US ROUTE 460 FINAL SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT

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PREPARED BY:

VDOT Virginia Department of Transportation

U.S. Department of Transportation Federal Highway Administration

US Army Corps of Engineers ®

ROUTE 460 PROJECT SOUTHEAST VIRGINIA
PRINCE GEORGE, SUSSEX, SURRY, SOUTHAMPTON
AND ISLE OF WIGHT COUNTIES AND THE CITY OF SUFFOLK
FINAL SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT

Submitted Pursuant to:
42 U.S.C. 4332(2)(c) and 49 U.S.C. 303

Submitted by the:
U.S. DEPARTMENT OF TRANSPORTATION FEDERAL HIGHWAY ADMINISTRATION
and the
U.S. ARMY CORPS OF ENGINEERS
and the
VIRGINIA DEPARTMENT OF TRANSPORTATION

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Date of Approval

Charles A. Kilpatrick, P.E.
Commissioner
Virginia Department of Transportation

June 17, 2016
Date of Approval

for Irene Rico
Division Administrator
Federal Highway Administration

09 Jun 2016
Date of Approval

Jason E. Kelly, P.M.P
Colonel, U.S. Army
Commanding
U.S. Army Corps of Engineers, Norfolk District

The following persons may be contacted for additional information regarding this document:

Mr. Edward Sundra
Federal Highway Administration
400 North 8th Street, Suite 750
Richmond, Virginia 23219-4825
(804) 775-3320

Ms. Angel Deem
Virginia Department of Transportation
1401 East Broad Street
Richmond, Virginia 23219
(804) 371-6756

Ms. Alice Allen-Grimes
U.S. Army Corps of Engineers
Regulatory Branch
803 Front Street
Norfolk, Virginia 23510-1096
(757) 201-7219

Cooperating Agency: Environmental Protection Agency

The study analyzes transportation needs along the Route 460 corridor from the intersection of Route 460 and I-295 in Prince George County to the interchange of Route 460 and Route 58 along the Suffolk Bypass. This Final Supplemental Environmental Impact Statement identifies the Preferred Alternative, which includes proposed transportation improvements between approximately one mile west of Zuni to the Route 460 / Route 58 interchange in Suffolk.

A Federal agency may publish a notice in the Federal Register, pursuant to 23 USC §139(l), indicating that one or more Federal agencies have taken final actions on permits, licenses, or approvals for a transportation project. If such notice is published, claims seeking judicial review of those Federal agency actions will be barred unless such claims are filed within 150 days after the date of publication of the notices, or within such shorter time period as is specified in the Federal laws pursuant to which judicial review of the Federal agency action is allowed. If no notice is published, then the periods of time that otherwise are provide by the Federal laws governing such claims will apply.

EXECUTIVE SUMMARY

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This Supplemental Environmental Impact Statement (SEIS) has been prepared pursuant to 23 CFR §771.130 and 40 CFR §1502.9(c), because of new information and circumstances relevant to the federal action that may result in significant environmental impacts to wetlands, streams and water quality not evaluated in the approved Final Environmental Impact Statement (FEIS).

ES.1 STUDY DESCRIPTION AND LOCATION

The Virginia Department of Transportation (VDOT), in cooperation with the Federal Highway Administration (FHWA) and the United States Army Corps of Engineers (USACE) as joint lead federal agencies, has evaluated options for highway transportation improvements along the existing U.S. Route 460 (Route 460) corridor between Interstate 295 (I-295) in Prince George County and Holland Road (Route 58) in the City of Suffolk, Virginia.

Considerations for improvements along the Route 460 corridor have a lengthy history and were originally included as a part of several regional alternatives that were identified in the *TransAmerica Transportation Corridor Study* (1992). The east-west TransAmerica Transportation Corridor was identified as a High Priority Corridor in the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 (P.L. 102-240). Additional study and documentation pursuant to the National Environmental Policy Act (NEPA) and associated actions taken on improvements evaluated in the corridor have included the following:

- 2003, July: FHWA issued a Notice of Intent (NOI) to prepare an Environmental Impact Statement, to contribute to the east-west *TransAmerica Transportation Corridor Study*, and to evaluate highway improvements between the Route 58 Bypass in Suffolk and Interstate 295 near Petersburg (78 Fed. Reg. 127, 2003)
- 2005, May: Draft Environmental Impact Statement (DEIS) issued, evaluating a No Build Alternative, a Transportation System Management (TSM) Alternative, and three Candidate Build Alternatives (CBAs)
- 2005, July: Pubic Hearings held to solicit public feedback on the DEIS
- 2005, November: Commonwealth Transportation Board (CTB) selected a new location alternative south of existing Route 460, following roughly parallel to it for the entire length, with an alignment shift in Isle of Wight County (referred to as Modified CBA 1)
- 2008, June: FEIS issued to analyze the environmental consequences of Modified CBA 1
- 2008, September: FHWA issued a Record of Decision (ROD), selecting Modified CBA 1, a 53-mile long, four-lane, limited access freeway
- 2012, November: FHWA completed a re-evaluation under NEPA for the consideration of funding the project through the implementation of tolls and concluded that a Supplemental Environmental Impact Statement (SEIS) was not warranted
- 2012, December: VDOT executed a comprehensive agreement with the 460 Mobility Partners to deliver the project for 1.4 billion dollars
- 2013, December: FHWA and the USACE issued NOIs to prepare an SEIS because of new information with a bearing on the environmental consequences, including aquatic resource impacts

Further detail on the project background and history are included in **Chapter 1.0** and **2.0** of this Final SEIS.

In September 2014, the Draft SEIS was issued to analyze five Build Alternatives and a No Build Alternative. Following the publication of the Draft SEIS, VDOT determined that none of the five Build Alternatives evaluated over the extent of the study corridor would be viable options based on public comments that were received, input from the resource and regulatory agencies regarding the estimated environmental impacts, including potential Council of Environmental Quality (CEQ) referral, and the cost opinions that had been developed. However, in addition to the Draft SEIS supporting the ability to select one of the five alternatives studied or the No Build Alternative [1], it also supported combining sections of those alternatives, including the No Build Alternative, to form an alternative not individually evaluated as a standalone alternative in the Draft SEIS.

As a result, VDOT carefully reconsidered each of the Draft SEIS alternatives – in whole, in parts, and in hybrid combination with one another – in order to identify a single alternative that would sufficiently address the identified project Purpose and Need, while minimizing environmental impacts and providing a cost effective project. VDOT, in close coordination with FHWA, developed a Preferred Alternative that would consist of a combination of alternatives evaluated in the Draft SEIS, including the No Build Alternative and Build Alternatives 4, 2N, 3, and 1 (from west to east). This FHWA/VDOT Preferred Alternative consists of implementing the No Build Alternative between I-295 and one mile west of Zuni, upgrading the existing Route 460 between one mile west of Zuni and two miles west of Windsor, and constructing a new four-lane divided highway from west of Windsor to a new Route 460/Route 58 interchange in Suffolk.

In February 2015, the CTB approved the location for the Route 460 corridor improvements consistent with the FHWA/VDOT Preferred Alternative. Additionally, the USACE stated in January 2015[2] that it did not find reason to disagree with the assessment that FHWA/VDOT's Preferred Alternative appears to be the Least Environmentally Damaging Practicable Alternative (LEDPA), noting that the USACE comments do not constitute a final LEDPA determination or indication of a permit decision (Note: the Preferred Alternative identified in tables and figures throughout the Final SEIS and Technical Reports refers to the FHWA/VDOT Preferred Alternative).

Prepared in accordance with the implementing regulations of the NEPA at 23 CFR §771.130 and 40 CFR §1502.9(c), the Final SEIS addresses public and agency comments received on the September 2014 Draft SEIS, documents the FHWA and VDOT identified Preferred Alternative and the updated analysis associated with the FHWA/VDOT Preferred Alternative, and documents the action of the CTB. All technical reports and memoranda referenced in the Final SEIS are available for review on VDOT's study website at: **www.route460project.org**.

A permit is required from USACE for the discharge of fill material into waters of the United States in conjunction with the construction of the Route 460 Project. The USACE is jointly preparing this document in support of its permit review process and public interest review.

[1] The No Build Alternative includes all planned transportation improvements in the study area that have been programmed for construction and adopted for implementation by 2040, as identified in the VDOT Six Year Improvement Program (SYIP).
[2] Olsen, Colonel Paul B. Letter to Aubrey Lane, Jr. 9 Jan. 2015. Norfolk, Virginia.

ES.2 PURPOSE AND NEED

The purpose of the improvements to the Route 460 corridor is to construct a facility that is consistent with the functional classification[3] of the corridor, sufficiently addresses safety, mobility, and evacuation needs, and sufficiently accommodates freight traffic along the Route 460 corridor between Petersburg and Suffolk, Virginia.

The following needs have been identified for the project:

- Address roadway deficiencies: Route 460 was designed and constructed using geometric standards that are now outdated.
- Improve safety: Fatality rates for Route 460 are higher than other comparable rural roadways in Virginia.
- Accommodate increasing freight shipments: Truck percentages for Route 460 are higher than national averages for rural roads with similar functional classification, and are forecasted to grow due to expansions at the Port of Virginia.
- Reduce travel delay: Growing future traffic volumes will experience increased travel delays on Route 460 due to capacity limitations at traffic signals and the current design deficiencies.
- Provide adequate emergency evacuation capability: Route 460 is a designated hurricane evacuation route for Southside Hampton Roads communities, yet during recent events, the road was closed due to effects caused by these storms.
- Improve strategic military connectivity: Route 460 is a designated part of the Strategic Highway Network (STRAHNET) by the Department of Defense (DOD) and FHWA.
- Support local economic development plans: In addition to statewide and regional economic development needs, jurisdictions along the Route 460 study area have identified economic development priorities related to transportation improvements.

ES.3 ALTERNATIVES

Regulations for the implementation of NEPA require that the project sponsors consider a reasonable range of alternatives prior to making any decisions to proceed with a particular course of action (40 CFR § 1505.1). The VDOT/FHWA Preferred Alternative currently being considered in this Final SEIS is the result of efforts that have occurred over the decade-long history of the Route 460 Location Study.

The alternatives carried forward for evaluation in the Draft SEIS and this Final SEIS evolved through these previous efforts and were formulated based on a comprehensive development process that incorporated input from the public as well as coordination with local, state, and federal agencies. This Executive Summary briefly discusses the previous efforts, followed by a discussion of the alternatives analysis and evaluation processes that have contributed to the development and selection of the FHWA/VDOT Preferred Alternative presently under study. A more detailed summary and full detail on alternatives development and alternatives eliminated from detailed evaluation are provided in ***Chapter 2.0*** of this Final SEIS and in the ***Supplemental Alternatives Technical Report*** (VDOT, 2016e).

[3] Functional classification is the process by which streets and highways are grouped into classes (i.e. arterial, collector, local), or systems, according to the character of traffic service that they are intended to provide (e.g. mobility and access). Arterials are intended to provide a high level of mobility while providing a low level of access to adjoining properties. In contrast, local roadways are intended to provide a high level of access to adjoining properties while providing a low level of mobility.

ES.3.1 Inventory Corridor and Design Corridor

To identify resources along the Build Alternatives analyzed in the Draft SEIS, a 500-foot wide Inventory Corridor was developed to identify resources within a reasonable proximity of each alignment. In order to estimate impacts and compare alternatives, conceptual designs and typical sections were applied to each Build Alternative in the Draft SEIS to develop a Design Corridor to represent the likely "footprint" for each alternative. The reported impacts in the Draft SEIS were based upon the Design Corridor, which included roadway width, proposed right-of-way, and construction limits.

Design and engineering were advanced in order to develop the permit application for the FHWA/VDOT Preferred Alternative. As a result, the planning level design associated with the Draft SEIS Design Corridor assumptions for the FHWA/VDOT Preferred Alternative was refined to more accurately reflect the anticipated impacts of the project, known as the Limits of Disturbance (LOD). The typical sections and Design Corridor assumptions were refined to include both temporary and permanent impacts, including stormwater management facilities and construction access. To the extent practicable, the LOD was developed to avoid and minimize impacts to resources, including wetlands and streams. This LOD has been used to calculate predicted impacts of the FHWA/VDOT Preferred Alternative as discussed in detail in **Chapter 3.0**.

