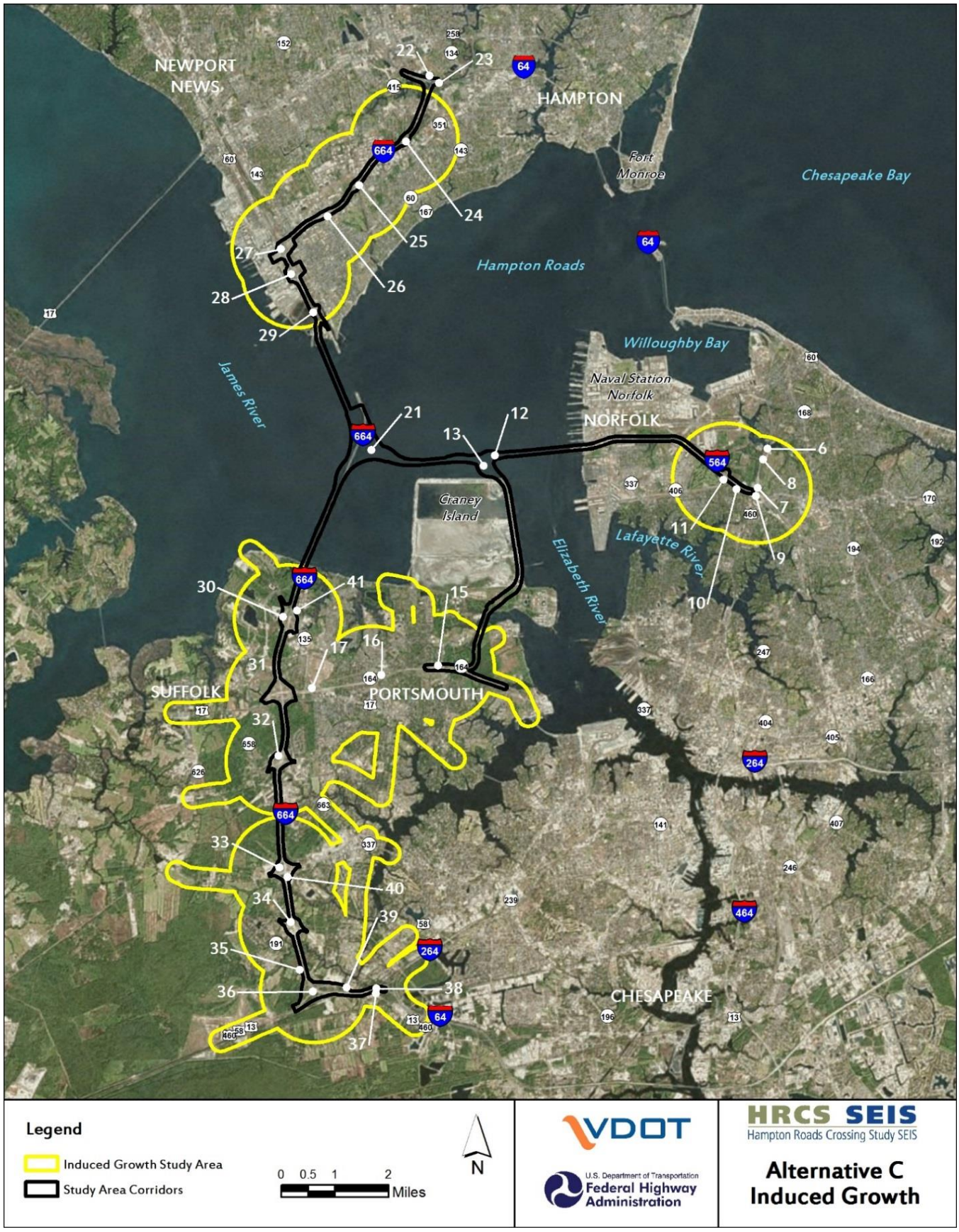
The interchanges and Induced Growth ICE Study Area boundaries of Alternative C are shown in **Figure 3-31** and the interchange map key is presented in **Table 3-64**. **Figure 3-27** shows the extent of developed lands (79 percent) in the Induced Growth ICE Study Area of Alternative C. Lands classified as developed or undeveloped in the NLCD could include military or other inaccessible government-controlled lands. Induced growth is not expected along I-564 or the I-664, I-564, or VA 164 Connectors because these areas are either primarily under government control or over water. **Figure 3-29** depicts the designated commercial, industrial and mixed use areas.

The Induced Growth ICE Study Area of Alternative C extends beyond planned growth areas as identified by the planning documents of the cities of Chesapeake, Hampton, Newport News, Norfolk, Portsmouth and Suffolk (see **Figure 3-28**). The *HRCS Indirect and Cumulative Effects Technical Report* provides a breakdown of Induced Growth ICE Study Area acreage outside designated growth areas by land use category. Approximately 27 percent (7,343 acres) of the total Induced Growth Ice Study Area acres extend beyond designated growth areas in the cities crossed by Alternative C, including areas over water. Of the land uses, the majority are residential (51 percent), open space (18 percent), and military lands (14 percent). As seen in **Figure 3-28**, the Induced Growth ICE Study Area of Alternative C in Suffolk and Chesapeake is mostly within designated growth areas, which also includes more open space than in either Hampton, Newport News, Norfolk or Portsmouth. However, much of this open space is within wetlands and the Great Dismal Swamp that are more difficult and costly to develop because of protective regulations. The Induced Growth ICE Study Area boundaries of Alternative C in Hampton, Newport News and Norfolk includes more acreage outside designated growth areas than elsewhere. Because these cities are largely built-out, induced growth associated with Alternative C is expected to occur more as redevelopment and infill in these communities. As discussed for Alternatives A and B, induced growth of Alternative C is anticipated to occur in areas designated for such growth, but pressure to change land use or increase density beyond what is currently planned may occur in the future, primarily in residential areas. It is difficult to predict the extent of the induced growth associated with Alternative C as transportation is but one of many factors that influence growth and development. As discussed for Alternative A, land use policies and guidelines are set by local governments and are required by the Code of Virginia § 15.2-2223 to be updated every five years. This process reduces the potential for unwanted growth or unplanned land use.

Table 3-64: Alternative C Induced Growth ICE Study Area Interchange Map Key

Key #	Interchange Description	Key #	Interchange Description	Key #	Interchange Description
6	I-64 WB Entrance Ramp from Granby St/Norfolk Naval Station Gate 22/ Forest Lawn Cemetery	**21**	I-664 Connector	**32**	Exit 10 - VA 659 Pughsville Rd
7	Exit 276 - I-564 & Granby St/VA 460	**22**	Exit 1A - Williamsburg/Richmond	**33**	Exit 11A - VA 337 West/ Portsmouth Blvd
8	I-64 EB Entrance Ramp from Norfolk Naval Station Gate 22	**23**	Exit 1B - Downtown Hampton/ Norfolk/Virginia Beach	**34**	Exit 12 - VA 663/ Dock Landing Rd
9	I-64/I-564	**24**	Exit 2 - Power Plant Pkwy/ Powhatan Pkwy	**35**	Exit 13A - US Rt 13 South/ US Rt 58 West/ US Rt 460 West/ Suffolk
10	VA 165/VA 170 Little Creek Rd	**25**	Exit 3 - Aberdeen Rd	**36**	Exit 13B - US Rt 58 East to US Rt 13 North/ US Rt 460 Alt/ US Rt 460 East/ Bowers Hill Military Hwy
11	VA 406/Terminal Blvd to Hampton Blvd	**26**	Exit 4 - Chestnut Ave	**37**	Exit 15B - I-64/ Chesapeake/Virginia Beach
12	I-564 Connector	**27**	Exit 5 - 35th St	**38**	Exit 15A - I-264 East/ Portsmouth/Norfolk
13	VA-164 Connector	**28**	Exit 7 - Terminal Ave	**39**	Exit 14 - US Rt 13 North/ US Rt 460 East/ Military Hwy
15	Cedar Ln	**29**	Exit 6 - 26th St/ 27th St	**40**	Exit 11B - VA 337 East/ Portsmouth Blvd
16	Towne Point Rd	**30**	Exit 8B - VA 135 South/ College Dr/Churchland	**41**	Exit 8A - VA 135 North /College Dr
17	VA 135/College Dr	**31**	Exit 9 - US Rt 17 North/ Bridge Rd		

Figure 3-31: Interchanges and Alternative C Induced Growth ICE Study Area



Induced growth could potentially take place over a larger area under Alternative C compared to Alternatives A and B. Therefore, the related effects of induced growth would have more widespread potential benefits to socioeconomic resources and adverse effects to natural and historic resources than Alternatives A and B. The types of indirect effects to these resources in the Peninsula portion of the I-664 corridor under Alternative C would be similar to those discussed for Alternative A along I-64. Greater benefits to socioeconomic resources along I-664 on the Southside are expected under Alternative C from more extensive induced growth than on the Peninsula because more undeveloped land could be developed. Therefore, impacts to natural resources are expected to be greater on the Southside than on the Peninsula. Most of this development would be in areas designated for growth.

Based on NWI and NHD data, an estimated 490 wetland acres, 167,048 linear feet of streams, and 3,545 floodplain acres are throughout the Induced Growth ICE Study Area of Alternative C. The federal and state regulations protecting water resources as discussed under Alternatives A and B, as well as the previously discussed government-controlled land use along I-564 and the proposed VA 164 Connector, would apply to development in the Alternative C Induced Growth ICE Study Area and substantially reduce the amount of land available for induced growth. Modern stormwater measures would replace older stormwater systems under this alternative, neutralizing potential indirect impacts and leading to downstream improvement in water quality by treating runoff. More induced growth under Alternative C could have greater adverse impact to wildlife, wildlife habitat, and protected species as described under Alternative A and B, but less than Alternative D. This potential should still be minimized as the type of induced growth is expected to be infill or redevelopment within previously disturbed areas designated in regional and local planning for such type of development. State and local governments have identified priority areas for preservation of wildlife habitat and implemented land use policies to preserve many of these areas.

Induced growth under Alternative C would occur over a larger area than Alternatives A and B. Therefore, potential adverse effects to historic properties from Alternative C would be more widespread. These effects should be similarly minimized by regulations as described under Alternatives A and B. In addition, Chesapeake has a historic preservation commission that maintains and updates a list of historic sites and reviews architectural projects in historic and cultural preservation overlay districts, including the Sunray Historic District south of the I-664 Bowers Hill interchange area. Newport News has a historic architectural review board that reviews proposed projects in the North End / Huntington Heights Historic District southwest of I-664 and northeast of the Newport News Shipbuilding shipyard. Suffolk has a Historic Landmarks Commission but no Historic Overlay District in the Induced Growth ICE Study Area of Alternative C.

3.15.2.9 Alternative D- Encroachment Effects

Socioeconomic Resources

Alternative D would combine elements of the other Build Alternatives and would have indirect effects similar to those facilities described above. This alternative would have a narrower footprint along I-664 than Alternative C, but with little difference in indirect effects to socioeconomic resources. This alternative would not offer the competitive travel time advantage for transit that the dedicated transit lanes in Alternative C provide. Therefore, Alternative D would have fewer benefits for transit-dependent populations.

Alternative D includes all the other Build Alternatives, and therefore would provide the greatest benefits when it comes to reducing congestion and increasing regional travel reliability and connectivity. Under Alternative D, which includes widening on both the HRBT and the MMMBT, the overall increase in traffic volumes would be balanced between the two bridge-tunnels. Congestion would still occur during peak hour travel times at the Hampton Roads crossings. Regional traffic patterns would shift as described for Alternative A, because increased capacity of the widened Study Area Corridors would reduce excess travel demand on parallel local streets, resulting in traffic volume reductions on those roads. Tolling could also influence how traffic is diverted to other crossings. While the indirect effects of tolling on traffic cannot be reliably determined at this time because of a number of unknowns (e.g., which facilities would be tolled, the toll rate, etc.), the *HRCS Traffic and Transportation Technical Report* includes a basic toll diversion analysis. Tolling scenarios are based on those developed by the HRTAC (HRTAC, 2015). Two toll scenarios were considered for Alternative D.. Under the first scenario, a toll was placed on the new Elizabeth River crossings (i.e. the I-564, I-664, and VA 164 Connectors). A fixed toll of $1 was coded on the I-564, I-664 and VA 164 connectors. However, because vehicles would always need to travel on at least two of these connectors to cross the Elizabeth River, the effective toll on the crossing is $2. See the *HRCS Traffic and Transportation Technical Report* for details on the assumptions used for the toll diversion analysis. The results indicate that traffic volumes on the MMMBT would decline slightly while traffic volumes on the HRBT would increase. This pattern occurs despite the relatively larger capacity increase on the MMMBT. This indicates that the HRBT is the preferred means of crossing Hampton Roads, in particular when the trip between the Peninsula and the Norfolk area via the HRBT remains toll-free compared to a trip travelling the MMMBT that would involve the (tolled) I-664 and I-564 Connectors. For the same reasons as discussed for Alternative A, Alternative D would not have disproportionately high and adverse indirect impacts to EJ populations under either of the above tolling scenarios.

Traffic volumes on the VA 164 Connector would likely see the largest decline with the implementation of a toll, indicating that travelers using the VA 164 Connector would find alternate, lower cost routes to and from the Norfolk area from areas to the south. Under the second scenario, a managed lane scenario (i.e., HOT Lanes with the toll rates shown in **Table 3-61**) was considered. HOT lanes would cause volumes on the MMMBT to be substantially less under Alternative D. This is likely due to the longer distance that drivers would experience traveling between the Peninsula and Norfolk, as well as the higher toll cost they would incur.

Temporary indirect effects to socioeconomic resources during construction would be similar to those described for Alternative A, but would occur over a larger area than the other Build Alternatives. These effects would end once construction is completed and therefore are considered minor.

Natural Resources

Alternative D would combine elements of the other Build Alternatives and would have indirect impacts similar to those facilities described above. This alternative would have a narrower footprint along I-664 than Alternative C. This reduction in footprint, however, would not substantially decrease the indirect effects to natural resources relative to Alternative C.

Alternative D would potentially generate approximately 6.1 million cubic yards of dredge material requiring disposal, fewer relative to Alternative C, but more than the other Build Alternatives. For the same reasons cited for the other alternatives, the exact indirect dredging effects to natural resources and regional disposal capacity are not known at this time. However, with the exception of the initial impacts to benthic communities at the disposal site, which is inevitable, the potential for other effects to possibly occur as a result from disposal operations would be site specific, depending on the characteristics of the dredged material, whether disposal is on land or in water, and the hydrodynamic

conditions at the disposal site. These include impacts from increased or decreased light penetration and potential release of toxicants that may alter feeding, breeding, and nursery habitat as well as affect the life and health of nearby wildlife. These potential effects at the disposal site are minimized as part of the USACE permitting process for the disposal site approval.