ES.3.2 FHWA/VDOT Preferred Alternative Development

In **Section 2.3.6** of the Draft SEIS, the public was alerted to the possibility that hybrid alternatives could be considered and one advanced as the preferred alternative. Following the publication of the Draft SEIS, VDOT determined that none of the five Build Alternatives evaluated over the extent of the study corridor would be viable options based on public comments that were received, input from the resource and regulatory agencies regarding the estimated environmental impacts including potential CEQ referral, and the cost opinions that had been developed. In order to identify a single alternative that was less impactful, as well as less costly, while sufficiently addressing the Purpose and Need, VDOT explored a combination of segments from the Draft SEIS alternatives in various configurations to develop hybrid alternatives. The goal of the hybrid development was to arrive at a recommendation for a preferred alternative that could be considered the LEDPA while sufficiently addressing the project's Purpose and Need and providing a cost effective solution. Following the development of initial hybrids, as described below, further refinement and modifications were analyzed and evaluated in an effort to identify FHWA/VDOT's recommended Preferred Alternative.

While developing and analyzing theses hybrids, consideration was given to the viability of tolling. As the hybrids were further refined, tolling was determined not to be a viable option as the hybrid combinations and configurations considered included variations of tolled and untolled alternatives from the Draft SEIS, including improvements along existing Route 460 where tolling would be impractical due to lack of limited access. For the areas that would be limited access, the revenue anticipated to be generated by the facility was expected to be insufficient to cover the cost of installation, operation, and maintenance of the required tolling infrastructure and equipment. As a result, tolling is not being considered for the FHWA/VDOT Preferred Alternative.

VDOT's development of initial hybrids went through many iterations starting with the development of end-to-end combinations and/or spot improvements along the length of the study corridor. VDOT further refined the evaluation of hybrid alternatives, by exploring smaller portions of the initial hybrids considered that would better balance impacts and cost, while sufficiently satisfying the Purpose and Need. Through this evaluation, the following were identified as key improvements necessary for addressing the Purpose

and Need, even if these improvements involved a hybrid alternative less than the full length of the Route 460 corridor.

- Improvements that meet current design standards are needed along Route 460 at the Blackwater River to address longstanding flooding issues which relate to the safety, emergency evacuation, and roadway deficiency elements of the Purpose and Need.
- Improvements are needed at the Route 58/Route 460 interchange to provide efficient high-speed traffic movements between the two facilities. The Purpose and Need elements related to travel time, freight mobility, military connectivity, and emergency evacuation need to be addressed at this interchange.
- Improvements to the eastern portion of the corridor are needed as this area has the largest number of conflict points compared to the rest of the corridor. The Purpose and Need elements related to safety would be addressed and better realized with improvements to the eastern portion of the corridor.

Based on the identification of these key components necessary for addressing the Purpose and Need, geographic limits for the hybrid alternative were refined within the eastern portion of the study corridor, where these key project components were focused and the elements of need had been demonstrated in the Draft SEIS as more pronounced. In developing refined hybrids, it was important to consider opportunities to minimize environmental impacts, such as displacements and aquatic resources, and costs when comparing the refined hybrids to the Draft SEIS alternatives and the initial hybrids. Various combinations were compared based upon anticipated wetland impacts, number of displacements, and estimated cost. These hybrids generally fell into two groups based on the section between east of Windsor and Suffolk: those that remained on the existing Route 460 with no new interchange at Route 58, and those that were on new location south of Route 460 with a new interchange.

Of these groups of refined hybrids, Refined Hybrid 11 was selected from the first group (remaining on existing Route 460 east of Windsor), due to the potential for reduction in wetland impacts, as well as cost. From the second group (new location east of Windsor along the Draft SEIS Alternative 3 alignment with a new interchange), Refined Hybrid 17 was selected for continued evaluation, because it adequately addressed the key project elements and Purpose and Need, while providing a cost effective solution that balanced anticipated wetland impacts and displacements. In addition to considering the key factors outlined above, the practicability of each hybrid was examined. Following is a brief description of the two refined hybrids selected for consideration.

Refined Hybrid 11 – the existing Route 460 would be upgraded to a four-lane divided highway from west of Zuni to west of Windsor and from east of Windsor to Route 58. From west of Windsor to east of Windsor a new four-lane grade separated divided highway would be constructed to run north around Windsor (i.e. bypass). This refined hybrid is a combination of Draft SEIS Alternatives 4 and 2N.

Refined Hybrid 17 – the existing Route 460 would be upgraded to a four-lane divided highway from west of Zuni to west of Windsor. From west of Windsor to Route 58 a new four-lane, grade separated, divided highway would be constructed. This would include a new system to system interchange with free-flow ramps at Route 58. The new highway alignment would run north around Windsor (i.e. bypass) and then south of the existing Route 460 from east of Windsor to Route 58. This refined hybrid is a combination of Draft SEIS Alternatives 4, 2N, 3, and 1.

VDOT prepared a technical memorandum that compares the benefits of Refined Hybrids 11 and 17 (in the memorandum Refined Hybrid 11 is referenced as Hybrid X and Refined Hybrid 17 is referenced as Hybrid B). This memorandum is included in Appendix A of the ***Supplemental Alternatives Technical Report*** (VDOT, 2016e).

As a result of the comparative analyses, it was determined that Refined Hybrid 17 is the most effective improvement option for the 16 miles for which the improvements were considered; it best addresses the project's Purpose and Need, while balancing cost, displacements, and wetlands. VDOT also determined that Refined Hybrid 17 appears to be practicable. Refined Hybrid 17 yields the lowest corridor crash rate, maximum evacuation capacity, greatest travel time savings, and most effective new route for freight. Unlike Refined Hybrid 11, Refined Hybrid 17 offers an efficient high-speed through connection while maintaining local access. Refined Hybrid 17 also includes a free-flow direct connection from the new highway to existing Route 58. As a result, Refined Hybrid 17 was identified and selected as FHWA/VDOT's recommended Preferred Alternative.

ES.3.3 Approval of the FHWA/Preferred Alternative Location

In January 2015 the CTB was presented with FHWA's/VDOT's recommended Preferred Alternative, and in February 2015, the CTB passed a resolution approving FHWA's/VDOT's recommended Preferred Alternative as the location for the Route 460 corridor improvements. The resolution also officially rescinded the CTB's previous 2005 selection of a preferred alternative.

FHWA/VDOT met further with resource agencies and private property owners and, as a result, made further minor modifications to the FHWA/VDOT Preferred Alternative to reduce impacts to commercial operations, and properties and avoid and minimize impacts to wetlands and streams.

This Final SEIS provides detailed analysis of the FHWA/VDOT Preferred Alternative that meets the key components of the Purpose and Need of the project, as well as applicable design standards. Along the alignment, a variety of additional design elements and special items have been considered in refining the corridor improvements including interchanges, intersecting road overpasses, transitions between the existing road and bypasses, at-grade intersections, bridges, and roadway drainage enhancements to address flood prone areas. Specific details are discussed in ***Chapter 2.0*** of the Final SEIS and the ***Supplemental Alternatives Technical Report*** (VDOT, 2016e).

ES.3.4 Preliminary Costs

In support of the Final SEIS, preliminary cost opinions were developed to determine the anticipated project cost for the FHWA/VDOT Preferred Alternative and are presented in **Table ES.3-1**. Refer to **Appendix C** of the ***Supplemental Alternatives Technical Report*** (VDOT, 2016e) for the detailed documentation and supporting calculations for the Probable Opinion of Costs developed for each of the pay items, categories, and groups. Costs will be refined during future phases of project development as additional design information is developed.

Table ES.3-1: Cost Estimate for the FHWA/VDOT Preferred Alternative (Millions)

Description	FHWA/VDOT Preferred Alternative
Preliminary Engineering	$27
Construction[1,2,3]	$314
Right-of-Way & Relocations[4]	$22
Utilities[4]	$17
Environmental Mitigation[5]	$13
SUB-TOTAL (without Construction Contingency)	**$393**
Construction Contingency[6]	$55
TOTAL	**$448**

NOTES

1. Construction costs are based on VDOT Historical Bid Listings from February 2011 through March 2013.
2. Construction cost assumptions are detailed in the Alternatives Technical Report - Appendix B.
3. Construction cost is the sum of raw construction cost, mobilization cost, and construction engineering and inspection cost.
4. Right-of-Way and Utilities costs are detailed in the Supplemental Right-of-Way and Relocations Technical Report.
5. Environmental mitigation costs include Wetland, Stream, and Noise Impact Mitigation. Refer to Natural Resources Technical Report and the Noise Analysis Technical Report for cost methodology and assumptions.
6. Construction contingency assumed to be 20% of raw construction cost and is not applied to the Preliminary Engineering, Right-of-Way & Relocations, Utilities, or Environmental Mitigation costs.

ES.4 ENVIRONMENTAL CONSEQUENCES

Potential environmental consequences of the FHWA/VDOT Preferred Alternative were determined based on the anticipated LOD, which was generated based upon preliminary design. However, these assumptions are not based on detailed design and additional impacts to environmental resources may be identified, or further avoided and minimized, as the project development advances. **Table ES.4-1** illustrates a summary of potential project related impacts associated with the FHWA/VDOT Preferred Alternatives. Additional details on these resources and the potential impacts are provided in **Chapter 3.0** and the respective supporting technical studies.

Table ES.4-1: Summary of Potential Environmental Impacts within the Limit of Disturbance

Category	Element/Resource Assessed	Potential Impacts
Operational Characteristics	Length (Miles)	16
	Proposed New Interchanges/Intersections (No.)	3
	Railroad Crossings (No.)	0
	Tolling Considered (Y/N)	N
Relocations	Residential Displacements (No.)	21
	Business Displacements (No.)	6
	Farm Displacements (No.)	1
	Non-Profit Displacements (No.)	1
Socioeconomics	Minority Populations (% Population)	46%
	Low Income Populations (% Population)	0%
	Displacements within Minority Census Blocks (No.)	7
	Displacements of Community Facilities (No.)	1
Land Use	Conversion of Land (Acres)	507
	Prime Farmlands Converted (Acres)	265
	Farmland of Statewide Importance (Acres)	56
	Agricultural/Forestal Districts (Acres)	0
	Public and Private Recreational Resources (No.)	1

Category	Element/Resource Assessed	Potential Impacts
Natural Resources	Forested Habitat/Wildlife Corridors (Acres/No.)	162.7/3
	Regional Biodiversity (Acres of Conservation Lands)	5.32
	Threatened and Endangered Species or Potential Habitat (No.) *	6
	Floodplains (Acres)	11
	State Wild and Scenic Rivers (Linear Feet)	500
	Streams (No. of Crossings)	53
	Stream Impacts (linear feet)	6,874
	Stream Impacts – Pipe Replacement (linear feet)	789
	Jurisdictional Ditch	9,339
	Permanent Impacts to Vegetated Wetlands (cut/fill, bridge conversion, right-of-way clearing, and secondary) (Acres)	39.77
	Open Water (Acres)	3.93
	Temporary Impacts to Vegetated Wetlands / Open Water (Acres)	1.31 / 0.12
Hazardous Materials	Open Petroleum Release Sites of Concern (No.)	0
Air Quality	Violations of National Ambient Air Quality Standards (No.)	0
Noise	Noise Receptors Affected (No.)	292
Historic Properties	Listed or Eligible Architectural Resources (No. of Properties)	0
	Listed / Potentially Eligible Archaeological Resources (No. of Sites)	0 / 3
Recreational Resources	Properties Impacted	1
	Section 4(f) Properties Used	0
Visual Quality	High Visual Quality Effects (No.)	0
Cost	Project Cost (Million $) **	$448

* There is habitat present which appears to meet the species' requirements and the study area is within the known range of the species for the following species: northern long-eared bat, barking tree frog, Mabee's salamander, little brown bat, tri-colored bat, and bald eagle.
** Includes construction contingency at an assumed 20% of raw construction cost.

ES.5 INDIRECT EFFECTS AND CUMULATIVE IMPACTS

ES.5.1 Indirect Effects

Indirect effects are those effects which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. One particularly applicable category of indirect effects are those which result from induced growth and subsequent changes in the pattern of land use. Other indirect effects may include physical, biological, or socioeconomic alteration of the behavior and functioning of the affected environment that are a result of and/or lead to changes in "population density or growth rate, and related effects on air and water and other natural systems, including ecosystems" (40 CFR 1508(a)).

The FHWA/VDOT Preferred Alternative would pass through residential, commercial, and agricultural portions of the study area, resulting in property impacts, noise impacts, and visual effects, as well as community impacts such as disruption and fragmentation, which in turn may lead to land use changes. These direct impacts could have indirect effects. Three interchange/intersection locations were identified as having the potential for induced growth associated with the FHWA/VDOT Preferred Alternative because they represent new or modified interchange/intersections due to the project – Route 460 intersection (west of Windsor), Route 460 interchange (east of Windsor), and Route 58 interchange. Within the induced development zone of influence developed for these interchanges/intersections and feeder roads, agricultural

lands are most susceptible to being converted to other uses from induced growth because they are the least protected.

The FHWA/VDOT Preferred Alternative, between west of Windsor and Route 58 would introduce a new roadway element into the area that would lead to increased noise levels, fragmentation of existing properties, moderate visual impacts, and short-term construction impacts, such as noise and dust. The region would have a new, limited access roadway that would connect to more developed areas east of the study area. The introduction of a limited access four lane roadway would fragment several large tract parcels that may interfere with certain farming operations, lead nearby property owners to opt to move away, or attract new landowners to the corridor.

Indirect impacts to natural communities, wildlife, and biodiversity include, but are not limited to, habitat fragmentation, increased pollution from traffic accidents and oil spills, animal-vehicle collisions, and introduction of invasive species by equipment and vehicles traveling from other locations. The proposed project may indirectly affect threatened and endangered species by altering landscape habitat, such as increased noise, degradation of water quality, and fragmentation of habitat corridors. The primary indirect effect associated with the introduction of pollutants from roadway runoff is the degradation of nearby terrestrial and aquatic habitat from increased deposition of sediments or contamination from chemical pollutants in the form of heavy metals, inorganic salts, asbestos, and petroleum products and their byproducts, all of which can be carried downstream.

The disruption or alteration of natural processes leads to the indirect effect of changing hydrologic flow dynamics through the local natural communities and sometimes altering these dynamics at the ecosystem level such that the ability of the system to maintain itself is altered. Some of the potential effects that may occur as a result of natural processes in the wetlands of the study area include changes to floodwater storage capacity and retention times, vegetative community composition and structure, nutrient cycling, and aquatic life movement. Indirect impacts to wetlands and surface waters caused by roadway construction may include blocking water flow, increasing or decreasing water volume, dust from construction activities, habitat fragmentation, noise, vibration associated with construction, shading, introduction of invasive species, and disturbance due to temporary construction staging.

The centerline of the alignment was located to avoid and minimize impacts to important resources, including both socioeconomic and natural resources. Beyond this effort, further mitigation strategies have been included in this NEPA analysis. Consideration has been given to avoiding, minimizing, and mitigating reasonably foreseeable indirect impacts during design, permitting, and construction activities.

Because all roadway crossings would utilize structures designed to adequately pass design floods and accommodate passage of aquatic organisms, and the roadway project would incorporate stormwater Best Management Practices (BMPs) to mitigate pollutant runoff, it is not anticipated that the indirect effects would extend very far downstream from the crossings.

ES.5.2 Cumulative Impacts

Cumulative impacts are defined 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 impacts can result from individually minor but collectively significant actions taking place over a period of time” (40 CFR §1508.7).

Past and present actions have shaped the current state of socioeconomic, natural, and cultural resources within the study area, and future actions will continue to shape these resources irrespective of this project. Historic forestry and farming activities have had the greatest impact on the region. These actions led to the degradation and/or loss of the natural resources that existed when colonists settled the region and have continued to the present. These actions not only impacted the region but in many respects, the effects of those impacts continue to the present day such that the environment has not returned to its original state.

Initially, there was a great deal of growth along the railroad corridor. As the region grew, many of the properties that are now considered historic were constructed. The region's population grew as the natural resource-based economy expanded. In more recent years, the natural resource-based economy has slowed. Virginia's forest products industry has been particularly hard hit, losing over 19,000 jobs state-wide from 2006 to 2011. The severe recession from 2007 to 2009 and the housing market downturn caused rapid contraction in demand for wood products used in housing construction, furniture, and related products. The farming industry has faced pressure from international competition and from domestic competition from larger farms. These downturns have resulted in a loss of jobs in the region, but also less frequent and intense impacts to the natural environment. However, extensive agricultural activities continue throughout the study area.

While the FHWA/VDOT Preferred Alternative would introduce measurable impacts to natural and socioeconomic resources, impacts to wetlands and streams under the FHWA/VDOT Preferred Alternative would represent less than one percent of the total wetlands and streams that exist in the substantially human-altered environment of the study area. The incremental cumulative impacts of the FHWA/VDOT Preferred Alternative to the region's resources would be minimal in relation to past agriculture and forestry activities. Present and reasonably foreseeable future actions such as economic development and continuing agriculture and forestry activities are expected to cumulatively impact resources far less than past actions have.

ES.6 PUBLIC AND AGENCY COORDINATION

VDOT, in cooperation with FHWA and USACE, has coordinated extensively with local, state, and federal entities as well as engaged in an extensive public involvement effort, throughout the Route 460 Location Study project, in order to provide information and solicit feedback. Agencies were contacted early in the study and asked to assist in determining and clarifying issues relative to the study. The public was notified about the study and invited to provide comments about transportation needs, potential alternative solutions, and environmental issues within the study area. The agency and public feedback received in response to these coordination efforts were used in the development of the purpose and need, potential alternatives, and environmental issues and methodologies included in this Final SEIS.

Pursuant to 40 CFR §1501.7, FHWA and USACE issued separate NOIs in the Federal Register in December 2013. Upon publication of the NOIs, the scoping process was initiated by inviting interested individuals, organizations, and agencies to provide their ideas, comments and concerns regarding proposed transportation solutions within the study area. The following agencies provided their comments and feedback during the 30-day comment period that followed the issuance of the NOIs:

- U.S. Environmental Protection Agency (EPA);
- U.S. Fish and Wildlife Service (USFWS);
- Virginia Department of Forestry;

- Virginia Department of Environmental Quality (DEQ), Office of Environmental Impact Review; and,
- Virginia Department of Conservation and Recreation (DCR), Virginia Natural Heritage Program.

In accordance with 40 CFR §1501.6 of the CEQ Regulations for Implementing the Procedural Provisions of NEPA, FHWA and USACE invited the EPA and USFWS in April 2014 to participate as cooperating agencies, as they were recognized in the 2005 DEIS. The USFWS respectfully declined the invitation to participate as a cooperating agency, but agreed to assist as a participating agency based on the project's potential impacts on threatened and endangered species within the study area.

The EPA accepted the invitation to participate as a cooperating agency and has provided meaningful feedback and guidance in the development of the purpose and need as well as project alternatives, analysis of indirect and cumulative effects, identification of minority populations, photointerpretation and identification of wetlands and their functions, and documentation of natural resource impacts. EPA also participated in numerous study team meetings that were held throughout the development of the SEIS. VDEQ also participated on the study team and provided input into avoidance and minimization, wetlands identification and assessment, and the development of an appropriate mitigation plan for wetlands and streams.

Pursuant to 23 CFR §771.111(d), other local, state, regional, and federal agencies served as participating agencies over the course of the environmental study, providing insight and advice regarding the purpose and need, potential alternatives, environmental issues, and study methodologies. Agencies, such as the Natural Resources Conservation Service (NRCS) and the Port of Virginia, and local governments were contacted early in the study and identified issues, provided information and answered questions relative to the study.

In addition to the feedback solicited from local, state, and federal agencies following the issuance of the NOIs, many members of the public offered input during the 30-day Federal Register comment period. In total, 60 substantive comments were received during this time. These public comments, as well as the agency input previously described are included in the Draft SEIS and were considered in the development of this SEIS.

During July 2014, VDOT conducted five town hall meetings in communities along the Route 460 corridor between Suffolk and Petersburg to provide residents with updated information and an opportunity to discuss the study. The Draft SEIS was published in September 2014 and presented at three Location Public Hearings that took place in October 2014. A total of 521 comments were submitted during the public hearing, online, or by mail. These comments, and associated FHWA/USACE/VDOT responses, are included in **Appendix D: Draft SEIS Comments and Responses**.

During May 2015, VDOT conducted two public meetings to inform the public on the FHWA/VDOT Preferred Alternative approved by the CTB and the anticipated next steps for the project.

The findings of this Final SEIS are being made available publicly. Comments and input from the public, local governments, and state and federal resource and regulatory agencies will be considered before any further decisions are made on the project.

ES.7 TRAFFIC ANALYSIS

The need to address congestion is not a component of the Purpose and Need for this project, as it is not a systemic problem along the existing Route 460 corridor; however, several intersections do have poor levels of service (LOS) and would benefit from improvements. Following is a summary of the traffic analysis, which was updated to evaluate the FHWA/VDOT Preferred Alternative. Detailed traffic analyses are documented in the ***Supplemental Traffic and Transportation Technical Report*** (VDOT, 2016h).

The traffic analysis considered the area between Ivor and Suffolk; Ivor was selected because the improvements extend past Zuni and the next major intersection on existing Route 460 is located in Ivor. Using east of Windsor as a representative location, in the No Build scenario the average weekday daily traffic (AWDT) on Route 460 is expected to increase from 14,900 vehicles per day (vpd) in 2013 to 25,800 vpd by 2040, an increase of 10,900 vpd or 75 percent. With the FHWA/VDOT Preferred Alternative, the AWDT on Route 460 (existing and new Route 460 combined) in 2040 would be 34,900, which is 20,000 vpd (134 percent) higher than existing. It is also 9,100 vpd (35 percent) higher than the 2040 No Build scenario volume. This illustrates that the proposed project is forecasted to attract considerable additional traffic to the corridor compared to the No Build scenario.

Two useful measures of the effect of a proposed transportation improvement are the change in vehicle miles traveled (VMT) and vehicle hours traveled (VHT), both in the corridor and across the larger transportation system. The projected 2040 No Build VMT on existing Route 460 from one mile west of Zuni to Route 58 is 363,240 per day. With the FHWA/VDOT Preferred Alternative, the 2040 daily VMT on Route 460 is projected to increase to 506,250 (including both existing Route 460 and new Route 460). This is an increase of 143,010 VMT (39 percent), reflecting the increase in traffic attracted to the new Route 460. With regard to VHT on Route 460, the increase in traffic is offset by the increase in travel speeds. The result is that there is essentially no change in the 2040 daily VHT on Route 460 between the No Build scenario and the FHWA/VDOT Preferred Alternative, despite the increase in traffic volume.

On a regional level, the inclusion of the FHWA/VDOT Preferred Alternative in the Tidewater Superregional Model results in a 0.07 percent predicted increase in the multi-region daily VMT, and a predicted 0.26 percent decrease in the multi-region daily VHT. This is consistent with the expectation that some traffic would shift to use the improved Route 460 corridor because it is faster and would save time (reduced VHT) even though the travel distances could increase (increased VMT). The shift in traffic to Route 460 also reduces traffic (and therefore potential congestion) elsewhere in the system; for example, traffic is predicted to decrease on I-64 on the peninsula. The forecasted 0.26 percent reduction in daily VHT on I-64 from the travel model is equal to 7,810 hours per day. This yields over 2.8 million hours of saved travel time over a one-year period.

Capacity analyses were performed using the forecasted traffic volumes and truck percentages for the Build Year of 2040. A summary of all LOS is contained in **Chapter 2.0**, with further detail in the ***Supplemental Traffic and Transportation Technical Report*** (VDOT, 2016h).

ES.8 PREFERRED ALTERNATIVE'S ABILITY TO ADDRESS THE PURPOSE AND NEED

This section describes the ability of the FHWA/VDOT Preferred Alternative (which includes 16 miles of improvement and 36 miles of the No Build Alternative) to address the components of the Purpose and Need.

Address Roadway Deficiencies: Route 460 was designed and constructed using geometric standards that are now outdated. This substandard design in turn contributes to the other identified transportation needs of improving safety, reducing travel delays, accommodating the movement of increasing freight traffic, enhancing emergency evacuation and supporting military preparedness. The FHWA/VDOT Preferred Alternative includes upgrades and improvements for the 16 miles of the corridor that experience the most traffic conflicts that would meet current VDOT design standards and provide better traffic service as intended by the functional roadway classification. Specifically, the FHWA/VDOT Preferred Alternative would have appropriately sized lanes, shoulders, and clear zones for the 16-mile corridor. Additionally, the FHWA/VDOT Preferred Alternative would address flooding issues in Zuni, discussed in the preliminary flooding analysis and described in the Draft SEIS. Providing improvements to the FHWA/VDOT Preferred Alternative that address flooding enables the new roadway to adequately address the emergency evacuation component of the Purpose and Need at the Blackwater River.