Historic Resources

As Alternative D would construct improvements over a larger area, it would have the most indirect benefits and adverse indirect effects to historic properties among the Build Alternatives. Compared to the other Build Alternatives, Alternative D would increase capacity and regional accessibility the most, and therefore would make historic properties in the Historic Resources ICE Study Area more accessible. This could increase historic tourism the most relative to the other alternatives, but also may have greater adverse effects to historic properties that do not limit access, as discussed under Alternative A.

3.15.2.10 Alternative D- Induced Growth

Alternative D would combine elements of the other Build Alternatives and would have induced growth effects similar to those described for those alternatives. However, Alternative D would not include an additional dedicated transit lane as proposed by Alternative C. **Figure 3-32** shows the existing and proposed interchanges and Induced Growth ICE Study Area of Alternative D with the interchange map key in **Table 3-65**. Alternative D would improve all the Study Area Corridors. Therefore, the potential for induced growth effects would be over a larger area than all of the other Build Alternatives.

Developed lands within the Induced Growth ICE Study Area for Alternative D are shown in **Figure 3-27**. Lands classified as developed or undeveloped in the NLCD could include military or other inaccessible government-controlled lands. Approximately 81 percent of the Induced Growth ICE Study Area of Alternative D on land is developed. **Figure 3-29** depicts the designated commercial, industrial and mixed use areas.

The Induced Growth ICE Study Area for this alternative extends beyond areas designated for growth by the cities transected by Alternative D (**Figure 3-28**). The *HRCS Indirect and Cumulative Effects Technical Report* presents the land use category of the Induced Growth ICE Study Area extending out of designated growth areas under Alternative D. Approximately 27 percent (9,453 acres) of the total Induced Growth Ice Study Area acres extend beyond designated growth areas in the cities crossed by Alternative D, including areas over water. Of these, the majority are residential (48 percent), military (18 percent), and open space (17 percent). It is not expected that induced growth would occur on military lands or areas over water. As discussed for the other Build Alternatives, induced growth in the largely built-out cities of Hampton, Newport News, Norfolk and Portsmouth would occur as infill or redevelopment most likely within areas designated for such growth. However, some induced growth associated with Alternative D could occur outside of designated growth areas, especially in Hampton, Newport News, Norfolk and Portsmouth. This could occur primarily on residential lands. In these areas, induced growth associated with Alternative D could increase pressure to increase density or change land use classification. Induced growth in Suffolk and Chesapeake associated with Alternative D would occur almost entirely within designated growth areas (**Figure 3-28**). This may change existing land use, but in accordance with comprehensive plans. Besides transportation accessibility, other factors affect the decision to develop; hence, the extent of induced growth associated with Alternative D is uncertain. As discussed for Alternative A, land use policies and guidelines are set by local governments and are required by the Code of Virginia § 15.2-2223 to be updated every five years. This process reduces the potential for unwanted growth or unplanned land use.

Figure 3-32: Interchanges and Alternative D Induced Growth ICE Study Area

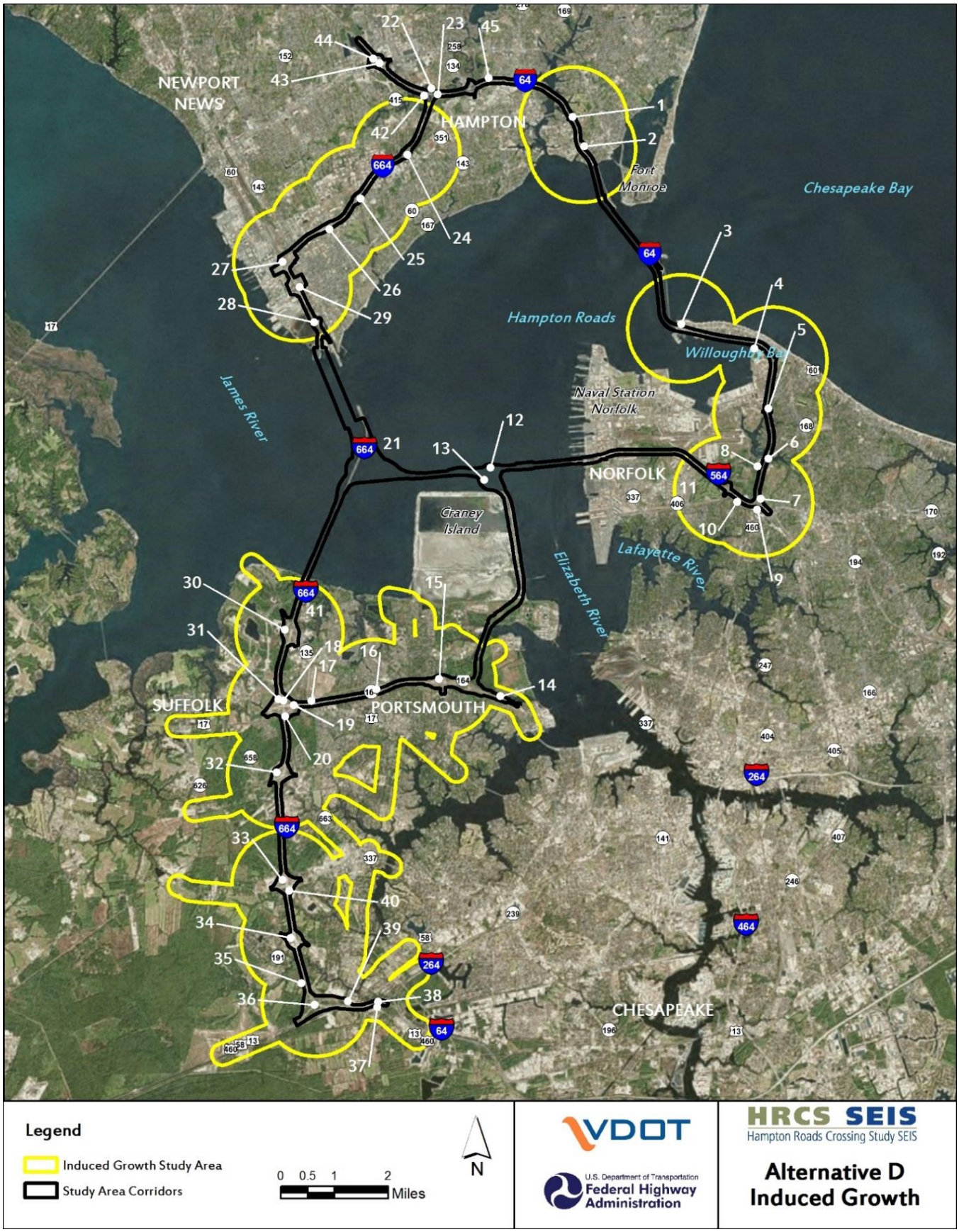


Table 3-65: Alternative D Induced Growth ICE Study Area Interchange Map Key

Key #	Interchange Description	Key #	Interchange Description	Key #	Interchange Description
1	Exit 267 - US Rt 60/VA143 Settlers Landing Rd & Woodland Rd	**16**	Towne Point Rd	**31**	Exit 9 - US Rt 17 North/ Bridge Rd
2	Exit 268 - VA 169 South Mallory St	**17**	VA 135/College Dr	**32**	Exit 10 - VA 659 Pughsville Rd
3	Exit 272 - West Ocean View Ave/Willoughby Spit	**18**	Exit 9A - US Route 17 North/Bridge Rd/ James River Bridge	**33**	Exit 11A - VA 337 West/ Portsmouth Blvd
4	Exit 273 - Rt 60 4th View St	**19**	I-664/VA164 Interchange	**34**	Exit 12 - VA 663/ Dock Landing Rd
5	Exit 274 - West Bay Ave to I-64 East/ I-64 to WB West Ocean View Ave	**20**	Exit 9B - VA 164 East /US Rt 17 South/Portsmouth	**35**	Exit 13A - US Rt 13 South/ US Rt 58 West/ US Rt 460 West/ Suffolk
6	I-64 WB Entrance Ramp from Granby St/Norfolk Naval Station Gate 22/ Forest Lawn Cemetery	**21**	I-664 Connector	**36**	Exit 13B - US Rt 58 East to US Rt 13 North/ US Rt 460 Alt/ US Rt 460 East/ Bowers Hill Military Hwy
7	Exit 276 - I-564 & Granby St/VA 460	**22**	Exit 1A - Williamsburg/Richmond	**37**	Exit 15B - I-64/ Chesapeake/Virginia Beach
8	I-64 EB Entrance Ramp from Norfolk Naval Station Gate 22	**23**	Exit 1B - Downtown Hampton/ Norfolk/Virginia Beach	**38**	Exit 15A - I-264 East/ Portsmouth/Norfolk
9	I-64/I-564	**24**	Exit 2 - Power Plant Pkwy/ Powhatan Pkwy	**39**	Exit 14 - US Rt 13 North/ US Rt 460 East/ Military Hwy
10	VA 165/VA 170 Little Creek Rd	**25**	Exit 3 - Aberdeen Rd	**40**	Exit 11B - VA 337 East/ Portsmouth Blvd
11	VA 406/Terminal Blvd to Hampton Blvd	**26**	Exit 4 - Chestnut Ave	**41**	Exit 8A - VA 135 North /College Dr
12	I-564 Connector	**27**	Exit 5 - 35th St	**42**	Exit 264 - I-664
13	VA-164 Connector	**28**	Exit 7 - Terminal Ave	**43**	Exit 263B - VA 258 North/VA 134 South/ Mercury Blvd/Hampton Coliseum

Key #	Interchange Description	Key #	Interchange Description	Key #	Interchange Description
14	Virginia International Gateway Blvd	**29**	Exit 6 - 26th St/ 27th St	**44**	Exit 263 - Mercury Blvd/ VA 258 South James River Bridge/ VA 258 North/ VA 134 South Coliseum
15	Cedar Ln	**30**	Exit 8B - VA 135 South/ College Dr/Churchland	**45**	Exit 265 - VA 167/VA 134 - LaSalle Ave/ North Armistead Ave & Rip Rap Rd

NWI and NHD data indicate 511 acres of wetlands, 211,837 linear feet of streams and 6,058 floodplain acres are throughout the Induced Growth ICE Study Area. Alternative D would have the greatest potential to adversely affect these resources. Modernized stormwater management systems and implementation of BMPs such as limiting increases impermeable surfaces to previously developed areas could reduce the impacts to water resources from induced growth. Aside from induced development associated with Alternative D occurring as infill and redevelopment in primarily previously disturbed areas, federal, state, and local regulations should minimize the potential adverse effects to these aquatic resources as described for the other alternatives.

Alternative D would also have the greatest potential to adversely affect wildlife, wildlife habitat, and protected species compared to the other Build Alternatives because it has the potential to induce growth over the largest area. As described under the other Build Alternatives, this potential would be minimized because expected growth would occur mostly in previously developed areas and some development would be subject to federal, state, or local regulations that require minimizing or mitigating impacts.

The potential effects of Alternative D's induced growth to historic properties would include all those discussed for the other Build Alternatives as Alternative D includes elements of all the other Build Alternatives.

3.15.2.11 Preferred Alternative – Encroachment Effects

Socioeconomic Resources

The Preferred Alternative would have indirect impacts to socioeconomic resources, including EJ populations, similar to those described for Alternative A because the direct effects are similar.

Natural Resources

Overall, the Preferred Alternative would have indirect impacts to most natural resources similar to Alternative A because the direct effects are similar. Dredge quantities would be similar to Alternative A with similar indirect effects. However, as the direct effects to floodplain, EFH, Areas of Particular Concern, and Anadromous Fish Use Areas acreage under the Preferred Alternative would be greater than under Alternative A, indirect effects to these resources would be greater compared to Alternative A.

Historic Resources

The indirect effects of the Preferred Alternative to historic properties is similar to that of Alternative A, although direct effects are reduced as described in **Section 3.9** Historic Resources.

3.15.2.12 Preferred Alternative - Induced Growth

As the Induced Growth Study Area for the Preferred Alternative is identical to that of Alternative A and the direct effects of the Preferred Alternative are similar, the Preferred Alternative would have the same indirect effects to land use and growth as Alternative A.

3.15.3 Induced Growth Impact Summary

In summary, the potential impacts of the Build Alternatives to induced growth would be limited. The Induced Growth Study Area of the Build Alternatives are already heavily developed (**Table 3-66**). Any induced growth of the Preferred Alternative would be in the form of infill and redevelopment as authorized by local planning.

Table 3-66: Percent Development Within Induced Growth Study Area of the Build Alternatives

Study Area	Alternative A	Alternative B	Alternative C	Alternative D	Preferred Alternative
Percent Developed Area within Induced Growth Study Area	93	87	79	81	93

3.15.4 Cumulative Effects

3.15.4.1 Cumulative Effects Analysis

This section presents the cumulative effects analysis based on the Build Alternatives. Cumulative impacts consist of the direct and indirect impacts of the alternatives under consideration in the HRCS SEIS in combination with the impacts of past, present, and reasonably foreseeable actions. The geographic boundaries of the Cumulative Effects Study Area are shown in **Figure 3-33**. The temporal boundaries for the cumulative effects study spans from 1955, when construction of I-64 within the Study Area Corridors began, to 2040, which is the modeled design year used for the Build Alternatives. Past, present, and reasonably foreseeable actions have already impacted or have the potential to impact the same socioeconomic, natural, or historic resources as the proposed project. These potential impacts are taken into consideration in the following discussions of the alternatives' cumulative effects.

3.15.4.2 Past, Present and Reasonably Foreseeable Actions

Past Actions

Development since 1955 has transformed a rural landscape into an urban/suburban environment that is largely built-out in the Cumulative Effects Study Area. Historic topographic maps and aerials most readily illustrate the pace and extent of growth in the Hampton Roads region since the mid-Twentieth century. The maps and aerials also show the progression and extent of development impacts to the natural environment and historic properties. Topographic maps or aerials prior to 1955 are not widely available. However, the US Geological Survey (USGS) historical topographic maps are available for the years 1955, 1964, 1965, 1973, and 1986 and aerials for the years of 1963, 1982, 1983, 1990, 1991, 1994, 2002 and

2010 are included in **Appendix F**. Aerial imagery from Google Earth was also reviewed to assess recent change in land use and development. Prior to 1955, growth and development in the Hampton Roads region was historically driven by European colonialism, river transportation and shipping, development of the railroad system, and military investments. The development of highways, bridges, and tunnels in the late 1950s through 1990s enabled the linking of residential areas to commercial, industrial, and military activity centers of the six study cities, with the suburban growth occurring near the newer highway interchanges. As described below, the once rural landscape has been transformed to residential neighborhoods, shopping centers, port facilities, military and industrial facilities, and business parks by years of rapid development following the construction of I-64, I-564, I-664, and VA 164.