Improve Safety: The FHWA/VDOT Preferred Alternative addresses several critical higher crash rate segments within the overall Petersburg to Suffolk corridor. In fact, 172 (45 percent) of the 380 reportable crashes from January 2010 to December 2012 in the overall corridor occurred in the approximately 16-mile segment that would be improved by the FHWA/VDOT Preferred Alternative. Furthermore, crash patterns on Route 460 within the study area over the three-year period serve to illustrate the design deficiencies present under existing conditions and the expected benefits of the FHWA/VDOT Preferred Alternative. Rear end and angle crashes, crashes with fixed objects off the road, and head-on crashes account for 80 percent of the total crashes in the corridor. These will be reduced by providing medians, turn-lanes, access control, and increased clear zones. To further evaluate the potential safety benefits of the FHWA/VDOT Preferred Alternative, a safety analysis was prepared for the corridor using Highway Safety Manual (HSM) methods. The predicted crash rate along this section in 2040 under the No Build was approximately 133 crashes per 100 million vehicle miles (100 MVM) traveled. The predicted crash rate in 2040 for the FHWA/VDOT Preferred Alternative was approximately 67 crashes per 100 MVM on the improved highway and approximately 117 crashes per 100 MVM on the existing highway for a combined rate of 78 crashes per 100 MVM. Thus the FHWA/VDOT Preferred Alternative would be anticipated to reduce overall crash rates by approximately 41 percent compared to the No Build Alternative along these 16 miles.

Reduce Travel Delays: In the No Build scenario, as traffic increases between 2013 and 2040 in the approximately 16-mile corridor, travel speeds will decrease. The predicted 2040 No Build travel time from the western project limit to the westbound Route 58 ramp terminals is 25 minutes, with an average speed of 37 mph. The FHWA/VDOT Preferred Alternative travel time from the western project limit to the ramps to/from Route 58 (on the new highway) is 18 minutes, with an average speed of 52 mph. Thus the FHWA/VDOT Preferred Alternative will decrease the travel time in this section by nearly seven minutes per vehicle. Travel time on the existing Route 460 would also decrease; travel time would be 22 minutes, with an average speed of 43 mph, a savings of three minutes. The weighted average travel time savings for all vehicles traveling the corridor in 2040 is approximately 6 minutes. Based on model outputs from the Tidewater Superregional Travel Demand Model, it is forecasted that the FHWA/VDOT Preferred Alternative could reduce regional travel times in 2040 by as much as 7,810 hours per day or 2.85 million hours per year. The FHWA/VDOT Preferred Alternative also provides two routes of connectivity between west of Windsor and Route 58. Therefore, if a major incident were to congest or close one route, traffic could shift to the other route.

Accommodate Freight Movement: Currently, Route 460 has been classified as a Gateway Freight Corridor and is the third highest gateway (I-64 is highest and Route 58 is second highest) for trucks entering and exiting Hampton Roads. The FHWA/VDOT Preferred Alternative will provide an opportunity to facilitate more efficient movement of truck traffic over the 16 miles of associated improvements by separating truck traffic from local traffic and limiting the number of intersections along the new portion of the alignment. The 2040 No Build scenario truck volume east of Ivor is forecasted to be 3,980 trucks per day (tpd). With the FHWA/VDOT Preferred Alternative this increases to 4,650 tpd, an increase of 670 tpd. West of Route 258, the increase is from 4,000 tpd in the No Build scenario to 4,920 tpd with the FHWA/VDOT Preferred Alternative with 4,420 tpd (90 percent) on the new Route 460 highway. Approximately half a mile west of the Route 460/58/13 overpass of Pruden Boulevard (west of Northfield Road), the 2040 prediction is for an increase from 3,730 tpd to 5,700 tpd, an increase of 1,970 tpd, with 81 percent of the trucks on the new Route 460 highway. The truck traffic in the corridor would benefit from the improved safety and travel time benefits discussed previously. The FHWA/VDOT Preferred Alternative offers further benefits by providing a direct high-speed free-flow connection between Route 58 and the new highway. This connection would simplify and speed access through the corridor.

Enhance Emergency Evacuation: Route 460 is a designated hurricane evacuation route for Southside Hampton Roads communities. Working with the Virginia Department of Emergency Management, VDOT evaluated the anticipated hurricane evacuation traffic flows and travel times both in the Route 460 corridor and within the larger Hampton Roads and Richmond regions, with and without the FHWA/VDOT Preferred Alternative improvements in place. With the FHWA/VDOT Preferred Alternative the Route 460 corridor was forecasted to serve 7,300 additional vehicles (approximately 14,750 people, an increase of 15.6 percent) over an approximately 25-hour hurricane evacuation event when compared to the No Build Alternative. Overall, the combined clearance times of the six highest volume evacuation routes, I-64 (including primary and reverse directions), Route 60, Route 10, Route 58, and Route 460, are predicted to decrease by over three percent. Specific to Route 460, the new corridor removes the constraint points at the existing Route 460 / Route 58 interchange and on Route 460 in downtown Windsor, which limit evacuation on the existing facility. With the removal of these constraint points the evacuation traffic can flow more smoothly all the way to Zuni. By removing the most limiting locations, overall evacuation movements during the peak times can increase. Prior to reaching Zuni, some traffic will use Route 258 and Route 10 to travel to the west. Thus there will be some dispersion along the route, reducing the amount of traffic that will travel to Zuni and Ivor and points west on Route 460. In addition to the increased capacity in the Route 460 corridor and the reduced corridor clearance times, the FHWA/VDOT Preferred Alternative also provides additional system redundancy and the ability to accommodate incidents during evacuations in the stretch of highway from Route 58 to west of Windsor. System redundancy can be very beneficial in emergency situations where vehicle breakdowns or other incidents may occur.

Support Military Preparedness: Route 460 is a designated part of the STRAHNET by the DOD and FHWA. The FHWA/VDOT Preferred Alternative would provide infrastructure improvements that would enhance connectivity to and from the DOD facilities in the Hampton Roads area, allowing for a more reliable and efficient deployment, enhancing the military's responsiveness to defense-important infrastructure at Virginia's ports. Additionally, the FHWA/VDOT Preferred Alternative would contribute to the resiliency of the STRAHNET due to the new roadway's proximity to military facilities and the mobility offered by its associated improvements.

Address Local Economic Development Goals: The FHWA/VDOT Preferred Alternative would address the comprehensive plans of Suffolk and Isle of Wight County for economic development. Both municipalities identify the area around the new 460 interchanges/intersections as growth areas. The Isle of Wight County plan acknowledges Route 460 as representing short- and long-term economic development potential for the community. Likewise, Suffolk's plan notes that investment in the Route 460 corridor is critical to the City's economic development and crucial to the City's access to regional markets. Additionally, the FHWA/VDOT Preferred Alternative, by improving traffic movement through and around the Town of Windsor and by providing an interchange of existing 460 with the new roadway east of Windsor in proximity to the planned industrial area, would provide access to the existing and planned expansion of the industrial area (Shirley T. Holland Intermodal Park), giving potential businesses access to freight routes and ports in Hampton Roads.

ES.9 FUTURE COORDINATION AND ACTIONS; OTHER LOCAL, STATE, AND FEDERAL ACTIONS AND PERMITS REQUIRED

ES.9.1 Least Environmentally Damaging Practicable Alternative

USACE will consider all available information, including but not limited to, information gathered during the NEPA process, information provided in the public comments, VDOT and/or FHWA input on technical aspects of the Preferred Alternative, the permit application, and public comments on the permit application, to make a final decision regarding the LEDPA, which is the only alternative that can be permitted in accordance with the 404(b)(1) Guidelines. An alternative is practicable where it is available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes. In determining whether to issue or deny a permit for the LEDPA, USACE will balance the benefits of the project versus the impacts.

ES.9.2 National Historic Preservation Act – Section 106 Compliance

The Programmatic Agreement (PA) among FHWA, VDOT, and the SHPO was signed on September 7, 2007. The PA sets forth guidance and directives designed to address and mitigate, if necessary, impacts of future actions on significant archaeological sites and remains in effect through September 7, 2012. Prior to the PA's expiration date, the Agreement was amended in 2012 to:

- Add new stipulations to address future design changes (Stipulation X);
- Authorize the Public Private Transportation Act (PPTA) Concessionaire to act on the VDOT's behalf to fulfill any VDOT's obligations under the Agreement;
- Coordinate with appropriate Virginia Indian tribes in replacement of the Virginia Council on Indians in previous stipulations of the Agreement; and,
- Amend the duration of the Agreement until August 27, 2017.

In November 2015, the agencies executed a second amendment to the PA. Amendment No. 2 acknowledges that, as a result of the Draft SEIS prepared in 2014, VDOT, in close coordination with FHWA, identified the present FHWA/VDOT Preferred Alternative for the Route 460 project. It also recognizes that, prior to completing the Draft SEIS, VDOT, in consultation with the SHPO and other consulting parties, completed efforts to identify buildings, structures, and non-archaeological sites, districts, and objects listed on or eligible for listing on the National Register of Historic Places (NRHP) within the APE of the FHWA/VDOT Preferred Alternative. Although Amendment No. 2 acknowledges that VDOT has not yet completed the efforts necessary to identify archaeological historic properties that might be affected by the FHWA/VDOT Preferred Alternative, it notes that existing PA Stipulation X established a process that VDOT will follow

to complete the identification of any archaeological properties potentially affected by future design changes, assess the effects of the FHWA/VDOT Preferred Alternative on those properties, and identify and implement appropriate treatment actions to address any adverse effects.

As the design of the FHWA/VDOT Preferred Alternative is refined further, VDOT will re-examine three archaeological sites potentially eligible for the NRHP to determine whether they are still located within the LOD for the FHWA/VDOT Preferred Alternative. If the sites will be directly impacted by project construction, in consultation with the SHPO and other parties, VDOT will follow the process outlined in Stipulation X of the Section 106 PA to conduct evaluation studies to conclusively establish their NRHP-eligibility, assess project effects on any sites determined to be eligible for the NRHP, and determine whether avoidance or minimization of any adverse effects is feasible and prudent. If adverse effects cannot be avoided, VDOT will follow the process described in Stipulation X to develop and implement appropriate treatment plans to mitigate the adverse effects. Extant information about the three sites indicates they would be chiefly important for their information potential, and VDOT would likely recommend to the SHPO that the adverse effects could be mitigated appropriately through archaeological data recovery in advance of project construction.

ES.9.3 Endangered Species Act – Section 7 Consultation

The potential impacts to threatened or endangered species resulting from the FHWA/VDOT Preferred Alternative have been avoided and minimized by conducting presence/absence surveys, identifying potential habitat, and incorporating design measures such as bridging, countersinking culverts, and reducing the roadway footprint and median width. In addition, temporary impacts will be further reduced through proper location and minimization of staging areas, construction access roads, and modifying construction techniques in valuable habitats.

VDOT has completed due diligence studies and coordination with the Virginia Department of Game and Inland Fisheries (DGIF), DCR, and USFWS. As a result of the implementation of the aforementioned conservation measures, coordination, and due diligence, no further action or coordination with USFWS, DGIF, or DCR is required. Additional detail can be referenced in **Chapter 3.0** and the ***Supplemental Natural Resources Technical Report*** (VDOT, 2016f).

ES.9.4 Metropolitan Planning Organization (MPO) Action

The Preferred Alternative falls within the planning area of the Hampton Roads Transportation Planning Organization (HRTPO). The HRTPO is responsible for ensuring compliance with federal planning laws and regulations as a prerequisite to using federal funds for transportation improvements in the area. Specifically, before FHWA can issue a ROD, the HRTPO will need to add the project to its constrained long range transportation plan and identify the funding for construction. Both state and federal revenues represent options for funding the FHWA/VDOT Preferred Alternative.

Before the HRTPO can adopt the amended long range transportation plan with the project included, it will have to initiate its public participation process. If, following public participation, the HRTPO adopts the amended plan FHWA will then be in a position to issue a ROD.

ES.9.5 FHWA/VDOT Continued Public and Agency Coordination

Prior to making any final decisions regarding the FHWA/VDOT Preferred Alternative, VDOT and FHWA will provide the public, local governments, and state and federal resource and regulatory agencies additional

opportunities to provide input and comment. Additional opportunities for public coordination that will occur include:

- Comment on this Final SEIS.
- During draft Six-Year Improvement Program (SYIP) public hearings.
  - The project must be scored under House Bill Two (HB2). HB2 requires major projects that would improve statewide corridors, like Route 460 to be scored based on an objective data-driven process. The CTB reviews and evaluates projects for inclusion into the draft SYIP and then seeks input through public hearings before approving SYIP updates.
- During additional public involvement outreach efforts, as determined necessary by FHWA, once a decision is made on funding.

Any comments received will be considered and addressed in the ROD, to be issued by FHWA. The ROD is the final step in the EIS process for FHWA and will:

- Confirm the FHWA/VDOT Preferred Alternative;
- Present the basis for FHWA's decision;
- Summarize all the alternatives considered; and
- Outline all commitments agreed upon during the NEPA process.

TABLE OF CONTENTS

TABLE OF CONTENTS

Chapter 1.0 PURPOSE OF AND NEED FOR ACTION 1-1
1.1 INTRODUCTION 1-1
1.2 PROJECT BACKGROUND 1-1
1.2.1 Legislative Background 1-2
1.2.2 Funding Background 1-2
1.2.3 Project Status 1-3
1.3 PURPOSE AND NEED ELEMENTS 1-3
1.3.1 Address Roadway Deficiencies 1-4
1.3.2 Improve Safety 1-6
1.3.3 Accommodate Increasing Freight Traffic 1-8
1.3.4 Reduce Travel Delays 1-11
1.3.5 Provide Adequate Emergency Evacuation Capability 1-12
1.3.6 Improve Strategic Military Connectivity 1-14
1.3.7 Address Local Economic Development Goals 1-15
Chapter 2.0 ALTERNATIVES 2-1
2.1 ALTERNATIVES DEVELOPMENT AND SCREENING PROCESS 2-2
2.1.1 Alternative Development 2-2
2.1.2 Screening Approach and Criteria 2-3
2.2 ALTERNATIVES EVALUATED IN THE 2005 DEIS, 2008 FEIS, AND ROD 2-3
2.2.1 2005 DEIS Alternatives 2-4
2.2.2 Alternative Selected in the 2008 FEIS and 2008 ROD 2-4
2.3 2014 DRAFT SEIS ALTERNATIVES 2-5
2.3.1 Draft SEIS Alternative Development and Screening 2-5
2.3.2 Alternatives Eliminated From Detailed Study 2-5
2.3.3 Alternatives Retained for Detailed Study in Draft SEIS 2-6
2.3.4 SEIS Alternative Termini 2-13
2.3.5 Inventory Corridor and Design Corridor 2-15
2.4 FHWA/VDOT PREFERRED ALTERNATIVE DEVELOPMENT 2-15
2.4.1 Hybrid Development and Evaluation 2-16
2.4.2 Refined Hybrids Comparison 2-22
2.4.3 Recommendations of FHWA/Preferred Alternative 2-24
2.5 FHWA/VDOT PREFERRED ALTERNATIVE 2-24
2.5.1 Approval of the FHWA/VDOT Preferred Alternative Location 2-24

2.5.2 Further Modifications to the FHWA/VDOT Preferred Alternative 2-25
2.5.3 FHWA/VDOT Preferred Alternative Detailed Description 2-27
2.6 PRELIMINARY COSTS 2-36
2.7 TRAFFIC ANALYSIS 2-34
2.7.1 Volume Forecasts, Vehicle Miles Traveled, and Vehicle Hours Traveled 2-38
2.7.2 Level of Service Analysis 2-39
2.8 PREFERRED ALTERNATIVES ABILITY TO ADDRESS THE PURPOSE AND NEED ..2-41
2.8.1 Address Roadway Deficiencies 2-42
2.8.2 Improve Safety 2-43
2.8.3 Reduce Travel Delays 2-56
2.8.4 Accommodate Freight Movement 2-46
2.8.5 Enhance Emergency Evacuation 2-47
2.8.6 Support Military Preparedness 2-48
2.8.7 Address Local Economic Development Goals 2-48
Chapter 3.0 ENVIRONMENTAL RESOURCES, IMPACTS AND MITIGATION 3-1
3.1 OVERVIEW AND SUMMARY OF EFFECTS 3-1
3.2 SOCIOECONOMICS 3-5
3.2.1 Regulatory Context and Methodology 3-5
3.2.2 Affected Environment 3-10
3.2.3 Environmental Consequences 3-18
3.2.4 Socioeconomic Mitigation 3-24
3.3 LAND USE 3-25
3.3.1 Regulatory Context and Methodology 3-26
3.3.2 Affected Environment 3-27
3.3.3 Environmental Consequences 3-33
3.3.4 Land Use Mitigation 3-36
3.4 NATURAL RESOURCES 3-36
3.4.1 Regulatory Context and Methodology 3-36
3.4.2 Affected Environment 3-43
3.4.3 Environmental Consequences 3-74
3.4.4 Mitigation 3-93
3.5 HAZARDOUS MATERIAL SITES 3-107
3.5.1 Regulatory Context and Methodology 3-107
3.5.2 Affected Environment 3-108

3.5.3 Environmental Consequences 3-109
3.5.4 Mitigation 3-110
3.6 AIR QUALITY 3-110
3.6.1 Regulatory Context and Methodology 3-110
3.6.2 National Ambient Air Quality Standards 3-111
3.6.3 Mobile Source Air Toxics: 3-112
3.6.4 Attainment Status 3-113
3.6.5 Transportation Conformity 3-113
3.6.6 Environmental Consequences 3-113
3.6.7 Construction Activities 3-121
3.6.8 Conclusion 3-121
3.7 NOISE 3-121
3.7.1 Noise Model, Data, and Results 3-121
3.7.2 Noise Impact Assessment 3-123
3.7.3 Noise Abatement Measures 3-125
3.7.4 Noise Barriers 3-126
3.7.5 Noise Abatement Summary 3-128
3.8 HISTORIC AND ARCHAEOLOGICAL RESOURCES 3-129
3.8.1 Regulatory Context and Methodology 3-129
3.8.2 Affected Environment 3-129
3.8.3 Environmental Consequences 3-130
3.8.4 Mitigation 3-133
3.9 VISUAL QUALITY 3-133
3.9.1 Regulatory Context and Methodology 3-134
3.9.2 Affected Environment 3-135
3.9.3 Environmental Consequences 3-136
3.9.4 Mitigation 3-137
3.10 ENERGY 3-137
3.10.1 Regulatory Context and Methodology 3-138
3.10.2 Affected Environment 3-138
3.10.3 Environmental Consequences 3-139
3.10.4 Mitigation Measures 3-139
3.11 SECTION 4(F) 3-140
3.12 SHORT-TERM IMPACTS/LONG-TERM BENEFITS 3-140

3.12.1 Short-Term Gains 3-140
3.12.2 Short-Term Losses 3-141
3.12.3 Long-Term Gains 3-141
3.12.4 Long-Term Losses 3-142
3.13 IRREVERSIBLE AND IRRETRIEVABLE RESOURCES 3-142
Chapter 4.0 INDIRECT EFFECTS AND CUMULATIVE IMPACTS 4-1
4.1 REGULATORY CONTEXT AND METHODOLOGY 4-1
4.2 INDIRECT EFFECTS ANALYSIS 4-3
4.2.1 Methodology 4-3
4.2.2 Step 1: Scoping 4-4
4.2.3 Step 2: Identify Study Area Direction and Goals 4-5
4.2.4 Step 3: Inventory Notabley Features in the Study Area 4-14
4.2.5 Step 4: Identify Impact Causing Activities of the Preferred Alternative 4-21
4.2.6 Step 5: Identify Indirect Effects for Analysis 4-22
4.2.7 Step 6: Analyze Indirect Effects and Evaluate Analysis Results 4-27
4.2.8 Step 7: Assess Consequences and Develop Mitigation 4-37
4.2.9 Summary 4-42
4.3 CUMULATIVE IMPACTS ANALYSIS 4-42
4.3.1 Methodology 4-42
4.3.2 Scoping 4-43
4.3.4 Describe Affected Environment 4-47
4.3.5 Determine Environmental Consequences 4-50
4.3.6 Cumulative Impact Conclusion 4-61
Chapter 5.0 LIST OF PREPARERS 5-1
Chapter 6.0 DISTRIBUTION LIST 6-1
6.1 Federal Agencies 6-1
6.2 State Agencies 6-1
6.3 Local Government 6-2
6.4 Regional Organizations 6-2
Chapter 7.0 PUBLIC AND AGENCY COORDINATION 7-1
7.1 INTRODUCTION 7-1
7.2 AGENCY COORDINATION 7-1
7.2.1 Cooperating and Participating Agencies 7-2
7.3 PUBLIC COORDINATION 7-2

7.3.1 Public Coordination Next Steps 7-3
Chapter 8.0 REFERENCES 8-1

LIST OF TABLES

Table 1.3 1: VDOT Design Criteria Comparison Four-lane Rural Principal 1-5
Table 1.3 2: Crash Modification Factors Associated with Route 460 1-7
Table 1.3 3: Crash Rates Comparisons – Study Area to Other Facility Types (2010 to 2012) 1-8
Table 1.3 4: Crash by Type within the Route 460 Corridor Study Area (2010 - 2012) 1-8
Table 1.3 5: Change in Annual Average Daily Traffic (AADT) and Truck Traffic on Major Routes 1-9
Table 1.3 6: Virginia Traffic Information Management System Priority Levels 1-12
Table 2.3 1: Route 460 No Build Projects 2-8
Table 2.4 1: Initial Hybrids Evaluated 2-16
Table 2.4-2: Refined Hybrids 2-20
Table 2.4-3: Refined Hybrid 11 – Between west of Zuni and Eastern Terminus 2-20
Table 2.5-1: New Bridging Locations 2-32
Table 2.6 1: Cost Estimate for the FHWA/VDOT Preferred Alternative 2-37
Table 2.7 1: Route 460 Total Vehicle Volumes and Percentage Increases 2-38
Table 2.7 2: Route 460 Level of Service Summary 2-40
Table 2.8 1: Crash Rates Comparison (2010 to 2012 Crashes) 2-43
Table 2.8 2: Existing Route 460 Crash Rate 2-44
Table 2.8 3: Daily Truck Volume Comparison 2-46
Table 3.1 1: Summary of Environmental Resources 3-1
Table 3.1 2: Summary of Potential Environmental Impacts within the Limit of Disturbance 3-4
Table 3.2 1: Population for the Study Area and Jurisdictions Represented by the Study Area 3-10
Table 3.2 2: Population Age of the Study Area 3-11
Table 3.2 3: Study Area Racial and Ethnic Characteristics 3-11
Table 3.2 4: Minority Populations within the Study Area Portion of Jurisdictions 3-12
Table 3.2 5: Poverty Characteristics for the Study Area 3-12
Table 3.2 6: Study Area Jurisdictional Demographics 3-13
Table 3.2 7: 2014 Poverty Guidelines for the 48 Contiguous States and the District of Columbia 3-13
Table 3.2 8: Median Household Income by Census Block Group 3-14
Table 3.2 9: Study Area Housing Data – Occupancy 3-15
Table 3.2 10: Journey to Work for Study Area Jurisdictions 3-17
Table 3.2 11: Travel Patterns within the Study Area 3-17