According to USACE data for the lower James River from March 28, 2006 to March 28, 2016, the USACE Norfolk District has permitted the following:

- Permits issued: 1,723
- Authorized fill acres: 149
- Acres of permanent loss: 44
- Authorized dredge removal acres: 1,030
- Required mitigation acres: 137

VDOT records also provide some insight into impacts to wetlands and streams. Between 2007 and 2016, VDOT has received permits for the following impacts[15]:

Streams
- 3,157 cubic yards of dredge material
- 4,231 cubic yards of permanent fill
- 6,635 linear feet of permanent fill

Wetlands
- 8 acres of dredge material
- 30 acres of fill

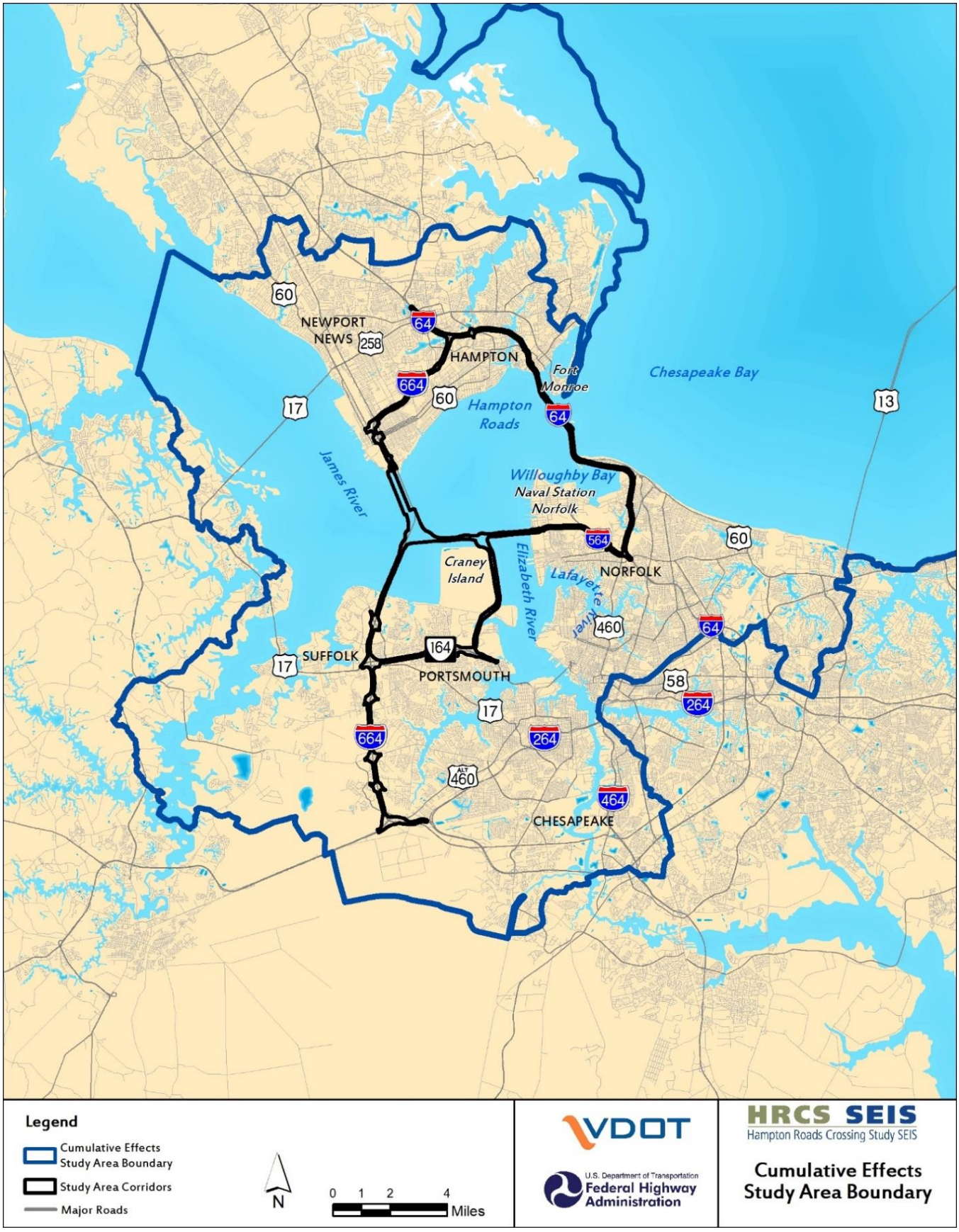
The following identifies specific past actions that have contributed to existing conditions within the Cumulative Effects Study Area. The following past transportation, major development, military and port activities are focused upon as the most relevant to understanding the potential cumulative impacts of the HRCS alternatives. Permit data is not available for many of these projects; however, some of these developments are clearly visible in the historic mapping and aerials included in **Appendix F**.

Past major roadway projects include:

- I-64, with the initial section in the Hampton Roads region opened in 1957. The section in Newport News and Hampton was widened from four to six lanes in two projects between 1979 and 1988 (Roads to the Future, 2016). I-64 is the only interstate into and out of the Hampton Roads region.

[15] Data as of March 23, 2016

Figure 3-33: Cumulative Effects Study Boundary



- I-264 was originally located between two interchanges with I-64 between Bowers Hill in Chesapeake and the junction in Norfolk, and was designated in the late 1950s. The stretch of I-264 to the east, now known as the Virginia Beach Expressway, was originally built in 1967 as a toll road with four lanes and was widened to six lanes in the 1980s and to eight lanes in the early 1990s. I-264 connects Portsmouth and Norfolk through the Downtown Tunnel and Berkley Bridge that were constructed in 1952.
- I-464 connects I-64 in Chesapeake to I-264 in downtown Norfolk at the Berkley Bridge and Downtown Tunnel, just outside the Natural Resources ICE Study Area boundary. Military Highway opened in 1967 between I-64 and US 13 and extended north in 1987, I-464 connects directly to the Virginia 168 Chesapeake Expressway, which comprises a limited access facility southward to the North Carolina State Line for travelers headed to the Outer Banks.
- I-564 connects NAVSTA Norfolk to the east to I-64 for a total of approximately 3 miles. I-564 was completed in the early 1970s and is also known as Admiral Taussig Boulevard.
- I-664 starts at the junction of I-64 and I-264 at Bowers Hill in Chesapeake and continues north for approximately 21 miles to I-64 in Hampton. I-664 crosses Hampton Roads on the MMMBT, which was completed in 1992. The roadway between I-64 and Aberdeen Road in Hampton was first completed in 1971, while the section south of Aberdeen Road was completed in 1989 prior to construction of the MMMBT. The roadway south of the MMMBT was partially completed in 1990 and connected with Bowers Hill in 1993.
- VA 164 known as the Western Freeway is approximately 7 miles long and connects I-664 and Route 17 in Suffolk with US 58 in Portsmouth. This roadway includes a crossing of the Western Branch of the Elizabeth River on the West Norfolk Bridge. The West Norfolk Bridge was part of the first section of the Western Freeway to be completed in 1979 in order to replace an outdated bridge originally built in the 1920s. The last part of the roadway, west of the bridge, was completed in 1992.
- US 17 James River Bridge was originally completed as a two lane bridge in 1928, later replaced with a new four-lane bridge in 1982. The bridge connects Newport News across the James River with Isle of Wight County.

Five large bridge tunnels have been constructed within the Cumulative Effects Study Area since 1950 that have served to connect the Hampton Roads region. Given the age of most of these improvements, permitted impacts are not available. These projects include:

- The 3.5-mile long HRBT opened with the first set of lanes in 1957; the second set of lanes was opened in 1976.
- The Chesapeake Bay Bridge Tunnel (CBBT) constructed in 1964 connecting Northampton County on the Eastern Shore to Virginia Beach
- The 4.6-mile long MMMBT opened in 1992 connecting Chesapeake with Newport News.
- The Midtown Tunnel opened in 1962, connecting Portsmouth with Norfolk via Route 58. Constructing a second set of lanes and parallel tunnel is nearing completion.

- The Downtown Tunnel opened in 1952, connecting Portsmouth with Norfolk via I-264, and expanded to four lanes in 1989. Traffic can continue north over the Eastern Branch of the Elizabeth River using the Berkley Bridge into Norfolk, or can turn south and travel on I-464 towards Chesapeake. The existing Berkeley Bridge was completed in 1952 along with the Downtown Tunnel and subsequently widened in 1989.

Recently completed transportation projects within the Cumulative Effects Study Area are listed in **Table 3-67.**

Table 3-67: Recently Completed Transportation Projects

Project
Gilmerton Bridge replacement and additional channel clearance to limit bridge openings, larger bridge deck to accommodate future widening of Military Highway, Chesapeake
South Norfolk Jordan Bridge replacement with a higher, fixed span bridge, Chesapeake
Wesleyan Drive, widen to 4 lanes from Northampton Boulevard to Baker Road, Norfolk to Virginia Beach
Hampton Boulevard Railroad Grade Separation - Hampton Blvd in Norfolk was lowered below the existing railroad tracks, thus eliminating interruptions to vehicular traffic

Several military facilities are located within the Cumulative Effects Study Area that were constructed or expanded since 1955. They include:

- NAVSTA Norfolk – 4 miles of waterfront space and 7 miles of pier and wharf space of the Hampton Roads peninsula known as Sewell's Point. Established in 1917, by the end of World War II, the base became much more industrial in nature, including becoming a major supplier of aircraft parts and a rework plant. The Naval Aviation Depot Norfolk plant was closed in 1996 as part of the Congressional Base Realignment and Closure Act.
- Naval Support Activity (NSA) Hampton Roads – Located east of NAVSTA Norfolk and north of Terminal Boulevard, NSA Hampton Roads hosts fleet headquarters administrative and communication facilities with 6,000 personnel and several major tenant commands. It is located where the Atlantic Fleet Headquarters Support Activity was established in 1977, and reorganized in 2000 to Naval Support Activity Norfolk, which subsequently changed its name to NSA Hampton Roads in 2011.
- Mid-Atlantic Military Family Housing – Located south of Little Creek in Norfolk near the Joint Expeditionary Little Creek-Fort Story Base is a small area of military housing across from Tarralton Elementary School.
- Craney Island US Naval Supply Center – Depicted as a US Naval Reservation on the 1955 historical topographic map near the mouth of the Elizabeth River opposite Lambert's Point. By 1964, construction of the US Army Disposal Center had begun to the north of what was now depicted as the US Naval Supply Center. The northern portion of CIDMMA was completed using dredged materials sometime before 1973. The Craney Island Fuel Terminal located at the southeastern corner of the island, possesses 1,100 acres of above- and below- ground fuel storage tanks providing fuel, lubricants and fuel related service to approximately 256 fleet ships. Facilities include 60 storage tanks and over 100 miles of pipeline.
- US Coast Guard Base Portsmouth – Land was purchased in 1974 south of the Craney Island Naval Supply Center along the coast of the Elizabeth River and construction underway in 1983.
- Joint Staff Suffolk Complex – Newly assembled after dissolution of the Joint Forces Command in 2011, the Joint Staff Suffolk Complex replaced the Joint Warfighting Center in North Suffolk near the I-664 and College Drive interchange. It contains elements of Navy Cyber Forces, Navy Cyber Defense Operations Command, and Naval Network Warfare Command.

Listed below are state-run and private ports in the Cumulative Effects Study Area, major shipyards, a dredged material management area, and the Hampton Roads:

- Hampton Roads – The Norfolk Harbor and Channels, Virginia project is a long-term effort in partnership with USACE and the Virginia Port Authority initiated in 1986. It is a network of federally managed navigation channels that has been constructed in separable elements including the Outbound Element completed in 1989; the 50-foot Anchorage in 1999, and 50-Foot Inbound Element in 2007 (USACE, 2015). All federal navigation channels are continually maintained by dredging. The USACE is currently conducting a study to determine if a number of these channels should be dredged to meet or exceed their Congressionally-authorized depths.
- Portsmouth Marine Terminal (PMT) – 287 acres of land located on the west bank of the Elizabeth River, the terminal was largely built upon reclaimed land from dredged material from construction of the Midtown Tunnel which was completed in 1962.
- Norfolk International Terminals (NIT) – Located south of NAVSTA Norfolk in the Hampton Roads on 567 acres along the Elizabeth and Lafayette Rivers, NIT is the POV's largest terminal. The land was originally a military site that Norfolk purchased in 1965. The terminal originally had one berth and one crane but was upgraded starting in the early 1970s with a second container berth and two more cranes. The terminal continued to expand until 2008 when the three newest and largest cranes were installed. Thousands of trucks are processed through the existing 17 interchange lanes. The port has plans for expansion up to 26 interchange lanes.
- Virginia International Gateway (VIG) – Opened in 2007, VIG is the largest privately-owned container terminal in the US at 576 acres. It is leased by the POV. The port has plans to add approximately 60 additional acres of space to the terminal.
- Newport News Marine Terminal (NNMT) – The NNMT has 165 acres of land on the north bank of the James River, just off I-664 in downtown Newport News, with easy access to I-64. The port was established in the late 1880's. Expansion of the terminal facilities included a second pier in the late 1960s, a third pier in 1972, and additional expansions in the 1990s and 2011.
- Major Private Ports – Kinder Morgan, Dominion Terminal Associates, and CSX (Chesapeake and Ohio Railroad) all hold port facilities southeast of NNMT at the southernmost tip of the Peninsula, directly southwest of I-664. Kinder Morgan and Dominion are coal port facilities.
- Major Private Shipyards – Newport News Shipbuilding/Huntington Ingalls is the nation's sole industrial designer, builder, and re-fueler of nuclear-powered aircraft carriers located at the tip of the Peninsula just south of I-664. Established for 130 years but with changing ownership, the shipyard is a major employer in the Hampton Roads region.
- Craney Island Dredged Material Management Area (CIDMMA) – Completed in 1957, the USACE used dikes to create an area to accept dredging material from the Elizabeth River and Hampton Roads to maintain the shipping channels. When funding becomes available, planned expansion of the CIDMMA would extend eastward. The POV plans to construct a new Craney Island Marine Terminal on top of the expanded CIDMMA, increasing the ports capacity by 20 percent (Virginia Places, 2016).

A recent major improvement project in the ICE study areas was the US Navy dredging of the Elizabeth River Channel from Lambert's Point to Norfolk Naval Shipyard in 2011 that established a 600- foot wide channel, deepening it from 40 feet to between 47 to 50 feet deep. The potential environmental effects of this action were evaluated in an EIS concluding with the ROD issued in 2009 [74 FR 46583, September 9, 2009].