Table 3.2 12: Relocations by the FHWA/VDOT Preferred Alternative 3-18
Table 3.2 13: Relocations by the FHWA/VDOT Preferred Alternative 3-19
Table 3.2 14: Demographics of the Census Blocks within the LOD of the FHWA/VDOT Preferred Alternative 3-21
Table 3.2 15: Relocations within Census Blocks with Minority Populations 3-23
Table 3.3 1: Land Cover in the Study Area 3-27
Table 3.3 2: Land Use in the Study Area 3-28
Table 3.3 3: Farmland Uses and Production for Jurisdictions within Study Area 3-30
Table 3.3 4: Agricultural and Forestal Districts 3-31
Table 3.3 5: Study Area Recreational Resources 3-31
Table 3.3 6: Impacted Acreage by Land Cover for FHWA/VDOT Preferred Alternative 3-33
Table 3.3 7: Acres of Prime Farmland Soils 3-35
Table 3.3 8: Acres of Farmland of Statewide Importance 3-35
Table 3.3 9: Recreational Resource Located within the Inventory Corridor 3-35
Table 3.4 1: Recent Water Quality Data – Physical and Chemical Parameters Associated with Stormwater Runoff (TP, TS, SS, BOD, TOC) 3-44
Table 3.4 2: Recent Water Quality Data – Physical and Chemical Parameters Associated with Stormwater Runoff (NH3, CDM, CRS, CUS, PBS, NIS, ZNS, FEM) 3-45
Table 3.4 3: Suspected Sources of Impairment Ranked by Percentage of Impaired Water Size 3-46
Table 3.4 4: Drainage Areas Determined by VDH to be Important to Public Drinking Water Supplies 3-46
Table 3.4 5: Ecosystem Classification Cross-Reference 3-58
Table 3.4 6: Rare or Unique Communities in the Project Area 3-62
Table 3.4 7: Threatened and Endangered Species within Study Area 3-65
Table 3.4 8: Impaired Waters Crossed By FHWA/VDOT Preferred Alternative 3-75
Table 3.4 9: Groundwater Public Water Supply Wells 3-77
Table 3.4 10: Route 460 FHWA/VDOT Preferred Alternative Floodplain and Floodway Impacts 3-77
Table 3.4 11: Wetlands Within the Inventory Corridor and the LOD 3-78
Table 3.4 12: Streams Within the Inventory Corridor and the LOD 3-82
Table 3.4 13: Waterbodies and Jurisdictional Ditch Within the Inventory Corridor and the LOD 3-83
Table 3.4 14: Potential Impacts to Natural Communities 3-86
Table 3.4 15: Potential Impacts to Agricultural Lands and Brush and Old Fields 3-87
Table 3.4 16: Threatened and Endangered Species Evaluation Matrix 3-89
Table 3.4 17: Highly Invasive Plant Species Observed with Potential to Occur Within the Vicinity of the Inventory Corridor 3-92
Table 3.4 18: Wetland Impacts Compared to Wetlands Within Each HUC-12 3-97

Table 3.5 1: Hazardous Materials Sites 3-109

Table 3.6 1 National Ambient Air Quality Standards.....3-111

Table 3.6 2: Peak Modeling Results for the Eastern Terminus Intersection/Interchange (ppm) 3-115

Table 3.6 3: Congestion Performance Metrics Summary Between Zuni and Suffolk 3-116

Table 3.7 1: FHWA Noise Abatement Criteria.....3-123

Table 3.7 2: Noise Impact Summary Table 3-125

Table 3.7 3: Feasible and Reasonable Noise Barriers.....3-128

Table 3.8 1: Previously Identified Architectural Properties Located within the APE and Determined in Consultation with the SHPO to be On, Eligible for, or Potentially Eligible for the NRHP 3-130

Table 3.8 2: Newly Recorded or Newly Evaluated Architectural Resources within the Inventory ..... Corridor 3-131

Table 3.8 3: Archaeological Sites Located within the Limits of Disturbance 3-132

Table 3.9 1: Summary of Existing Visual Quality and Viewer Sensitivity by Point of Assessment....3-136

Table 3.9 2: Summary Comparison of Visual Quality and Viewer Sensitivity by VAU and Degree of Impact by Alternative.....3-137

Table 4.2 1: Locality Coordination.....4-5

Table 4.2 2: Land Acreage within Designated Growth Area.....4-13

Table 4.2 3: Direct Impact within the Limit of Disturbance of the FHWA/VDOT Preferred ..... Alternative 4-22

Table 4.2 4: Land Use within Induced Growth Areas* 4-24

Table 4.3 1: History of Towns Established within the Study Area.....4-44

Table 4.3 2: Past Projects within the Study Area.....4-44

Table 4.3 3: Present and Reasonably Foreseeable Future Transportation Projects within the Study Area.....4-46

Table 4.3 4: Reasonably Foreseeable Future Projects Sponsored by Local Governments 4-47

Table 4.3 5: Human Activities with Potential Cumulative Effects on Identified Resources 4-48

Table 4.3 6: Relative Cumulative Impacts.....4-52

Table 4.3 7: Wetland Impacts Compared to Wetlands Within Each Impacted Subbasin, Watershed, and Subwatershed 4-60

LIST OF FIGURES

Figure 2.1-1: Alternative Development and Screening Process 2-2

Figure 2.3-1: Draft SEIS Build Alternatives.....2-7

Figure 2.3-2: Typical Section A.....2-9

Figure 2.3-3: Typical Section B 2-10
Figure 2.3-4: Typical Section C 2-12
Figure 2.3-5: Typical Section D 2-13
Figure 2.3-6: Conceptual Layout for Eastern Terminus 2-14
Figure 2.3-7: Conceptual Layout for Western Terminus 2-14
Figure 2.4-1: Refined Hybrid Corridors 2-19
Figure 2.4-2: Refined Hybrid 17 – Between west of Zuni and Eastern Terminus 2-21
Figure 2.4-3: Refined Hybrid 11 – Between west of Zuni and Eastern Terminus 2-22
Figure 2.5-1: Preferred Alternative and Draft SEIS Build Alternatives ..... Volume II
Figure 2.5-2: FHWA/VDOT Preferred Alternative ..... Volume II
Figure 2.5-3: New Intersection Connecting Existing Route 460 and Improved Route 460 with New Route 460 2-28
Figure 2.5-4: Route 460 Crossing Existing Route 258 with No Interchange 2-29
Figure 2.5-5: New Route 460/Existing Route 460 East of Windsor 2-30
Figure 2.5-6: Route 460/Route 58 Interchange 2-31
Figure 2.5-7: FHWA/VDOT Preferred Alternative Typical Sections 2-33
Figure 2.5-8: Typical Section A1 2-33
Figure 2.5-9: Typical Section A2 2-34
Figure 2.5-10: Typical Section A3 2-34
Figure 2.5-11: Typical Section A4 2-34
Figure 2.5-12: Typical Section A5 2-35
Figure 2.5-13: Typical Section A6 2-35
Figure 2.5-14: Typical Section A7 2-36
Figure 2.5-15: Typical Section C 2-36
Figure 2.8-1: Study Area Crash Map 2-44
Figure 3.1-1: Study Area Map ..... Volume II
Figure 3.2-1: Communities Along Existing Route 460 ..... Volume II
Figure 3.2-2: Minority Population Census Blocks in the Study Area ..... Volume II
Figure 3.2-3: Distribution of Residential Relocations by Jurisdiction for the FHWA/VDOT Preferred Alternative 3-19
Figure 3.2-2: Demographics of the Census Blocks within the LOD of the FHWA/VDOT Preferred Alternative 3-21
Figure 3.3-1: Land Cover ..... Volume II
Figure 3.3-2: Land Use ..... Volume II
Figure 3.3-3: Prime Farmland ..... Volume II

Figure 3.3-4: Agricultural and Forestal Districts ..... Volume II
Figure 3.3-5 Recreational Resources ..... Volume II
Figure 3.3-6: Agricultural and Forestal Districts near the Preferred Alternative ..... Volume II
Figure 3.4-1: River Basins ..... Volume II
Figure 3.4-2: Stream Monitoring Stations and Impaired Waters ..... Volume II
Figure 3.4-3: Surface Drinking Water Intakes and Watersheds ..... Volume II
Figure 3.4-4: Groundwater Resources ..... Volume II
Figure 3.4-5: Floodways and 100-Year Floodplains ..... Volume II
Figure 3.4-6: NWI Wetlands ..... Volume II
Figure 3.4-7: Waterways, Waterbodies, and Associated Deepwater Habitat ..... Volume II
Figure 3.4-8: State Scenic Rivers ..... Volume II
Figure 3.4-9: Forested Lands ..... Volume II
Figure 3.4-10: Agricultural Lands ..... Volume II
Figure 3.4-11: Brush and Old Fields ..... Volume II
Figure 3.4-12: Conservation Lands & Wildlife Corridors ..... Volume II
Figure 3.4-13: Known Occurrences of T&E Species ..... Volume II
Figure 3.4-14: Geologic Map ..... Volume II
Figure 3.4-15: Stream Monitoring Stations and Impaired Water Crossings ..... Volume II
Figure 3.4-16: Preferred Alternative Wetland Impacts ..... Volume II
Figure 3.4-17: Bridging of Resource Area Example ..... Volume II
Figure 3.4-18: Stream and Other Waters Impacts ..... Volume II
Figure 3.4-19: Natural Community Impacts ..... Volume II
Figure 3.4-20: Conservation Lands Impacts ..... Volume II
Figure 3.5-1: Petroleum Release Sites ..... Volume II
Figure 3.5-2: Petroleum Registered Facilities ..... Volume II
Figure 3.5-3: Hazardous Materials Sites ..... Volume II
Figure 3.6-1: CAL3QHC Receptor Locations: Eastern Terminus Including Route 58 SB On/Off Ramps for Existing and No Build Alternative ..... Volume II
Figure 3.6-2: CAL3QHC Receptor Locations: Eastern Terminus Including Route 58 EB and WB On/Off Ramps for Existing, No Build and Preferred Alternative ..... Volume II
Figure 3.6-3: CAL3QHC Receptor Locations: Eastern Terminus Including Route 58 SB On/Off Ramps for Preferred Alternative ..... Volume II
Figure 3.6-4: Nation MSAT Trends 1999-2050 Using EPA's MOVES 2010b Model 3-117
Figure 3.7-1: Feasible and Reasonable Barriers ..... Volume II
Figure 3.8-1: NRHP-Listed/Eligible Architectural Resources within the Study Area ..... Volume II

Figure 3.9-1: Visual Assessment Units and Observation Points.....Volume II
Figure 3.10-1: Total End-Use Energy Consumption by Sector (2012) 3-138
Figure 4.1-1: Direct vs. Indirect Environmental Impacts 4-1
Figure 4.1-2: Cumulative Impacts 4-2
Figure 4.2-1: Socioeconomics and Land Use Indirect and Cumulative Effects Study Area .....Volume II
Figure 4.2-2: Natural Resources Indirect and Cumulative Study Area.....Volume II
Figure 4.2-3: Historic Properties Indirect and Cumulative Effects Study Area.....Volume II
Figure 4.2-4: Recreational Resources Indirect and Cumulative Effects Study Area .....Volume II
Figure 4.2-5: Consolidated Land Use .....Volume II
Figure 4.2-6: Potential for Development .....Volume II
Figure 4.2-7: Minority Population Census Blocks in the Study Area.....Volume II
Figure 4.2-8: Highway Investment on Typical Progress of Urbanization 4-22
Figure 4.2-9: Induced Growth Area.....Volume II
Figure 4.2-10: Potential for Development within Induced Growth Area .....Volume II
Figure 4.2-11: Wetlands and Streams within the Induced Growth Area .....Volume II
Figure 4.2-12: Historic Properties within the Induced Growth Area.....Volume II
Figure 4.2-13: Recreational Resources within the Induced Growth Area .....Volume II

APPENDICIES

APPENDIX A: List of Technical Reports

APPENDIX B: Agency Coordination

APPENDIX C: Acronym List

APPENDIX D: DSEIS Comments and Responses

APPENDIX E: Noise

APPENDIX F: Historical Aerial Photography

CHAPTER 1.0 | PURPOSE & NEED

US ROUTE 460 FINAL SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT

Chapter 1.0 PURPOSE OF AND NEED FOR ACTION

1.1 INTRODUCTION

US Route 460 (Route 460) is a primary east-west arterial highway that traverses the Commonwealth of Virginia. From Interstate 295 (I-295) in Prince George County to US Route 58 (Route 58) in the City of Suffolk, Route 460 is a four lane, undivided arterial roadway with posted speeds between 35 to 55 miles per hour (mph). This eastern segment of the road was built in the mid-1930s as a two-lane roadway, parallel to the Norfolk and Petersburg Railroad line that had been constructed in the 1890s. In the mid-1950s, two lanes were added, widening Route 460 to four undivided travel lanes. Since the widening, minor roadway improvements including some median turn lanes and new traffic signals have been implemented.

The Route 460 Location Study, which was initiated in 2003, evaluated transportation improvements in the Route 460 study area from I-295 in Prince George County, southeast to Route 58 in the City of Suffolk. Within the study area existing Route 460 is approximately 52 miles in length and passes through portions of the Counties of Prince George, Surry, Sussex, Southampton and Isle of Wight; the City of Suffolk; the incorporated towns of Waverly, Wakefield, Ivor, and Windsor; and the unincorporated communities of Disputanta and Zuni.

Prepared in accordance with the implementing regulations of the National Environmental Policy Act (NEPA) at 23 CFR §771.130 and 40 CFR §1502.9(c), this Final Supplemental Environmental Impact Statement (SEIS) addresses public and agency comments received on the September 2014 Draft SEIS, documents the Federal Highway Administration (FHWA) and the Virginia Department of Transportation's (VDOT) identified Preferred Alternative and the updated analysis associated with the FHWA/VDOT Preferred Alternative, and documents the action of the Commonwealth Transportation Board (CTB).

A permit is required from the U.S. Army Corps of Engineers (USACE) for the discharge of fill material into waters of the United States in conjunction with the construction of the Route 460 Project. The USACE jointly prepared this document in support of its permit review process and public interest review.

1.2 PROJECT BACKGROUND

Improvements to the Route 460 corridor were originally considered as part of a nationwide study to develop an east coast to west coast transportation corridor referred to as the TransAmerica Transportation Corridor. The corridor was listed as a High Priority Corridor in the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 (P.L. 102-240). Although none of the nationwide alternatives for the *TransAmerica Transportation Corridor Study* were determined to be feasible, several regional alternatives were advanced for further study and design. These regional alternatives included the East-West TransAmerica Corridor, extending from Beckley, West Virginia, to the Hampton Roads region in Virginia (P.L. 102-240 §1105(c)(3)). To contribute to the East-West TransAmerica Corridor, VDOT began a location study for Route 460 in 2003. In addition to its role as part of the regional corridor, VDOT identified other needs that could be met. These needs were documented in a Draft Environmental Impact Statement (DEIS) published in 2005 and a Final EIS (FEIS) signed in June 2008.

FHWA issued a Record of Decision (ROD) in September 2008, selecting a preferred alternative, identified at the time as Modified Candidate Build Alternative (CBA) 1, to address the needs identified through the Route 460 Location Study.

In November 2012, FHWA completed a NEPA Re-evaluation of the FEIS and in particular, Modified CBA 1, giving consideration to funding the project through the implementation of tolls. In 2013, FHWA and USACE determined that the preparation of an SEIS would be necessary in order to analyze new information with a bearing on the environmental impacts, including aquatic resources.

A Draft SEIS was published in September 2014 and presented at three Location Public Hearings that took place in October 2014. The Draft SEIS provided detailed analysis of five Build Alternatives and the No Build Alternative. Following the issuance of the Draft SEIS, public comments were received, as well as input from the resource and regulatory agencies regarding the estimated environmental impacts including potential CEQ referral. Following the close of the formal comment period on the Draft SEIS, VDOT, in close coordination with FHWA, developed the FHWA/VDOT Preferred Alternative, which was approved by the CTB in February 2015 and included in a permit application submitted to the USACE in November 2015. The development and analysis of the VDOT/FHWA Preferred Alternative is detailed in this Final SEIS.

1.2.1 Legislative Background

ISTEA was the federal transportation legislation for the period of 1991 through 1997. The "East-West TransAmerica Corridor" is identified in Section 1105(c) (3) of ISTEA as a "National Highway System high priority corridor." The purpose of designating such corridors in the legislation is to:

> *"Identify highway corridors of national significance; to include those corridors on the National Highway System (NHS); to allow the Secretary, in cooperation with the States, to prepare long-range plans and feasibility studies for these corridors; to allow the States to give priority to funding the construction of these corridors; and to provide increased funding for segments of these corridors that have been identified for construction"* (ISTEA, 1991).

The National Highway System Designation Act of 1995 officially designated the National Highway System (NHS). In Section 332, the Act defined the TransAmerica corridor as "...commencing on the Atlantic Coast in the Hampton Roads area going westward across Virginia" (National Highway System Designation Act of 1995). The Act also directed the Secretary of Transportation, in cooperation with the States of Virginia and West Virginia, to "…conduct a study to determine the feasibility of establishing a route for the East-West TransAmerica Corridor." The Virginia Transportation Act of 2000 (VTA) established a Priority Transportation Fund, identified sources to fund the Priority Transportation Fund, and designated specific roadway improvement projects across Virginia to be funded by the VTA or other available funding sources. Within the Suffolk (now Hampton Roads) District of VDOT, the Act listed "regional Route 460 improvements" and allocated $25 million for the improvements.

1.2.2 Funding Background

The Commonwealth of Virginia has taken a number of actions to advance improvements to the Route 460 Corridor. In 2003 the Virginia General Assembly passed legislation requiring a Public-Private Transportation Act (PPTA) solicitation for improvements to the highway. The PPTA method was selected due to the lack of public funds available and the necessity to seek innovative financing to implement the project. The PPTA solicitation was initiated in 2006, concurrent with the issuance of the DEIS. After extensive discussions internally on issues related to financing, VDOT committed to provide public funding in addition to the other sources of funding identified, including tolls, and continued with the procurement process in earnest in Spring 2012. Additional detail regarding the PPTA solicitation can be referenced in the Draft SEIS.

The Route 460 Funding Corporation of Virginia (the Corporation) was created in August 2012 for the purposes of undertaking the Route 460 project. It was a nonstock, nonprofit corporation formed under the laws of Virginia and its purposes and activities have been approved by the CTB. The Corporation was approved by the CTB to issue tax-exempt bonds to be financed from projected toll revenues to assist in the development, design, construction, financing, maintenance, tolling, and operation of the Route 460 Corridor Improvements Project.

1.2.3 Project Status

In March 2014, Virginia's Transportation Secretary announced that the contract and permit work being performed for Modified CBA 1 was temporarily suspended. In April 2015, the contract for development of Modified CBA 1 was terminated, while VDOT continued with environmental work on the project in coordination with FHWA and USACE.

1.3 PURPOSE AND NEED ELEMENTS

The purpose of the improvements to the Route 460 corridor is to construct a facility that is consistent with the functional classification of the corridor, sufficiently addresses safety, mobility and evacuation needs, and sufficiently accommodates freight traffic along the Route 460 corridor between Petersburg and Suffolk, Virginia.

The following needs have been identified for the project:

- Address roadway deficiencies: Route 460 is based on outdated geometric standards (see **Section 1.3.1**).
- Improve safety: Fatality rates for Route 460 are higher than other comparable rural roadways in Virginia (see **Section 1.3.2**).
- Accommodate increasing freight shipments: Truck percentages for Route 460 are higher than national averages for rural roads with similar functional classification, and truck traffic is forecasted to grow due to expansions at the Port of Virginia (see **Section 1.3.3**).
- Reduce Travel Delay: Future traffic volumes will result in increased travel delays on Route 460 due to capacity limitations at traffic signals and the current design deficiencies (see **Section 1.3.4**).
- Provide adequate emergency evacuation capability: Route 460 is a designated hurricane evacuation route for Southside Hampton Roads communities, yet during recent events, the road was closed due to effects caused by these storms (see **Section 1.3.5**).
- Improve strategic military connectivity: Route 460 is a designated part of the Strategic Highway Network (STRAHNET) by the Department of Defense (DoD) and FHWA (see S**ection 1.3.6**).
- Support local economic development plans: In addition to statewide and regional economic development needs, jurisdictions along the Route 460 study area have identified economic development priorities related to transportation improvements (see **Section 1.3.7**).

The individual components of the purpose and need were identified for the entire corridor, but those elements of need are more pronounced at the eastern end of the corridor where there is a higher population density and which is in proximity to major population centers, established industrial parks, the ports, military bases, and evacuation routes in the Hampton Roads region. While a preferred alternative has been identified that does not improve the entire corridor, **Section 2.8** documents that this alternative is still effective at addressing the purpose and need over the length that the improvements are made.

In accordance with 40 CFR §230.10(a)(3), the USACE has determined that the Basic Project Purpose is: To address transportation needs along the Route 460 corridor between Petersburg and Suffolk, VA.

In accordance with Section 404(b)(1) Guidelines, the USACE has determined that the Overall Project Purpose is: To construct a facility that sufficiently addresses existing safety, mobility and evacuation needs and sufficiently accommodates expected freight traffic along the Route 460 corridor between Petersburg and Suffolk, VA.

1.3.1 Address Roadway Deficiencies

The entire length of Route 460 subject to this study has roadway deficiencies that result in numerous problems related to other corridor needs such as safety, accommodation of truck traffic, travel delays, emergency evacuation and military preparedness. Route 460 was initially constructed in the mid-1930s as a two-lane roadway parallel to the Norfolk and Petersburg railroad. Two more lanes were added in the mid-1950s creating a four-lane undivided facility. While Route 460 was originally constructed in accordance with applicable design standards in effect at the time, design criteria have evolved since then. The current functional classification[1] for Route 460 is "other principal arterial." The intent of roadway facilities under this functional classification is to provide a safe level of service at higher speeds, for long uninterrupted distances, with some degree of access control.

Route 460, between Suffolk and Petersburg, fails to meet the current VDOT design requirements for its functional classification, based on several key criteria including lane width, median width, left turn lane protection, shoulder width, and clear zone protection. Although the VDOT *Road Design Manual* (VDOT, rev. 2016) does not list type of access control as a criterion, existing Route 460 does not meet the intent for roadways under the other principal arterial functional class. Lane widths on existing Route 460 range from 10 to 11 feet. Currently there are no programmed transportation improvements within the Route 460 corridor that would address these deficiencies.

The Hampton Roads Transportation Planning Organization (HRTPO), which functions as the region's Metropolitan Planning Organization required by federal regulation, conducts a continuing, cooperative and comprehensive transportation planning process. According to the HRTPO, Route 460 in Isle of Wight County and Suffolk is currently the only roadway in the "National Freight Network – Hampton Roads Base Network" (developed by HRTPO in anticipation of National Freight Network designation by FHWA) without the AASHTO-recommended 12 foot lane widths, having average lane widths of 10 to 11 feet from Route 58 to the Southampton County line (approximately 16 miles).[2]

According to the AASHTO Green Book - *A Policy on Geometric Design of Highways and Streets*, inadequate roadway lane widths can negatively impact safety and traffic operations. The lane width influences the comfort of driving, operational characteristics, and, in some situations, the likelihood of

[1] Functional classification is the process by which streets and highways are grouped into classes (i.e. arterial, collector, local), or systems, according to the character of traffic service that they are intended to provide (e.g. mobility and access). Arterials are intended to provide a high level of mobility while providing a low level of access to adjoining properties. In contrast, local roadways are intended to provide a high level of access to adjoining properties while providing a low level of mobility. The AASHTO Green Book explicitly recognizes the relationship between highway functional classification and design. It states, "The first step in the design process is to define the function that the facility is to serve. The level of service required to fulfill this function for the anticipated volume and composition of traffic provides a rational and cost-effective basis for the selection of design speed and geometric criteria within the range of values available.

[2] Positioning Hampton Roads for Freight Infrastructure Funding-MAP-21 and Beyond, HRTPO, Mar. 2014, pp. 28-30.

crashes. A 12-foot lane provides desirable clearances between large commercial vehicles traveling in opposite directions on two-way undivided rural highways when high traffic volumes and particularly high percentages of trucks are expected such as those found in the study area (HRTPO Freight Study). Minimum lane widths of 12 feet provide safe and consistent vehicle operation and separation between multiple lanes and multiple classes of vehicles. Minimum 12-foot lane widths also benefit high-speed facilities where passing is necessary.[3]

Route 460 in its existing condition does not provide medians, and there is no protection from oncoming traffic and often no refuge area for turning vehicles. The lack of medians likely contributes to the incidence of rear end collisions on Route 460. The lack of shoulders along Route 460 results in no safe haven locations for vehicle breakdowns and law enforcement. Additionally, the lack of clear zones adjacent to the travel lanes severely limits opportunities for vehicle recovery for travelers who leave the paved surface at a high rate of speed.