Many residential developments were built following the construction of I-64 through Hampton, I-664 through Hampton, Newport News, Suffolk, and Chesapeake, and VA 164 through Portsmouth and Suffolk (see **Appendix F** aerials). Other major developments in the Cumulative Effects Study Area since 1955 include:

- Hampton Coliseum: The first large multi-purpose arena in the Hampton Roads region and the state of Virginia, the Hampton Coliseum opened in 1970.
- Chesapeake Square: Anchored by the Chesapeake Square Mall that opened in 1989, the Chesapeake Square area is a mixed commercial and residential development in north Chesapeake.
- Harborview: Located in north Suffolk near the I-664/US Route 17 interchange, Harborview is a mixed development of retail, medical services, and residential development designed in concert with development of I-664 in the early 1990s.
- Hampton Roads Crossing: On the border of Suffolk and Portsmouth in the area northeast of the I-664/VA 164 interchange, Hampton Roads Crossing is a mixed use development of housing, commercial uses, and the MAST Center, a regional technology campus that opened in 2007.
- Peninsula Town Center: Officially opened in 2010 on the former Coliseum Mall location in Hampton, Peninsula Town Center features specialty retailers, restaurants, a movie theater and bowling alley.

One commercial airport and one military airfield are located in the Socioeconomic Resources ICE Study Area that were constructed before 1950, but continue to be updated and expanded:

- Hampton Roads Executive Airport – A public use, privately owned airport that is located near the intersection of I-64, I-664, I-264 and Route 58 in Chesapeake. A runway expansion project was completed in 2014.
- NAVSTA Norfolk Chambers Field – Located along the north side of I-564 on NAVSTA Norfolk, aircraft operating out of Chambers Field also utilize other Navy installations in the Hampton Roads region of southeastern Virginia, including Naval Auxiliary Landing Field (NALF) Fentress in Chesapeake, Virginia. Recently, Norfolk and NAVSTA Norfolk have been addressing incompatible development surrounding Chambers Field.

Present and Reasonably Foreseeable Future Actions

There are a number of development actions that are occurring and/or are planned to occur that could contribute to cumulative effects on resources affected by the alternatives. In addition to the Hampton Roads Crossing under consideration in this SEIS, there are numerous VDOT actions planned within the Cumulative Effects Study Area, as identified in VDOT's Six-Year Improvement Program (SYIP). In addition, the HRTPO CLRP, *2040 Long-Range Transportation Plan* (HRTPO, 2016) lists regional projects that add capacity to the transportation network. The 2040 Long-Range Transportation Plan (LRTP) is the currently approved plan. The 2040 LRTP lists committed projects (which are currently in VDOT's SYIP) and regionally funded construction projects (which evolved through a prioritization process). Projects on these lists are treated as reasonably foreseeable actions because future construction funds have been set aside for them in the planning process. Due to scarce financial resources, projects that do not have identified funding may not be constructed, and are therefore not reasonably foreseeable. **Table 3-68** lists all of the present and reasonably foreseeable future transportation projects that would add capacity

within the Cumulative Effects Study Area and notes the status of each project. These projects would all contribute to cumulative impacts related to socioeconomic, natural and historic resources.

The I-564 Intermodal Connector (IC) shares a similar footprint and LOD as portions of the improvements proposed under Alternatives B, C, and D. At this stage, it is not appropriate to make decisions on which areas are shared impacts, as the I-564 IC may have permit modifications and this study is based on limited engineering. It is worth noting, however, that some of the impacts assumed under Alternatives B, C, and D may occur under the I-564 IC.

When conducting a cumulative effects analysis, FHWA and VDOT consider "Reasonably Foreseeable Future Actions" to be those actions that are fiscally constrained in the region's LRTP. One potential project recently listed in the 2040 LRTP, is the Air Terminal Interchange (ATI) that would be located on the I-564 IC. The ATI would represent a new interchange on the proposed I-564 IC to service NAVSTA Norfolk, NSA Hampton Roads, and the public. The ATI project is contained in the list of fiscally-constrained planned projects in the 2040 LRTP, but the FY 2015 to 2018 TIP does not have allocations for construction. An IJR is currently underway. As this project has only preliminary engineering underway and an IJR has not been completed to confirm its location and layout, it is not considered in the cumulative effects analysis. However, given its proximity to Study Area Corridors, it is noted in this document.

Table 3-68: Present and Reasonably Foreseeable Future HRTPO Transportation Projects within the Cumulative Effects Study Area

Project	Status
Elizabeth River Tunnels Project – addition of a new two-lane tunnel adjacent to the existing Midtown Tunnel, maintenance and safety improvements to the existing Midtown and Downtown tunnels, extension of the Martin Luther King (MLK) Freeway from London Boulevard to I-264, and interchange modifications at Brambleton Avenue and Hampton Boulevard	Under Construction
I-564 IC – Extends I-564 to connect to Norfolk Naval Base and Norfolk International Terminals, Norfolk	Under Construction
Portsmouth Boulevard improvements widen to 4 lanes between Jolliff Road and Suffolk City line, Chesapeake	In Design
Conventional Passenger Rail Service from Norfolk to Richmond/Northeast Corridor, along existing Norfolk Southern and CSX tracks, Norfolk	In Design
I-64 Widening Segment 1 from Jefferson Avenue Exit 255 to Yorktown Road Exit 247	Under Construction
I-64 Interchange at Lasalle Avenue ramp widening to allow dual left turn lanes and right turn lane, Hampton	In Design
I-64 Express Lanes Segment 1 HOV to HOT conversion	In Design
I-64 interchange improvements at Northampton Blvd	In Design
Widen High Rise Bridge and I-64 Lanes From I-464 to Bowers Hill	In Design
I-64/I-664 Bowers Hill Interchange improvements	In Design
Military Highway Phase I Robin Hood Road to 0.3 mi N of Northampton Blvd	Under Construction
Military Highway Phase II 0.3 mi N of Northampton Blvd to 0.3 mi S of Northampton Blvd	Under Construction
Military Highway Phase III widening from 0.3 mi S of Northampton Blvd to Lowery Road, Norfolk	Under Construction

Project	Status
Turnpike Road widening from 0.13 miles east of Frederick Boulevard to Constitution Avenue, Portsmouth	Under Construction
Nansemond Parkway widening from Chesapeake City Line to Norfolk Southern Railroad, Suffolk	In Design
Newport News Multimodal High-Speed and Intercity Passenger Rail Station	Under Construction
Chesapeake Bay Bridge-Tunnel Parallel Thimble Shoal Tunnel – addition of a new 2-lane tunnel, Virginia Beach to Northampton	In Design

Source: HRTPO 2040 Long Range Transportation Plan; VDOT Six-Year Improvement Program.

Numerous studies are being conducted in Hampton Roads region to further develop transportation in the region. Hampton Roads Transit is studying the expansion of light rail to NAVSTA Norfolk and ODU in Norfolk, and rapid transit on the Peninsula (Peninsula Fixed Guideway Corridor Study). Amtrak and HRT are studying building a Newport News Multimodal Center to include a new Amtrak station and HRT bus facility.

Other local non-transportation projects being studied by other state and federal agencies and private developments have been identified by examining local and regional plans and capital improvement project lists and are described in **Table 3-69**. These projects would all contribute to cumulative impacts related to socioeconomics, natural and historic resources.

Table 3-69: Present and Reasonably Foreseeable Future Non-Transportation Projects within the Cumulative Effects Study Area

Project Name	Project Type	Project Description
Chesapeake		
Stormwater & Drainage	Stormwater & Drainage	Various Stormwater and drainage projects – Citywide.
Oceaneering International	Energy Facility	An oilfield engineered services and products provider primarily to offshore oil and gas industry will expand to a new 150,000 square foot facility in Greenbrier North Commerce Park
Kroger Marketplace	Retail Development	Located at South Military Highway and I-64, will include four retail stores
Lidl Grocer	Retail Development	36,000 sq foot development in Chesapeake Square
Hoffman Beverage	Commercial Development	195,000 sq foot warehouse expansion at 4105 South Military Highway
Sonny Merryman Inc.	Commercial Bus Facility	37,000 sq foot bus service facility in Cavalier Industrial Park
Hampton		
Multi-Use Trails	Recreation	Trail construction of Newmarket Creek Trail & Pine Chapel Road Trail
Waterway Projects	Stormwater, Drainage & TMDL	Improvements to and maintenance of the waterways in Hampton, including the City's compliance with the Chesapeake Bay TMDL requirement – Citywide
Coliseum Crossing	Commercial Development	8,225 sq foot expansion on Coliseum Drive

Project Name	Project Type	Project Description
Riverpointe Shopping Center	Commercial Development	Overhaul of old Riverdale Plaza to include a 123,000 sq foot Kroger Marketplace and 91,000 sq foot At Home
Newport News		
Downtown Initiatives	Community Development	Waterfront redevelopment and enhancements to Historic Downtown
Southeast Community Development	Community Development	General urban developments which include survey of existing buildings, acquisition, demolition, relocation, infrastructure to improve the overall quality of life for citizens and revitalize the community
32nd Street Drainage Improvements	Stormwater Drainage	Rehab or replacement of drainage system to ensure the efficiency to the entire drainage network –less resources will be needed to respond and repair to recurring sinkholes
River Road Shoreline Stabilization	Stormwater Drainage	Reduce erosion of the existing embankments, loss of shoreline and protection of the City's roadway and underground utilities
Watershed Protection Improvements	Stormwater, Drainage	Citywide project will design and construct regional wet detention ponds to improve water quality of runoff into the reservoirs
Upper Newmarket Creek Drainage Improvements	Stormwater, Drainage	Project to reduce the flooding during the 10-year and 50-year storm events along the upper section of the watershed
Huntington Ingalls Industries	Commercial Development	Adding a 22,000 sq foot health center at Newport News Shipbuilding
Printpack	Commercial Development	50,000 sq foot warehouse facility expansion to 10.7 acres in Oakland Industrial Park
Newport News Shipbuilding	Commercial Development	52,000 sq foot headquarters expansion at 4104 Washington Avenue
Brooks Crossing	Mixed use Development	Redevelopment area along Jefferson Avenue between 14th and 35th Street constructing Jim's Local Market and the completed South Police Precinct facility
Norfolk		
Citywide Stormwater Quality Initiative	Stormwater, Drainage	Citywide effort to continue best practice used to reduce storm water related pollutants entering local waterways, rivers and the Chesapeake Bay
Develop Bicycle, Pedestrian Greenways, Sharrows and Complete Street	Recreation	Develop citywide transportation connectivity initiatives. Construction of new bike and pedestrian trails and curb improvements
Stormwater Waterfront Facilities	Stormwater	Citywide effort to initiate non-routine inspections, repair, rehabilitation and replacement of deteriorated bulkheads
Improve Downtown Corridor Streetscaping	Community Development	Streetscaping and corridor improvements in the Central Business District. Curb installation, sidewalks and paths to encourage pedestrian friendly environment
Norfolk Premium Outlet Mall	Retail Development	350,000 sq foot retail outlet mall near Northampton Boulevard and I-64

Project Name	Project Type	Project Description
Ikea	Retail Development	331,000 sq foot store on 19 acres at the northwestern corner of I-64 and Northampton Boulevard. Will involve interchange modification on I-64
Waterside	Retail Development	Overhaul of Waterside District in downtown
Automatic Data Processing Inc.	Office Development	New headquarters near downtown Waterside expected to bring 1,800 jobs
Sentara Norfolk General Hospital	Institutional Development	Revamping and adding three floors to existing structures dating from 1950s to 2006
The Main	Commercial Development	A new mixed use entertainment, meeting, dining and hotel destination at the corner of Main and Granby
Movement Mortgage	Commercial/ Office Development	Moving to Military Circle and overhauling the former JC Penney site
The Railyard	Retail/Office Development	New retail and office center on 13 acres at Lambert's Point
Portsmouth		
Citywide Stormwater Drainage Improvements	Utilities	Upgrade existing facilities and install new infrastructure
Multi-purpose Recreation Field/Facility at Greenland Road (Former Stump Dump)	Community Development	Converting the former "stump dump" facility on Greenland Road into a multi-purpose regulation-sized outdoor recreation field with artificial turf and include parking and trail access for the Hampton Branch Trail System
Dredging of Lakes/Ponds	Stormwater	Enhance water quality by re-establishing original lake/pond depths by removing organic materials and sediment by dredging
Closing Craney Island Landfill	Utility	This facility will be at capacity by 2017 and is planned to be closed by 2018.
InterChange Group, Inc.	Industrial Development	New industrial site on 12.5 acres at 2175 Elmhurst Lane
ZPMC	Industrial Development	7,500 sq foot facility at 4018 Seaboard Court in the Greenwood/Elmhurst Industrial Corridor
PER Properties	Industrial Development	New concrete facility on 16 acres along the Elizabeth River
Vane Brothers Company	Office Development	Expansion of waterfront facility at 4565 Burtons Point Road
Bon Secours Maryview	Institutional Development	Located in Midtown, plans include 60,000 sq foot expansion
MAST Center Office Park	Institutional/Retail/Office/ Residential Development	Technology park on the Portsmouth/Suffolk boundary off College Drive

Project Name	Project Type	Project Description
Suffolk		
Water Source Development and Water Treatment Expansion – Suffolk	Utilities	Improvements to water supply infrastructure and G. Robert House treatment plant
Sanitary Sewer System Upgrades – Suffolk	Utilities	Improvements and upgrades to City's sanitary sewer system and including drainage facilities
Hampton Roads Crossing	Retail/Office/ Residential Development	148 acre mixed use development off College Drive
Tidewater Community College Real Estate Foundation	Mixed Use Development	Planning for best use of the historic Pig Point Depot now owned by Tidewater Community College
Harbour View	Mixed Use	Continuing mixed use development in retail and residential areas such as Riverfront and Harbour View Golf community
Others		
The Norfolk Harbor and Channels Deepening Project Environmental Assessment – (USACE and POV)	Facilities	A 3-year feasibility study and Environmental Assessment for the deepening of the federal navigation channels extending from the Atlantic Ocean through the Chesapeake Bay into the Port of Hampton Roads. The study is anticipated to include an evaluation of a range of Norfolk Harbor Channels' dimensions
The Elizabeth River Project	Environmental Restoration	Various steps to restore the Elizabeth River through a series of projects that include the Money Point Revitalization, Paradise Creek Restoration, and the Lafayette River Project
USACE CIDMMA Eastward Expansion (partnered with the POV)	Facilities	Dredge material placement; future Craney Island Marine Terminal
Expansion of the NIT and VIG Terminals	Facilities	The POV requested $350 million from Virginia to expand the NIT and VIG Terminals in Norfolk and at CIDMMA in order to handle growing volume.
Intergovernmental Planning Pilot Project (Old Dominion University)	Plan	Develop a regional “whole of government” and “whole of community” approach to sea level rise preparedness and resilience planning in Hampton Roads region
National Disaster Resilience, US Department of Housing and Urban Development	Environmental Restoration / Facilities	Hampton Roads area will be receiving more than $120.5 million as part of the National Disaster Resilience Competition to help prepare for the effects of climate change, sea level rise, flooding and storms. Includes combination of natural infrastructure and integration with traditional resilience and storm hazard reduction strategies.

3.15.4.3 Cumulative Impacts

Cumulative impacts consist of the direct and indirect impacts of the alternatives under consideration in the HRCS Final SEIS in combination with the impacts of past, present, and reasonably foreseeable actions. This analysis relies on CEQ guidance to assess the severity of an impact based on context and intensity. Context may be geographic at multiple scales such as society as a whole, an affected region, affected interests, and specific localities. Intensity, as defined by CEQ, is the severity of impact with regard to multiple factors, including:

- impacts both beneficial and adverse
- degree of public health and safety impacted
- unique characteristics of the geographic area
- degree of controversy surrounding that action and the effect
- potential to set precedent for future actions
- cumulative effects which may be significant, even though the action itself would not create significant impacts
- whether there is a violation of Federal, State, or local law or requirements meant to protect the environment

Impacts with respect to each of the intensity criteria can be described in various levels of severity (**Table 3-70**). The significance or importance of impacts is determined by evaluating the proposed action against existing environmental standards, thresholds, guidelines, or objectives established by Federal, State, and local agencies. These impact significance factors are applied to all resource areas.

Table 3-70: General Effects Determination Matrix

Severity	Extent	Duration	Likelihood
Major	Large	Long	Probable
Moderate	Medium	Medium	Possible
Minor	Small	Short	Unlikely

A large extent would be statewide, medium would be regional (Hampton Roads) and small would be local. For most resources, a long duration corresponds to over five years, a medium duration would be one to five years, and a short duration would be less than one year. These potential effects are taken into consideration in the following discussions of cumulative effects of the alternatives to different resources.

Socioeconomic Resources and Land Use

Past and present actions have been both beneficial and adverse to socioeconomic resources and land use, and it is expected reasonably foreseeable future actions could as well. Past and present growth and development has increased the standards of living for communities that benefited community cohesion, and provided community facilities and recreational resources. Such growth and development has benefited local economies by improving access to markets and customers. Some past and present developments have resulted in large-scale residential, community facility, and business relocations that adversely affected community cohesion, such as construction of the interstate system and other major freeways. Transportation facilities such as I-64, I-664, and VA 164 have divided and isolated communities,

reducing access to neighbors and services. As seen on historic aerials in **Appendix F**, I-64 was constructed through the previously established neighborhoods of Willoughby Spit, West Ocean View, and Northside through Norfolk. In Hampton, construction of I-64 separated Kings Square from Olde Hampton, and I-664 was built through the Hampton Terrace, Azalea Gardens, Powhatan Park and Park Place neighborhoods. In Newport News, I-664 construction impacted the Newsome Park, Huntington, Jefferson Park, Marshall, and Tucker Creek neighborhoods. In Portsmouth, construction of VA 164 separated Ebony Heights (a historically African American community) and Edgewood Park from Merrifields and Pepperwood in Churchland. I-664 is on the edge of Suffolk and Chesapeake, and therefore its construction did not substantially divide neighborhoods at that time, but as development has increased to either side of I-664, access has been limited to few interchanges and roads that cross under or over the interstate. Minority and low-income populations have historically been adversely affected by past interstate construction (Karas, 2015). Future actions that lead to growth and development are expected to be beneficial for some, but not for others. For example, growth could increase employment opportunities, but require relocations to accommodate. Current federal regulations require that adverse effects of federal actions consider and incorporate mitigation into decisions that adversely affect communities.

Past growth and development has also led to widespread land use change as the region transitioned from a largely dispersed agricultural society to intensified commercial, residential, industrial, and other land uses in the modern urbanized area of the Hampton Roads region. Since 1955, this has led to four of the six cities in the Socioeconomic Resources ICE Study Area to be largely built-out, with future growth expected to occur as infill or redevelopment. Chesapeake and Suffolk are at a slightly less intensive growth progression than the other cities, with future growth constrained by wetlands and conservation lands.

No-Build Alternative

The No-Build Alternative would not improve the HRCS Study Area Corridors and therefore would not result in any incremental effect to community cohesion, community facilities and recreation resources, land use local economies, or environmental justice populations in the Cumulative Effects Study Area.

Alternative A

Past and present growth and development has resulted in largely built-out cities of Hampton and Norfolk along the I-64 Study Area Corridor comprising Alternative A. Growth of these cities has resulted in a loss of natural ecosystems and previously maintained agricultural land uses. Alternative A would improve an existing interstate, limiting the effects of converting other land uses to transportation compared to improvements on new alignment. The Induced Growth ICE Study Area of Alternative A is 93 percent built-out. Induced growth associated with Alternative A is expected to be limited to infill and redevelopment, primarily within urban areas designated by Hampton and Norfolk as suitable for such development. However, induced growth associated with Alternative A could also occur in areas outside of designated growth areas in Norfolk and Hampton that are primarily residential. This would likely lead to increased density rather than changes to land use type. Because transportation is only one element that can contribute to growth, it is difficult to predict the extent of induced growth associated with Alternative A. Code of Virginia § 15.2-2223 requires local land use planning to be updated every five years, limiting the potential for unplanned or unwanted growth.

Reasonably foreseeable transportation and other development projects are expected to convert more land use to future transportation and other uses in the Induced Growth ICE Study Area. The incremental

contribution of Alternative A to cumulative land use changes would be minor as limited right-of-way would be required along an existing facility, and potential induced growth would be limited to infill and redevelopment in built-out cities.

Past and present growth and development has positively contributed to community cohesion in the cities of Norfolk and Hampton traversed by the I-64 Study Area Corridor by improving the standard of living for these communities. However, original construction of I-64 and the expansion of controlled access facilities such as military installations like NAVSTA Norfolk have separated neighboring communities. Future growth and development is expected to continue, benefiting community cohesion from increased productivity and services. Widening I-64 would marginally increase the separation distance between communities located on either side, but because the relationship between the interstate and adjoining communities has been established for nearly 60 years and all local road crossings would be maintained, indirect effects to community cohesion would be minor. Alternative A would also relocate some residences that border the I-64 right-of-way; however, the number of affected residences would be low (nine) and dispersed among the Willoughby Spit and Commodore Park neighborhoods on the edge of these communities. Relocated residents would receive relocation assistance and comparable replacement housing is available in the affected communities, therefore, limited community cohesion effects would result. Future transportation and redevelopment projects could potentially result in residential relocations within the Cumulative Effects Study Area. The incremental contribution of Alternative A to cumulative effects to community cohesion would be minor because the direct and indirect effects would be minor.

Past growth and development also led to the provision of community facilities and recreational resources, and benefited local economies and long-term employment from increased access to markets and business customers. Both Hampton and Norfolk comprehensive planning provide for recreational opportunities in their communities. Past and present transportation improvements benefit community facilities and recreational resources by increasing access. Existing severe congestion impacts access to these facilities and recreation areas. Future transportation projects and development would continue to increase access to community facilities and recreational resources while potentially displacing others. Alternative A would improve an existing interstate, minimizing potential effects to community facilities and recreational areas, while improving their accessibility. Construction of Alternative A would result in minor right-of-way acquisition near Hampton University and less than 0.1 acre at the Willoughby Boat Ramp. The access to and functions of these community and recreation facilities would be unchanged. Other potential temporary effects from construction could occur to community facilities from detours and loss of parking. Overall, the incremental contribution of Alternative A to cumulative effects to community facilities and recreational resources would be minor because the direct and indirect effects would be minor. Past, present and future actions would continue to have both positive and adverse cumulative effects to community facilities and recreation.

Minority and low-income populations have historically been adversely affected by large infrastructure projects such as interstate construction. Since 1994, federal regulations require federal actions to avoid disproportionate and highly adverse effects to minority and low-income populations. Future federal and non-federal development would continue to have potential disproportionate and highly adverse impacts to minority and low-income populations, as well as benefits. Federal regulations would continue to avoid disproportionate and highly adverse effects of their authorized actions to minority and low-income populations whenever possible. Minority or low-income populations reside all along Alternative A

through Hampton and Norfolk. Beneficial effects to minority or low-income populations as well as other travelers would be realized from reduced congestion and improved access to transportation under Alternative A. The residential relocations (nine) would occur within some of these areas designated as minority or low-income populations; however, it is not known at this time whether affected individuals could be minorities or low-income (see **Table 3-20**). Approximately 74 percent and 69 percent of the resident population in the two Census Block Groups where relocations would occur under Alternative A identified themselves as non-minorities. The relocated households would receive relocation assistance and similar replacement housing exists in the potentially affected areas. It is possible the potential effects to minority and low-income populations would be reduced with refined design in advanced phases of the project, and that relocations would not impact individual minority or low-income residents, reducing the potential for disproportionate impacts in the Alternative A corridor. Temporary, short-term construction effects of increased noise, dust, and visual changes would not be high and adverse to the affected EJ community. Future federal infrastructure and development projects may have effects to protected EJ populations; however, EO 12898 should continue to minimize adverse effects. Alternative A would have incremental effects to minority and low-income populations resulting in cumulative effects. Past, present and foreseeable future actions would continue to have both beneficial and adverse cumulative effects to minority and low-income populations.

Increased commerce and employment from past and present growth and development, including original construction of I-64, has benefited economic resources in Hampton and Norfolk along the Alternative A Study Area Corridor. Existing severe congestion reduces access to markets and customers, thereby reducing commerce and employment that could otherwise occur. Continued growth and development is expected to have a positive impact to local economies from increased customer demand and long-term employment opportunities. Alternative A would result in moderate improvements to transportation accessibility and reduced congestion providing greater capacity for efficient movement of more goods and people that benefits productivity and local economies in Hampton and Norfolk. Few residential and no commercial relocations would result under this alternative. Short-term construction effects to businesses from temporary detours and lost parking could occur that could cause some customer losses and make deliveries more difficult, but these effects would be temporary and minimized by advance notice of closures and directional signing, resulting in minor effects. Alternative A would have minor adverse and moderately positive incremental effects to local economies. Past, present, and future growth and development in Hampton and Norfolk is expected to result in positive cumulative effects to commerce and employment.

Alternative B

For largely the same reasons as described for Alternative A, Alternative B would have minor incremental effects to cumulative land use impacts. In addition to I-64, Alternative B would continue along I-564 in Norfolk, the I-564 Connector across the Elizabeth River, and the VA 164 Connector and VA 164 freeway in Portsmouth. These latter areas are also largely built-out from prior developments and induced growth associated with Alternative B could occur as infill and redevelopment. Much of the land along I-564 is owned by the military, and the VA 164 Connector traverses CIDMMA and other military and state controlled lands. It is expected that no land use change from induced growth potentially related to Alternative B would occur in these latter locations.

Alternative B would also have moderate incremental effects to community cohesion. Its direct and indirect effects along I-64 would be similar to those described for Alternative A. Improvements along

I-564 and VA 164 would be to existing roadway facilities where communities have been previously separated by their original construction, or later grew around them. Improvements to these corridors would be at the periphery of established communities and would not bisect residential areas or create new impediments to travel through communities. The I-564 Connector proposed under Alternative B would be over water and the VA 164 Connector would be primarily across government-controlled lands with little potential for community cohesion direct or indirect effects. Up to nine residential relocations and no commercial relocations would occur under Alternative B (the same as Alternative A). The majority of the residential relocations would occur in the Willoughby Spit neighborhood in Norfolk. Both affected Census Block Groups are minority population areas. Similar to Alternative A, the race and/or ethnicity of potentially relocated persons is not known at this time. These relocations would occur on the edge of these communities near the existing roadway facilities. As stated in the Socioeconomic Resources section, the estimated right-of-way needed for Alternative B is conservative, and would be refined in more advanced design that may reduce relocation effects. Relocated residents would receive relocation assistance and comparable replacement housing is available in the affected communities. The incremental effects of Alternative B to community cohesion in Hampton and Norfolk would be minor, and moderate in Portsmouth, based on the number of relocations per community. Past, present, and future transportation projects and other actions are expected to have both positive and adverse cumulative effects to community cohesion.

Alternative B direct effects to community facilities and recreation resources would consist of minor right-of-way acquisitions (less than 12 acres) from six facilities including parks and recreation facilities, and a cemetery in Portsmouth, however, without affecting their access or functions. The majority of the impacts would occur at Fleet Park on NAVSTA Norfolk. No community facility relocations would occur under Alternative B. Other indirect temporary construction effects similar to those described for Alternative A could occur to community and recreational facilities and would be minor. The I-564 IC project currently in design would impact Fleet Park on NAVSTA Norfolk. Future actions are expected to provide additional recreational and facilities while potentially relocating others. The incremental contribution of Alternative B to community facility and recreation resources cumulative effects would be minor because the direct and indirect effects of this alternative would be minor.

I-64, I-564, and VA 164 encompassed by Alternative B were originally constructed prior to 1994 when EO 12898 became effective. Similar to Alternative A, minority or low-income populations reside all along I-64 through Hampton and Norfolk, thus Alternative B would have similar direct and indirect effects in these areas. Additionally, minority populations reside along VA 164 through Portsmouth. These communities would benefit from the proposed transportation improvements under Alternative B that increases access to transportation. Relocated households (nine, the same as Alternative A) would receive relocation assistance and similar replacement housing exists in the potentially affected areas. Although all relocations under Alternative B would occur in two Census Block Groups that meet the threshold for an EJ population (see **Table 3-20**), the minority or low-income status of potential relocated residents is not known at this time. Approximately 74 percent and 69 percent non-minority residents live in the two Census Block Groups with potential relocations. It is possible the potential effects to minority and low-income populations would be reduced with refined design in advanced phases of the project, and that relocations would not impact individual minority or low-income residents, reducing the potential for disproportionate impacts under Alternative B. Temporary effects from construction including increased noise, dust, and visual changes would not be high and adverse to the affected EJ community. Future federal infrastructure and development projects may have effects to protected EJ populations,

however, EO 12898 would continue to minimize adverse effects. Alternative B could have incremental contributions to cumulative effects on minority and low-income populations in the Cumulative Effects Study Area.

Alternative B would result in moderate improvements to transportation accessibility and reduced congestion providing greater capacity for efficient movement of more goods and people that benefits productivity, long-term employment and local economies. No commercial relocations would result under this alternative. Short-term construction effects to businesses from temporary detours and lost parking could occur that could cause some customer losses and make deliveries more difficult, but these effects would be temporary and minimized by advance notice of closures and directional signing. Temporary job increases associated with construction of Alternative B would occur that would benefit the local economies of Hampton, Norfolk, and Portsmouth. Alternative B would have minor adverse and moderate positive incremental effects to local economies. Past, present and future transportation and other development actions are anticipated to have primarily positive cumulative effects to the economy of the Hampton Roads region.

Alternative C

Alternative C would be constructed through the cities of Hampton, Suffolk, Chesapeake, Portsmouth, and Norfolk. Improvements would be made primarily along existing roadways. Therefore, right-of-way requirements would consist of narrow corridors along existing facilities with less potential conversions of existing land use to transportation. Hampton, Portsmouth and Norfolk are largely built-out, thus any indirect induced growth associated with Alternative C construction could occur as infill or redevelopment in these cities. For the same reasons as discussed for Alternative B, no substantial land use change is expected to occur from implementation of Alternative C along I-564, and the proposed I-564 and VA 164 Connectors surrounded principally by government-controlled lands or over water. The area along I-664 through Suffolk and Chesapeake is less developed, but much of the undeveloped land bordering the interstate interchanges and feeder roads is within wetlands and conservation lands that would pose challenges to development. Nevertheless, induced growth pressures in these areas would likely be greater under Alternative C. Population growth is forecasted to increase approximately 136 percent in Suffolk and 50 percent in Chesapeake from 2009 levels to the year 2040 (HRTPO, 2013). Further, almost all of the Induced Growth Study Area through Suffolk and Chesapeake is within designated areas for growth. Current land use in Suffolk and Chesapeake may change that is in part due to construction of Alternative C, but would be limited to within a few miles of I-664 interchanges, and would not conflict with local comprehensive land use planning. The incremental contribution of Alternative C to cumulative land use change in the Cumulative Effects Study Area would therefore be moderate.

Alternative C would primarily widen along existing transportation corridors and therefore would not further bisect residential areas or create new impediments to travel through communities. The only proposed new alignment on land is through the CIDMMA and southward along the VA 164 Connector, the majority of which is government land. Alternative C would result in ten residential relocations in the Hampton Terrace community of Hampton (near the I-64/I-664 interchange) and one relocation in Newsome Park, Newport News. Relocated households would receive relocation assistance and similar replacement housing exists in the potentially affected areas. In addition, five commercial relocations would occur. Future transportation and redevelopment projects could potentially result in residential and commercial relocations within the Cumulative Effects Study Area. Alternative C would have moderate incremental contributions to cumulative effects on community cohesion.

Alternative C direct effects to community facilities and recreation resources would consist of minor right-of-way acquisitions (10 acres) from four facilities including one religious facility, one school, and two park and recreation facilities. All but 1 acre of these effects would be at Fleet Park on NAVSTA Norfolk. This property would also be impacted by the I-564 IC currently in design. Other direct effects of Alternative C to community facilities and recreation resources include potential temporary construction impacts from detours and reduced parking. Based on the limited direct and indirect effects of Alternative C to community facilities and recreation resources, the incremental contribution of Alternative C to cumulative effects of this alternative to these resources would be minor. As described for Alternative A, past, present and reasonably foreseeable transportation and other actions would continue to have both positive and negative cumulative effects to community facilities and recreation resources.

I-564, I-664, and VA 164 encompassed by Alternative C were originally constructed prior to 1994 when EO 12898 became effective. Similar to the other Build Alternatives, minority populations reside all along the Alternative C alignment, with some low-income population Census Block Groups located in the Newport News and Norfolk portions of the Socioeconomic ICE Study Area. Several of the low-income Census Block Groups in Newport News are adjacent to I-664 at the tip of the Peninsula. These communities would benefit from the proposed transportation improvements under Alternative C that increases access to transportation. Under Alternative C, residential relocations (11) would occur in minority population areas, primarily in the Hampton Terrace area of Hampton as described above (see **Table 3-21**). Although all relocations under Alternative C would occur in Census Block Groups that meet the thresholds for an EJ population, the minority status of potentially displaced residents is not known at this time. Approximately 0-33 percent of residents in the three affected Census Block Groups are non-minority. It is possible the potential effects to minority populations would be reduced with refined design in advanced phases of the project, and that relocations would not impact individual minority residents, reducing the potential for disproportionate impacts in the Alternative C corridor. Temporary, short-term construction effects of increased noise, dust, and visual changes would not be high and adverse to the affected EJ community. Future federal infrastructure and development projects may have effects to protected minority and low-income populations, however, EO 12898 would continue to minimize adverse effects. Alternative C would have incremental effects contributing to cumulative effects on minority and low-income populations in the Cumulative Effects Study Area.

Alternative C would result in moderate improvements to transportation accessibility and reduced congestion providing greater capacity for efficient movement of more goods and people that benefits productivity, long-term employment and local economies. Five commercial relocations could result from this alternative, but affected businesses would receive relocation assistance. Short-term construction effects to businesses from temporary detours and lost parking could occur that could cause some customer losses and make deliveries more difficult, but these effects would be temporary and minimized by advance notice of closures and directional signing. Temporary job increases associated with construction of Alternative C would occur that would benefit the local economies of Chesapeake, Newport News, Norfolk, Portsmouth and Suffolk. Alternative C would have moderate incremental contributions to positive cumulative effects on local economies because the benefits would be moderate and adverse direct and indirect effects of this alternative would be minor.

Alternative D

Alternative D would include elements of all the other Build Alternatives, except it would not include additional dedicated transit lanes as proposed under Alternative C. As such, Alternative D would have

similar incremental contributions to cumulative effects on land use, community cohesion, community facilities, recreation resources, environmental justice populations, and local economies as described for the other individual Build Alternatives.

Preferred Alternative

The incremental cumulative effects of the Preferred Alternative to socioeconomic resources would be similar to those of Alternative A. This is because there are minor differences in the direct effects of these two alternatives.

Natural Resources

Past, present, and reasonably foreseeable future growth and development actions in the Natural Resources ICE Study Area have been primarily adverse to natural resources. Intensification of land use in the Hampton Roads region since 1955 has resulted in reduced water quality with many waters impaired for human and wildlife use; loss of wetlands, streams, and floodplains; substantial wildlife population loss from overexploitation and loss of habitat; fragmented habitat; and degraded habitat quality. Impacts that occurred early in the development of the region had a greater impact than more recent projects, given the pristine and undisturbed nature of the environment and absence of environmental regulations. The best indicators for cumulative effects on water resources is the extent of impaired waters in the Hampton Roads region – 111 waterbodies within the Cumulative Effects Study Area are impaired, including Hampton Roads and the James and Elizabeth Rivers.

All of these past and present actions have limited and/or degraded the quality of habitat for existing species. This has led to some species becoming threatened and endangered with extinction. Federal, state, and local regulations enacted over the last 50 years have done much to slow the loss of remaining wildlife and wildlife habitat, improve wildlife habitat and water quality, and recover protected species. These regulations require consideration of avoidance, minimization, and mitigation of adverse effects to natural resources. Past and present private conservation efforts have also positively contributed to natural resources in the region, such as at the Hoffler Creek Nature Preserve in Portsmouth and non-governmental organizations such as the Chesapeake Bay Foundation, the James River Association, the Elizabeth River Project, and Nansemond River Preservation Alliance. Future growth and development in the Natural Resources ICE Study Area is limited because of the lack of developable land and land use policies that aim to concentrate growth while preserving natural lands. The effects of growth and development would also be limited because its effects would be primarily within previously disturbed areas.

No-Build Alternative

The No-Build Alternative would not improve the existing HRCS Study Area Corridors. Although stormwater management along the Study Area Corridors has been updated over the past 25 years with retrofitted and more modern systems as improvements have been made, there are still sections where there are not any stormwater management features or the features are outdated that would not be improved under the No-Build Alternative. Existing indirect effects associated with untreated or poorly treated stormwater runoff would continue. Under the No-Build Alternative, the existing fragmented and limited wildlife habitat existing within and adjacent to the Study Area Corridor would continue to degrade.

Alternative A

As previously discussed, past growth and development has diminished natural resources within the Natural Resources ICE Study Area encompassing Alternative A. However, current federal, state, and local regulations and non-governmental conservation efforts lessen the effects of such development.

Alternative A would widen an existing interstate in a highly urbanized area that has been previously disturbed. Alternative A would directly impact approximately 8 acres of wetlands, 113 acres of floodplain, 147 acres of navigable waters, 12 acres of maintained navigable channels, and 1 acre of RPA. This alternative would not directly impact known streams. Indirect effects to these resources could include reduced water quality as discussed below, as well as changes to floodwater storage capacity and retention times, vegetative community composition and structure (which affects wetland functions), and nutrient cycling. The direct and indirect effects of these impacts would be minimized by implementation of BMPs and possibly compensatory mitigation as discussed in the Natural Resources direct effects section of this SEIS.

Under Alternative A, construction and post-construction discharges of stormwater, as well as dredging, would potentially 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. Drainage design for the new proposed bridge structures would be developed in later design phases and is expected to be in conformance with current stormwater regulations in order to minimize downstream effects to natural resources and water quality. Alternative A is not expected to disturb soils with *Enterococcus* or fecal coliform, which impair several waterbodies in the area. Furthermore, because Alternative A would upgrade existing systems that pre-date more stringent stormwater management regulations, impacts to water quality from highway runoff would be reduced compared to current conditions. Therefore, Alternative A is not expected to substantially contribute to the further impairment of any impaired waterbodies. Ongoing present actions that could affect water quality include maintenance dredging of navigable channels in the Chesapeake Bay and Hampton Roads, and watershed protection and stormwater and drainage projects completed by cities in the Hampton Roads region (**Table 3-67**). Near future impacts could occur from the Norfolk Harbor and Channels Deepening Project administered by the USACE and POV. The adverse incremental effects of Alternative A to cumulative water quality is anticipated to be moderate.

Dredging under Alternative A would be conducted to place the new tunnel for the HRBT. The new tunnel and bridges could potentially alter hydrodynamics and possibly affect aquatic habitat and navigation (see **Section 3.8.1.6** for more information). Dredging under Alternative A would generate approximately 1.2 million cubic yards of dredge material requiring disposal. Alternative A would have fewer indirect effects to regional dredge capacity than Alternatives B-D, but the same as the Preferred Alternative. Several options are available to dispose of dredge material that require testing to evaluate its suitability for various alternative uses and disposal sites. The exact effects of dredge material disposal to natural resources and the regional capacity for dredge material disposal under Alternative A is not known at this time. Ongoing, routine maintenance of navigable channels in the Chesapeake Bay and Hampton Roads, as well as future projects such as the Norfolk Harbor and Channels Deepening Project would continue to potentially impact hydrodynamics and regional dredging capacity in the Natural Resources ICE Study Area near the Alternative A alignment. Therefore, it can be anticipated short-term increases in the level of suspended sediment can give rise to changes in water quality that can affect marine flora and fauna, both favorably and unfavorably, such as increased turbidity and the possible release of organic matter, nutrients and or contaminants, depending upon the nature of the material in the dredging area.

Generally, sediments settle within the vicinity of the dredged area, where they are likely to have little effect on the recently disturbed communities, particularly in areas where dredging is a well-established activity which has occurred within Hampton Roads for decades. These potential effects should be minimized by adherence to federal and state regulations. Although the exact effects of Alternative A to hydrodynamics and regional dredge material capacity are unknown at this time, it is expected this alternative would not have substantial incremental contributions to cumulative effects to hydrodynamics and regional dredge material capacity due to the limited proposed tunnel footprint.

Past development and original construction of I-64 through Hampton and Norfolk has led to little remaining intact terrestrial wildlife habitat in the Alternative A Study Area Corridor and the Natural Resources ICE Study Area as a whole. Remaining habitat is highly fragmented along I-64 that is associated with habitat loss. Alternative A would cause some habitat loss, particularly near water crossings that tend to have greater integrity than areas on land along either side of the I-64 Study Area Corridor that have fewer legal protections. Alternative A would impact approximately 15 acres of forested terrestrial habitat. Habitat fragmentation can have wide-ranging indirect effects to wildlife, resulting in species shifts associated with greater edge habitat and less interior habitat (smaller patch size); lower diversity due to smaller habitat patches; potential isolation of populations; increased vulnerability of species to external competition and predation; potential decreased flow of genetic material through the landscape; restricting wildlife movements that disrupt foraging, breeding/nesting and migration; increased risk of invasive species establishment; and generally, reduced biological diversity. Roadway noise can result in altered habitat utilization, strained communication, and heightened metabolic rates on wildlife, especially avian communities, indirectly causing wildlife abandonment of the area, increased predation, reduced foraging success, decreased breeding success, and decreased wildlife health. Widening of existing bridges and lengthening culverts under Alternative A could indirectly restrict wildlife movement through the riparian corridors crossed by these structures and alter up and downstream hydrologic flow. Direct effects to wetlands, streams and floodplains may indirectly change hydrologic flow dynamics through adjacent natural communities up or downstream, which sometimes alters these dynamics at the ecosystem level such that the ability of the system to maintain itself is altered. Preserving the hydrodynamic flow systems is important because they are a major pathway for energy flow and dissipation in the Coastal Plain, an area of flat, low-lying land with many rivers, marshes and swamplands.

All of these effects to terrestrial wildlife habitat can be reduced with appropriate mitigation and minimization measures as discussed in the Natural Resources direct effects section of this document. Continued growth and development would potentially reduce and degrade terrestrial habitat. Federal, state, and local regulations would continue for the foreseeable future to require minimization, mitigation and compensation for terrestrial habitat direct and indirect impacts. The direct and indirect incremental contribution to cumulative on terrestrial habitat would be moderate under Alternative A.

Construction can increase the presence of invasive plant species enabled by earth disturbance and spreading from contaminated vehicles, clothing and shoes. 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 to ensure that seed mixes are free of noxious species. While the study area would be vulnerable to the colonization of invasive plant species from adjacent properties, implementation of the stated provisions would reduce the potential for the establishment and proliferation of invasive species. Future development actions could spread invasive species, and

accidental releases of invasive species could occur. Adherence to the VDOT specifications while constructing Alternative A would result in minor contributions to cumulative effects on habitat from invasive species.

Past development along the shoreline, bridges and tunnels, as well as navigation improvements and commercial and recreational fishing have impacted aquatic habitat. Impaired water quality associated with point and non-point pollution, and upstream obstructions along the James River have impacted aquatic wildlife and habitat in the vicinity of Alternative A. For example, archaeological evidence and historical records indicate anadromous fish species such as herring and shad migrated into the upper reaches of all major drainages in Virginia, including the James, Elizabeth, and Nansemond Rivers that meet in Hampton Roads (VDGIF, 2016). Heavy fishing pressure, dams, canals, and other obstructions have substantially reduced anadromous fish populations. By 1990, the shad harvest was only approximately six percent of the total harvest documented at the beginning of the 20th Century.

Alternative A would impact 156 acres of aquatic habitat, 43 acres of shallow tidal water habitat, 154 acres of benthic habitat, 138 acres of EFH, HAPC and Anadromous Fish Use Areas, and 2 acres of SAV. In addition, any construction activity under Alternative A 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. Strict adherence to time-of-year restrictions and erosion and sediment control measures, would minimize (to the maximum extent practicable) impacts to waterbird colonies. Surveys to locate existing waterbird colonies could also be required. While beach disturbance during construction may temporarily make areas inadequate for nesting waterbirds, Alternative A could ultimately augment the existing beach habitat, providing an opportunity for increased suitable nesting habitat along the I-64 corridor. Loss of habitat and direct impacts to any existing benthic communities could result from dredging associated with the tunnels, installation of bridge foundations, and the enlargement of the portal islands. Runoff from roadways could contain heavy metals, salt and associated materials, organic compounds, and nutrients. When runoff enters waters that are already impaired, the impacts are cumulative and can result in accelerated changes in the macrobenthic community structure and composition. In turn, this can affect the fish and amphibian populations that rely on them as a food source, as well as the birds and aquatic mammals that prey on the fish and amphibians. The effects can result in changes in community structure at a local level, but may also extend further to include changes in ecosystem structure and function in the absence of proper mitigation. In addition, existing SAV beds occur along the eastern side of the north island of the HRBT, just west of Fort Monroe, as well as along the north shore of Hampton Roads between I-64 and I-664. SAV can be indirectly impacted by reduced water quality from stormwater runoff, and increased sedimentation and photic zone impacts from turbidity associated with dredging. Stormwater runoff treatment along I-64 would be improved under Alternative A, potentially neutralizing adverse effects of roadway runoff.

The adverse effects of Alternative A to aquatic habitat and wildlife would be minimized, mitigated, and possibly compensated as described in the Natural Resources direct effects section of this SEIS. Ongoing dredging associated with navigation maintenance in Hampton Roads would continue to effect aquatic wildlife and habitat near Alternative A, as would the proposed Norfolk Harbor and Channels Deepening Project. The relatively small increases in siltation away from the immediate dredging area of Alternative A are generally considered unlikely to have long-term adverse effects on benthic populations in areas that are routinely dredged. Based upon the direct and indirect effects of Alternative A, this alternative

would have moderate incremental contributions to adverse cumulative effects on aquatic wildlife habitat occurring from past, present and future actions.

Past development and harvesting of wildlife has led to the very existence of some wildlife species to be threatened and endangered. Passage of the Virginia Endangered Species Act in 1972 and the federal Endangered Species Act in 1973 required state and federal agencies to avoid and minimize potential effects to designated rare, threatened, and endangered species and their critical habitat. Threatened and endangered species habitat within the I-64 Study Area Corridor includes the Hampton Roads Bridge-Tunnel Island Conservation Site that is habitat for federally listed shorebirds. As previously described, this habitat is already fragmented by the existing HRBT and surrounding development. Further, the widespread occurrence of common reed has rendered much of this habitat unsuitable for shorebird foraging. The majority of these estuarine areas would be bridged under Alternative A, limiting the direct loss of habitat, and thereby, indirect effects associated with additional habitat fragmentation. Due to the presence of higher quality foraging habitat outside the Study Area Corridor but in the vicinity of Alternative A, disruption during construction activities should have little to no impact on the shorebird species. Additionally, summer roosting habitat has been confirmed for bat species within Alternative A (NLEB, Little brown bat, Tri-colored bat), and forested habitat is very fragmented. Alternative A would not further degrade the quality of this habitat. Moreover, no confirmed maternity roosts or hibernacula are located within a two-mile radius of the I-64 Study Area Corridor, further limiting the potential indirect effects on the species from encroachment. Future growth and development would occur in the Natural Resources ICE Study Area that could degrade threatened and endangered species habitat. State and federal regulations would continue to require their actions to avoid and minimize effects to threatened and endangered species. Based on the limited direct and indirect effects of Alternative A to protected species, the incremental contribution of Alternative A on threatened and endangered species cumulative effects would be moderate.

Alternative B

Along existing I-64, Alternative B would have similar incremental effects to natural resources as described for Alternative A. However, Alternative B would also improve I-564, construct the I-564 and VA 164 Connectors on new alignment, and widen VA 164.

Alternative B would directly impact approximately 73 acres of wetland, 213 acres of floodplain, 215 acres of navigable waters, 24 acres of maintained navigable channels, and 16 acres of RPA. No impacts to known streams would result under Alternative B. The type of cumulative impacts to these water resources would be similar as described under Alternative A. Past development along the Norfolk shoreline has impacted water resources from the construction of the NAVSTA Norfolk docks and NIT. Water resources were also substantially impacted by decades of expansion of Craney Island using disposed dredge material (see **Appendix F** historic aerials). Continual maintenance of the CIDMMA affects wetlands along the shore of Craney Island. Future projects such as the Norfolk Harbor and Channels Deepening Project and the planned expansion of CIDMMA to the east, development of the Craney Island Marine Terminal (CIMT), and expansion of VIG and the NIT Terminals would also continue to impact wetlands and navigable waters. The incremental contribution of Alternative B to adverse cumulative effects on wetlands, floodplains, navigable waters, and RPA would be moderate.

The I-564 Connector would involve constructing a tunnel extending from the Norfolk shoreline across the mouth of the Elizabeth River, a tunnel portal island north of CIDMMA, and trestle bridges. This area

has been previously impacted by dredging and maintenance of the Norfolk Harbor Channel up the Elizabeth River, as well as expansion of CIDMMA to the east, and development along the Norfolk shoreline. The designs for the new HRBT and I-564 Connector tunnels would substantially influence the amount of dredging and fill needed that in turn could affect aquatic habitat, benthic species, EFH, HAPC and Anadromous Fish Use Areas, SAV, and threatened and endangered species. Together with improvements at the HRBT, Alternative B could impact 241 acres of benthic habitat and 214 acres of EFH, HAPC and Anadromous Fish Use Areas. No SAV is present along the I-564 Connector, so the effects of Alternative B to SAV (2 acres) would be the same as Alternative A. This alternative could result in direct aquatic habitat loss (201 acres), 59 acres of shallow tidal habitat, and indirect degraded water quality from sedimentation, resuspension of sediment in the water column (turbidity), and potential release of toxicants from water bottom disturbance by dredging for the new tunnel and bridge facilities along the I-564 Connector. However, potential direct and indirect effects to aquatic habitat and wildlife would be minimized and mitigated as described in the Natural Resources direct effects section. Future expansion of CIDMMA further to the east, construction of the CIMT, expansion of the VIG and NIT, and the Norfolk Harbor and Channels Deepening Project would continue to impact aquatic habitat. The incremental contribution of Alternative B to adverse cumulative effects on aquatic habitat and wildlife would be moderate.

It is estimated Alternative B would generate approximately 4.1 million cubic yards of dredge material requiring disposal. As discussed for Alternative A, several options are available to dispose of dredge material that requires testing to evaluate its suitability for various alternative uses and disposal sites. Therefore, the exact direct and indirect effects of dredge material disposal to natural resources and the regional capacity for dredge material disposal is not known at this time, hence, the incremental addition to cumulative effects is unknown. However, we can anticipate short-term increases in the level of suspended sediment that can give rise to changes in water quality that affect marine flora and fauna, both favorably and unfavorably, such as increased turbidity and the possible release of organic matter, nutrients and or contaminants, depending upon the nature of the material in the dredging area. Generally, sediments settle within the vicinity of the dredged area, where they are likely to have little effect on the recently disturbed communities, particularly in areas where dredging is a well-established activity which has occurred within Hampton Roads for decades.

Alternative B incremental effects to terrestrial wildlife and habitat along I-64 would be the same as described for Alternative A. The area along I-564 is highly developed with highly fragmented habitat. Alternative B is estimated to impact 73 acres of forested habitat and 112 acres of threatened and endangered species habitat. Unlike the I-564 Connector, the VA 164 Connector would be constructed on new alignment, but it is being proposed for construction on land, not on structure and over water. The potential for the VA 164 Connector to be placed on structure was not considered for the ICE analysis, but if it had been included in the Preferred Alternative, the possibility would have been evaluated (if needed) to accommodate US Navy and US Coast Guard security requirements. In the absence of an elevated facility, the VA 164 Connector under Alternative B could result in habitat loss and fragmentation. Habitat loss resulting in habitat fragmentation may have wide-ranging effects to wildlife and biological diversity as described under Alternative A. The Craney Island Conservation Site is also habitat for federally protected shorebirds (Piping plover, gull-billed tern, Wilson's plover, and Red knot) potentially impacted by Alternative B. The VA 164 Connector would be constructed on the eastern edge of the CIDMMA with more suitable habitat to the west. Therefore, the potential indirect effects of habitat fragmentation to wildlife and protected shorebird species is expected to be minimal near the VA 164 Connector. However,

the alignment south of the island through government-controlled lands to its connection with VA 164 would have more severe habitat fragmentation indirect effects to wildlife. Summer roosting habitat for federally protected bats occurs along I-64 as described for Alternative A. Although some larger tracts of forest do exist in the Study Area Corridor along Coast Guard Boulevard north of VA 164, the potential indirect effects of Alternative B to bat roosting and foraging habitat would be similar to the types described for Alternative A. Canebrake rattlesnake habitat is located in forest habitat on the Coast Guard property; however, the habitat area is isolated and it is thought the area is not able to support a viable population of the species long term. This area of the VA 164 Connector was also clear cut in the 1990s that likely eliminated any Canebrake rattlesnake population at that time. Therefore, Alternative B is not expected to have any direct or indirect effects to the Canebrake rattlesnake.

Future projects such as the I-564 IC currently in design, the expansion of CIDMMA and construction of the CIMT, and expansion of VIG would continue to impact terrestrial wildlife habitat within the Alternative B Study Area Corridor, as would other future development in the Cumulative Effects ICE Study Area. In combination with past, present and future actions, Alternative B would have moderate incremental contributions to cumulative impacts on terrestrial wildlife. It is anticipated further consultation with USFWS would result in measures to reduce effects of Alternative B to protected species.

Alternative C

As Alternative C would be the same width along I-564 and the VA 164 Connector as Alternative B, it would have the same cumulative effects to natural resources in these areas. With the addition of two dedicated transit lanes, Alternative C cumulative impacts to natural resources along the I-564 Connector would be the same type as described for Alternative B, but over a larger area. Alternative C would also widen the entire length of I-664, construct an additional tunnel alongside the MMMBT, and construct the I-664 Connector. No improvements would be made to the I-64 corridor and improvements to VA 164 would only include tying in the VA 164 Connector.

Past development and construction of the I-664 and the MMMBT as well as navigation improvements have impacted water resources in the Alternative C Study Area Corridor. Water quality has been impaired by previous and ongoing point and non-point pollution. The types of cumulative effects of Alternative C to wetlands, floodplains, navigation channels and RPA's would be the same as described for Alternative A and B, but would occur on a larger scale. Alternative C is estimated to directly impact 112 acres of wetlands, 370 acres of navigable waters, 57 acres of maintained navigable channels, and 127 acres of RPA. In addition, it could impact 548 linear feet of streams along I-664. Alternative C would impact 213 acres of floodplains. The types of indirect effects to these water resources under Alternative C would be similar to the type of indirect effects identified for Alternatives A and B. Minimization, mitigation and potentially compensatory measures as described in the Natural Resources direct effects section of this SEIS would lessen adverse effects to water resources. Future effects to water resources could occur from the planned expansion of CIDMMA further to the east, construction of the CIMT, expansion of the VIG and NIT, and the Norfolk Harbor and Channels Deepening Project. Federal, state, and local regulations protecting water resources would continue in the foreseeable future. With mitigation, the incremental contribution of direct and indirect effects of Alternative C to adverse cumulative effects on water resources would be moderate.

Alternative C is estimated to require disposal of approximately 7.1 million cubic of dredge material. As discussed for the other Build Alternatives, the exact direct and indirect effects to regional dredge material disposal capacity is unknown at this time, therefore, the incremental cumulative effects are unknown. However, anticipated short-term increases in the level of suspended sediment can give rise to changes in water quality that can affect marine flora and fauna, both favorably and unfavorably, such as increased turbidity and the possible release of organic matter, nutrients and or contaminants, depending upon the nature of the material in the dredging area. Generally, sediments settle within the vicinity of the dredged area, where they are likely to have little effect on the recently disturbed communities, particularly in areas where dredging is a well-established activity that has occurred within Hampton Roads for decades. In addition to the I-564 Connector, Alternative C would construct another tunnel alongside the MMMBT and the I-664 Connector on structure over water. This alternative is estimated to impact approximately 573 acres of aquatic habitat, 29 acres of shallow water habitat, 665 acres of benthic habitat, and 565 acres of EFH, HAPC, and Anadromous Fish Use Areas. No known existing or historic SAV areas occur within the Alternative C Study Area Corridor. The types of indirect effects to these resources by construction of Alternative C would be similar to the effects described for Alternative A and B, but would occur on a larger scale. Minimization, mitigation, and possibly compensatory measures would lessen direct and indirect adverse effects to aquatic wildlife and habitat from Alternative C. Future projects as described in the above paragraph could further impact aquatic habitat, but federal, state, and local regulations should minimize negative effects of these actions to aquatic habitat. The incremental contribution of Alternative C to adverse cumulative effects on aquatic wildlife and habitat would be moderate when combined with past, present, and future actions.

Direct and indirect impacts to terrestrial wildlife and wildlife habitat along I-564 and the VA 164 Connector would be the same as described for Alternative B as the footprint of Alternative C would be the same in these areas. Alternative C would widen the entire length of I-664 and thus could have additional terrestrial wildlife habitat effects. Past development in Hampton and the Newport News areas along I-664 has resulted in very little intact natural habitat in these portions of the Natural Resources ICE Study Area. Habitat along I-664 has also been fragmented from previous construction of I-664 and the rail line in the median. As land use is slightly less intensive along the I-664 Study Area Corridor on the Southside, more intact natural habitat is present in this area. Alternative C would impact 180 acres of terrestrial wildlife habitat and 164 acres of threatened and endangered species habitat. Habitat fragmentation along I-664 on the Southside would occur on the edge of the forested habitat bordering the interstate right-of-way; consequently, although the interstate corridor would be wider, it would not substantially change the fragmented condition of wildlife habitat in this area. The incremental contribution of Alternative C to cumulative effects on wildlife and wildlife habitat would be moderate.

Alternative C would have similar types of direct and indirect effects to protected shorebirds along the VA 164 Connector and the MMMBT as described for I-64 under Alternative A. It would also have similar effects to threatened and endangered species as Alternative B near the VA 164 Connector. Alternative C would have increased habitat fragmentation effects to Mabee's salamander habitat present on either side of I-664 on the Southside from reduction of forested buffers, and alteration of a pond that is habitat for this species resulting in indirect effects to light and temperatures from forest loss. An impact to the Mabee's salamander would not occur if two consecutive years of survey document the species is not present. Although more summer roosting bat habitat is present in the Alternative C Study Area Corridor, potential indirect effects on bat roosting and foraging habitat would be similar to that described for Alternative B. Canebrake rattlesnake habitat to either side of I-664 on the Southside would not likely

experience increased fragmentation as no habitat corridors currently connect these areas. Peregrine falcons have no documented use of the Alternative C Study Area Corridor for breeding, thus this alternative would have no indirect effects on this species. Impacts to protected species would be avoided, minimized, and mitigated as described in the Natural Resources direct effects section of this SEIS. The incremental contribution of Alternative C to cumulative effects on threatened and endangered species is expected to be reduced to a moderate level in consultation with USFWS.

The Norfolk Harbor and Channel Deepening Project, expansion of CIDMMA, NIT, and VIG, and construction of the CIMT within and near the Alternative C Study Area Corridor could also have adverse direct and indirect effects to terrestrial wildlife and protected species. Federal, state, and local laws and regulations would require these actions to avoid, minimize, and mitigate their effects to terrestrial wildlife and protected species, which would continue into the foreseeable future. With mitigation, Alternative C would have moderate incremental contributions to cumulative effects on these resources.

Alternative D

Alternative D includes elements of all the other Build Alternatives except it would not include additional dedicated transit lanes as proposed under Alternative C; **Table S-1** presents the direct effects of Alternative D to environmental resources. Alternative D would generate 6.1 million cubic yards of dredge material, fewer than Alternative C, but more than the other Build Alternatives. Alternative D would have similar incremental contributions to cumulative effects on natural resources as the other Build Alternatives.

Preferred Alternative

The Preferred Alternative would have similar incremental contributions to cumulative effects on most natural resources as Alternative A because there are few differences between these alternatives. Because the Preferred Alternative would impact more acres of floodplains and EFH, Habitat Areas of Concern, and Anadromous Fish Use Areas, the cumulative impacts of the Preferred Alternative would be greater on these resources compared to Alternative A.

Historic Resources

With human occupation of the Hampton Roads region extending thousands of years into the past and ongoing today, archaeological and architectural historic properties have been continuously created and destroyed by succeeding developments over time in the Historic Resources ICE Study Area. This has occurred more extensively since 1955 in the growing Hampton Roads region that is expected to continue to grow in the future. Transportation improvements and other actions potentially adversely affect archaeological and architectural historic properties by destruction or altering the integrity of their historically important characteristics. Federal and state laws requiring agencies to take into account effects to historic properties have slowed the loss of historic properties. Section 4(f) of the DOT Act of 1966 affords some protection to historic properties by requiring DOT agencies to avoid using archaeological and architectural historic properties important for preservation in place and only authorizing a use if there is no prudent and feasible avoidance alternative. Further, some of the six cities in the Historic Resources ICE Study Area regulate potential effects to historic properties by creating historic overlay zones and districts within which proposed projects are reviewed by committees and boards to minimize adverse effects to historic resources.

Transportation improvements can also increase visitation to historic properties open to the public, sustaining historic resources tourism and providing incentives for preservation. Other incentives for historic preservation are offered by federal, state, and local governments in the form of grants and tax breaks.

Build Alternatives

All direct and indirect effects to archaeological and historic architectural properties have been considered under Section 106 of the NHPA as described in the archaeological and historic architectural sections of this Final SEIS. In accordance with the executed PA, archaeological Phase I inventory would be conducted in portions of the APE with a high potential for archaeological remains that have not been previously surveyed and mitigation measures would be developed for the selected alternative, after issuance of the ROD. It is not expected that any archeological sites identified from later intensive survey would embody characteristics important for preservation in place.

Past and present development actions have directly and indirectly impacted archaeological and historic architectural historic properties. Future actions in the Historic Resources ICE Study Area such as redevelopment projects conducted by local governments, the I-564 IC, expansion of NIT and VIG, and various transportation and other present and reasonably foreseeable projects could have adverse effects to historic properties. Federal, state, and local regulations should continue to minimize potential adverse effects to historic properties from their actions. Section 4(f) requires federal DOT agencies to avoid adversely impacting historic properties important for preservation in place and authorizes adverse effects only if there is no other prudent and feasible alternative. The incremental contribution of the Build Alternatives to cumulative effects on historic properties would be moderately adverse.

3.15.4.4 Summary of Cumulative Effects

Table 3-71 summarizes the potential incremental contribution of the Build Alternatives to cumulative effects on the resources evaluated. As previously discussed for each Build Alternative, the racial or ethnic status of potentially relocated households is not presently known, although all the potential relocations for the Build Alternatives would occur in minority population areas. The more relocations an alternative would have, the greater the potential incremental effect to minority populations. Whether a disproportionate impact would occur and if mitigation would be required has only been determined for the Preferred Alternative. As such, **Table 3-71** presents the number of relocations in minority population Census Block Groups for the other Build Alternatives.

As described in **Section 3.9.3**, complete archaeological investigations are awaiting issuance of the ROD and more advanced preliminary design. However, it is anticipated no archaeological resources would be important for preservation in place. As shown in **Table 3-69**, incremental effects of the alternatives contributing to cumulative socioeconomic, natural, and historic resources would range from none to moderately adverse.

Past and present actions have shaped the current state of land use and socioeconomic, natural, and historic resources within the Cumulative Effects Study Area. These actions have been both beneficial and adverse to land use, socioeconomic, natural and historic resources within the Cumulative Effects Study Area. Future actions would be both beneficial and adverse to socioeconomic resources and land use, and primarily adverse to natural and historic resources. Coupled with past, present, and future actions, the overall cumulative effects of the Build Alternatives would be both beneficial and moderately adverse to

socioeconomic resources, including land use. Overall cumulative effects of the Build Alternatives in combination with past, present and foreseeable future actions to natural and historic resources would be primarily adverse.

Table 3-71: Summary of Build Alternative Incremental Contribution to Cumulative Effects[1]

Resource	Alternative A	Alternative B	Alternative C	Alternative D	Preferred Alternative	Cumulative Effect
Land Use	Minor	Minor	Moderate	Moderate	Minor	Adverse
Community Cohesion	Minor	Moderate	Moderate	Moderate	Minor	Adverse
Community Facilities and Recreation Resources	Minor	Minor	Moderate	Moderate	Minor	Adverse
Environmental Justice	9 residential relocations	9 residential relocations	11 residential relocations	20 residential relocations	9 residential relocations	Adverse
Local Economy	Moderate	Moderate	Moderate	Moderate	Moderate	Positive
Wetlands	Minor	Moderate	Moderate	Moderate	Minor	Adverse
Floodplains	Moderate	Moderate	Moderate	Moderate	Moderate	Adverse
Streams	0	0	Moderate	Moderate	0	Adverse
Navigable waters	Moderate	Moderate	Moderate	Moderate	Moderate	Adverse
Resource Protection Areas	Minor	Moderate	Moderate	Moderate	Minor	Adverse
Water Quality	Moderate	Moderate	Moderate	Moderate	Moderate	Adverse
Hydrodynamics/Regional Dredge Material Disposal Capacity	Moderate	Moderate	Moderate	Moderate	Moderate	Adverse
Hampton Roads Aquatic Habitat	Moderate	Moderate	Moderate	Moderate	Moderate	Adverse
Benthic Communities	Moderate	Moderate	Moderate	Moderate	Moderate	Adverse
EFH, HAPC, & Anadromous Fish Use Areas	Moderate	Moderate	Moderate	Moderate	Moderate	Adverse
SAV	Moderate	Moderate	0	Moderate	Moderate	Adverse
Terrestrial Habitat	Minor	Moderate	Moderate	Moderate	Minor	Adverse
Threatened & Endangered Species	Moderate	Moderate	Moderate	Moderate	Moderate	Adverse
Historic Architectural	Moderate	Moderate	Moderate	Moderate	Moderate	Adverse
Archaeological	Moderate	Moderate	Moderate	Moderate	Moderate	Adverse

[1] *See Table 3-70 for definitions of the severity of cumulative effects*

3.16 SHORT-TERM VERSUS LONG-TERM IMPACTS

Short-term impacts to resources in relation to long-term productivity have been evaluated in accordance with NEPA (42 USC 4332(C)(iv)) and guidelines published by CEQ on implementing NEPA (40 CFR 1502.16). This analysis qualitatively discusses the relationship between short-term impacts to and use of resources, and the long-term benefits and productivity of the environment. For this document, short-term refers to the estimated five-to-seven-year period of construction, the time when the largest number of temporary environmental effects is most likely to occur. Long-term refers to the more than 100-year life span estimated for the proposed improvements. This chapter discusses whether the short-term uses of environmental resources by the proposed improvements would affect (either positively or negatively) the long-term productivity of the environment.

3.16.1 Short-Term Impacts

The **No-Build Alternative** would not result in short-term impacts.

Construction of **Alternative A, B, C, D,** or the **Preferred Alternative** would result in short-term impacts, as described in **Section 3.14**. However, if the Preferred Alternative is constructed as a series of OISs, construction of each section would be of relatively short duration compared to the longer term duration of the overall alternative. In addition, each alternative would have variable levels of short term impacts, depending on such factors as the length of the alternative (longer alternatives would be constructed over a longer period of time); whether the alternative consists of widening of existing roadway or construction on new alignment (new alignment alternatives could take longer to construct), and the proportion of the alternative consisting of roadway, bridges, and tunnels (complex structures such as bridges and tunnels will require longer construction time). The Preferred Alternative is the shortest of the retained build alternatives in length, consists of widening existing roadway (no new alignment), and contains the fewest complex structures.

Furthermore, if construction occurred in OISs, it would affect how short term impacts occur. If the OISs of a Preferred Alternative are implemented sequentially without interruption, the duration of impact would be continuous. However, if there are gaps in OIS implementation, then multiple periods of short-term impacts would be separated by periods of no short-term impact.

Gains

An increase in employment and job opportunities for construction workers, suppliers, and inspectors would result during construction of a Build Alternative. In addition, short-term employment, use of materials to construct the improvements, and purchases of goods and services generated by construction could create a short-term improvement in the local economy that would diminish once the construction is completed. Workers who live in the region may fill these new positions or it is possible that people may move to the area as a result of the job opportunities created by the study. The concentration of workers within the area would stimulate the local economy by increasing business at area commercial and retail establishments. Increased sales tax would be derived from the commercial sales and from the sales of materials required for construction.

Losses

When construction is complete the positions created by the study may be eliminated. As a result of this job loss some residents may move in search of work or may remain in the area and file for unemployment

benefits; both scenarios would have a negative effect on the local economy. Sales tax revenues would also decrease as a result.

During construction detours may be required, rerouting travelers to other area roadways. Some travelers may choose to take alternate routes to avoid construction areas and further delays. The use of alternate routes may increase fossil fuel usage and could result in loss of business for commercial establishments thereby lowering sales tax revenues. Rerouting may lead to increased congestion and delays on the detour routes. There may be access modifications during construction.

New roadway alignments, materials storage areas, and movement of construction vehicles may result in the removal of existing vegetation. A temporary increase in soil disruption, air quality, and noise is expected. Water resources would also be needed for construction activities including mixing aggregate materials, road wetting, and landscaping.

3.16.2 Long-Term Impacts

Gains

The long-term benefits of the implementation of the study would remain for the duration of the facility's life. The increased capacity in the Study Area Corridors and reduced traffic congestion would result in more efficient use of fossil fuels. Improved transit access and regional accessibility would result in quicker trips and commutes for drivers. Enhanced emergency evacuation capability and decreased response time for emergency services would provide for better security and increased safety in the region. Reducing traffic on local roadways would result in decreased noise levels and air pollution along these roadways. The decrease in traffic along area roadways would also improve access to the existing businesses, port facilities, and military installations along these routes. These effects would result in an enhanced overall environment for the communities along these roadways.

Losses

The implementation of the study would require permanent conversion of property to transportation uses. Real estate taxes paid of those properties would be eliminated. Any commercial properties that are displaced by the study may result in the loss of employment at those locations. These long-term loses may be offset by areas adjacent to the improvements that experience induced growth.

3.17 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

This section has been prepared in accordance with 40 CFR 1502.16. The construction of any of the Build Alternatives, including the Preferred Alternative, would result in the commitment of natural, physical, and financial resources that would be irreversible and irretrievable.

Land used in the construction of the proposed facility is considered an irreversible commitment during the time period that the land is used for a transportation facility. However, if a greater need arises for use of the land or if the transportation facility is no longer needed, the land can be converted to another use. At present, it is not anticipated such a conversion would ever be necessary or desirable.

Significant amounts of fossil fuels, labor and highway construction materials would be irretrievably expended for the construction of any of the Build Alternatives or the Preferred Alternative. Anticipated construction materials may include aggregates, asphalt, bituminous pavement, cement, gravel, and sand.

Concrete and steel would be required for the bridges, tunnels, and other structures including retaining walls. Fuel, electricity, and labor required to manufacture, transport and install these materials would be irretrievably lost. As of the time of this document these construction materials are not in short supply and their use would not have an adverse effect upon the continued availability of these resources.

Another consideration is the loss of real estate/land which would result in the loss of tax revenues to the counties and cities. As described in **Section 3.1**, the Build Alternatives would require between 28 and 345 acres of land to be converted to transportation use (depending on the alternative). The Preferred Alternative would require the conversion of approximately 8 acres of land. Due to the relative sizes of the taxing entities, it has been determined that the losses incurred as a result of the implementation of a Build Alternative or the Preferred Alternative would not have long-term adverse effects to the respective tax bases.

Construction of a Build Alternative or the Preferred Alternative would also require a substantial expenditure of both state and federal funds, which are not retrievable. In addition to the costs of construction and right-of-way, costs would increase for the maintenance of transportation facilities, such as the roadway, bridges, tunnels, signs and markers, electrical systems, and stormwater facilities.

The commitment of these resources is based on the concept that residents in the immediate area, region, and state would benefit from the improved quality of the transportation system. These benefits would consist of reduced congestion and improved accessibility, as described in **Chapters 1 and 2** of this Final SEIS, which are expected to outweigh the commitment of these irreversible and irretrievable resources.