Table 1.3-1 illustrates the differences between the typical conditions along Route 460 and VDOT's design guidelines for rural principal arterials. The lack of a median, clear zone and shoulders along most of the roadway is due primarily to the relatively narrow right-of-way. Between Providence Road (Route 604) in Suffolk and through the Town of Windsor, the average right-of-way width is approximately 66 feet wide. West of Windsor, the right-of-way is approximately 80 feet wide.

Table 1.3-1: VDOT Design Criteria Comparison Four-lane Rural Principal

Design Criteria	Existing Route 460	Rural Principal Arterial - Other Principal Arterial	Rural Principal Arterial - Freeway
Lane Width	10' to 11'	Minimum 12'	Minimum 12'
Median Width	No Median	Minimum 40'	Minimum 40'
Outside Shoulder Width: Graded	No Shoulder	2' to 5'	2' to 5'
Outside Shoulder Width: Paved	No Shoulder	8'	12'
Inside Shoulder Width: Paved	No Shoulder	4'	4'
Clear Zone	No Clear Zone	30' – 34'	30' – 34'

AASHTO categorizes access control as Full Control of Access (ramps with selected public roads; no at-grade crossings; no driveways), Partial Control of Access (crossings at-grade or grade-separated with selected public roads), and Access Management (provides access to land development while preserving traffic flow in terms of safety, capacity, and speed).

There is another category, driveway/entrance regulations (abutting property permitted access; location, design, and number governed by regulations), where there is no access control. Within the corridor, Route 460 in its entirety falls into this last category.

Like the roadway deficiencies depicted above, the current lack of access control along Route 460 further contributes to operational conflicts along the corridor. Vehicles entering and exiting Route 460 via the many intersections, driveways, and curb cuts reduces the mobility of faster-traveling traffic, resulting in safety conflicts and travel delays. AASHTO recommends "access management" practices for arterial highways similar in function to Route 460:

[3] VDOT Road Design Manual, Vol. 1, 2005

> *"Arterials are designed and built with the intention of providing better traffic service than is available on local roads and streets…One of the most important considerations in arterial development is the amount of access control, full or partial, that can be acquired. The ability to control access on an arterial will often relate directly to the project's safety….Provision of access management is vital to the concept of an arterial route if it is to provide the service life for which it is designed."* (AASHTO, 2011)

Furthermore, because of the numerous access points, Route 460 essentially functions as a local road, as described below, through the towns of Waverly, Wakefield, Ivor, and Windsor, and the unincorporated communities of Disputanta and Zuni, resulting in an imbalance of mobility and access from what is intended given its functional classification.

> *"A local road or street serves primarily to provide access to farms, residences, businesses, or other abutting properties. Although local roads and streets may be planned, constructed, and operated with the predominant function of providing access to adjacent property for a variety of users, some local roads and streets serve a limited amount of through traffic. On these roads the through traffic is local in nature and extent rather than regional, intrastate, or interstate…because of the relatively low traffic volumes and the extensive roadway mileage, design criteria for local roads and streets are of a comparatively low order as a matter of practicality. However, to provide traffic mobility and safety…they should be planned, located, and designed to be suitable for predictable traffic operations and should be consistent with the development and culture abutting the right-of-way."* (AASHTO, 2011)

VDOT's access management regulations identify issues related to the lack of access control:

> *"Proposed highway entrances create a potential conflict point that impacts the safe and efficient flow of traffic on the highway; therefore, private property interests in access to the highway must be balanced with public interests of safety and mobility."* (24 VAC 30-73-20)

Needs related to current roadway deficiencies include:

- *Address the type and level of access control; and*
- *Manage local and through traffic by applying current VDOT design criteria to improve safety, reduce delays, and better accommodate trucks.*

1.3.2 Improve Safety

There are over 1,300 miles of four-lane roadways in Virginia functionally classified as a rural principal arterial. The majority of rural principal arterials in Virginia (77 percent) are four-lane divided roadways with no access control. However, because they are divided, traffic is separated on these roadways. Only five percent of rural principal arterials in Virginia (65 miles) are undivided four-lane roadways, including Route 460 within the study area, which makes up 50 of those miles. Roadways with a four-lane undivided cross section usually have higher than average crash rates due to the lack of median control and lack of clear zone. Furthermore, the numerous driveways and entrances with related turning vehicles increase crash potential. In addition, a high percentage of vehicles traveling on Route 460 are trucks and these larger vehicles operate less efficiently than standard passenger vehicles, thereby potentially increasing accident severity.

The *Highway Safety Manual* (HSM) provides crash modification factors (CMF) for various safety-related countermeasures or treatments. A CMF is a multiplicative factor used to compute the expected number of crashes after implementing a given countermeasure at a specific site. CMFs for improving Route 460 to meet the design standards for a Rural Principal Arterial are illustrated in **Table 1.3-2**. A CMF for increasing shoulder widths along a rural, undivided multilane highway is currently unavailable; however, the potential crash effects of reducing the outside shoulder width along a rural, divided multilane highway are provided in Table 13-8 of the HSM. A review of the table indicates an inverse trend between shoulder width and expected crash frequency, meaning that crash experience will likely decrease with increased shoulder widths.

Table 1.3-2: Crash Modification Factors Associated with Route 460

Design Criteria	Existing Route 460	Rural Principal Arterial	Crash Modification Factor
Lane Width	10’ to 11’	Minimum 12’	0.85[1]
Median Width	No Median	Minimum 40’	0.88 (Injury Crashes) 0.82 (Non-injury Crashes)[2]
Outside Shoulder Width: Graded	No Shoulder	2' to 5'	-
Outside Shoulder Width: Paved	No Shoulder	8'	-
Inside Shoulder Width: Paved	No Shoulder	4'	-
Clear Zone	No Clear Zone	30’ – 34’	0.44[3]

[1] Per *Highway Safety Manual* Tables 13-3 and 13-4; the provided range corresponds to converting from either a 10 or 11 foot lane to a 12 foot lane along both undivided and divided rural multilane highways; applies to single-vehicle run-off-the-road crashes and multiple-vehicle head-on and sideswipe crashes only.
[2] Per *Highway Safety Manual* Table 13-11; base condition is the absence of a raised median; median type and/or width are unknown.
[3] Per *Highway Safety Manual* Table 13-21; CMF applicable to two-lane roads and freeways only; applies to increasing the distance to roadside features from 3.3 ft. to 30 ft.

Route 460 in the study area is functionally classified as an Urban Other Principal Arterial for approximately nine miles of the corridor (near Petersburg, Virginia and near Suffolk, Virginia), and the other portions of Route 460 are functionally classified as Rural Other Principal Arterials. Due to the corridor functional class inconsistencies, the associated crash rates are also compared to other four-lane facilities throughout Virginia regardless of their functional classification.

Table 1.3-3 presents the number of crashes on Route 460 and compares them with various arterial and four-lane highway crash rates in Virginia. For Route 460, two sets of rates are presented, one for the entire 52-mile corridor and another for the 16-mile eastern portion of the corridor. The comparison shows that Route 460 has a higher fatal rate than any of the other categories. It is substantially higher than the rates for four-lane divided highways with some form of access control. While the fatal rate is lower for the eastern 16-mile section than the full 52-mile corridor, the injury rate and total crash rate is much higher than for the full corridor. While the crash rate for the Route 460 corridor and the section of existing Route 460 between Zuni and Route 58 are lower than the statewide averages for most of the facilities listed in **Table 1.3-3**, it is important to recognize that some of those statewide averages include similar facilities in highly urbanized areas where conditions are more conducive to crashes.

Of the 380 crashes within the 52-mile Route 460 corridor from 2010 to 2012, 12 percent involved trucks; while approximately 45 percent of fatal crashes within the corridor involved trucks. In the eastern portion of the study area, 10 percent of the crashes involved trucks; while approximately 33 percent of fatal crashes involved trucks.

Table 1.3-3: Crash Rates Comparisons – Study Area to Other Facility Types (2010 to 2012)

Crash Rates by Facility Type (per 100 million VMT)	Route 460 Corridor (I-295 to Route 58)	Route 460 (West of Zuni to Route 58)	Virginia Averages 2012				
			Rural Other Principal Arterial	4-Lane Undivided Two-Way [2]	4-Lane Divided No Access Control [3]	4-Lane Divided Partial Access Control [3]	4-Lane Divided Full Access Control
Total Crashes	380	172	-	-	-	-	-
Analysis Length (Miles)	52	16	-	-	-	-	-
Fatal Rate	1.8	1.3	1.2	1.0	1.0	0.7	0.3
Injury Rate[1]	37.3	50.4	42.6	156.0	91.7	73.6	31.0
Total Crash Rate	55.9	74.1	78.2	252.5	154.8	127.5	61.4

[1] Rates are based on the total number of fatalities or injuries, not the number of crashes.
[2] Route 460 is included in the average values for this type of highway facility, which includes both rural and non-rural, representing approximately nine percent of the total route miles statewide.
[3] Total crash rates include those for rural roads like Route 460, but also include highly urbanized areas with increased turning movements and greater congestion, which typically resulting in higher crash rates compared to similar facilities.
Source: VDOT crash data.

As **Table 1.3-4** depicts, the predominant crash types within the 52-mile corridor are angle crashes at 28 percent, followed by rear-end collisions at 24 percent, and fixed object off the road crashes at 19 percent. These three crash types comprised 73 percent of the total crashes within the corridor during this time frame. A similar pattern emerged for the 16-mile eastern portion of the study area with those same three categories accounting for 75 percent of all crashes.

Table 1.3-4: Crash by Type within the Route 460 Corridor Study Area (2010 - 2012)

Collision Type	Route 460 Corridor (I-295 to Route 58 – 52 miles)		Route 460 Corridor (West of Zuni to Route 58 – 16 miles)	
	Total	Percentage	Total	Percentage
Angle	108	28%	50	29%
Rear end	93	24%	54	31%
Fixed object, off the road	71	19%	26	15%
Deer	29	8%	7	4%
Sideswipe - same direction	25	7%	6	4%
Miscellaneous	21	5%	14	8%
Head-on	15	4%	8	5%
Jackknifes, overturned vehicles and ran off road	11	3%	2	1%
Sideswipe - opposite direction	6	2%	4	2%
Fixed-object, in road	1	0%	1	1%
Total	**380**	**100%**	**172**	**100%**

Needs related to safety include:

- *Apply current VDOT design criteria to improve safety and reduce the number and severity of rear end, fixed object and angle crashes.*

1.3.3 Accommodate Increasing Freight Traffic

Route 460 is an important shipping route and, therefore, carries a large amount of truck traffic. In 2013, the percentage of trucks on Route 460 at Route 616 in Ivor (23 percent) was higher than the percentage of

trucks on I-64 at the New Kent/James City line (eight percent) and on Route 58 at 653 in Capron (18 percent) (VDOT traffic data).

Table 1.3-5 shows truck volumes on Route 460, Route 58 and I-64. Daily truck volumes at the locations shown on these facilities currently range from approximately 2,080 to more than 4,320 trucks per day. While the number of trucks per day is lower on Route 460 than the locations shown for the other two facilities, Route 460 has the highest percentage of trucks in the total daily traffic (15 to 23 percent). By comparison, large trucks accounted for nine percent of the total vehicle miles traveled nationally in 2013 (National Highway Traffic Safety Administration, 2013).

Table 1.3-5: Change in Annual Average Daily Traffic (AADT) and Truck Traffic on Major Routes[4]

Route	Location	1990 Data			2002 Data			2013 Data		
		Total AADT	Truck AADT	% Trucks	Total AADT	Truck AADT	% Trucks	Total AADT	Truck AADT	% Trucks
I-64	New Kent County /James City County Line	27,130	3,230	12	42,000	2,520	6	54,000	4,320	8
Rt. 58	Capron, at Route 653	7,355	1,755	24	13,000	2,080	16	15,000	2,700	18
Rt.460	Disputanta, west of Route 625	9,950	1,690	17	16,000	3,200	20	13,000	2,080	16
	Ivor, at Rt. 616	9,660	1,980	21	9,700	2,040	20	9,300	2,100	23
	Windsor, at Route 610 (Court Street)	13,270	1,960	15	14,000	2,800	20	15,100	2,390	16
	Suffolk (at Kings Fork Road)	13,270	1,960	15	14,000	2,800	20	17,100	2,490	15

Source: VDOT, Average Daily Traffic Volumes with Vehicle Classification Data on Interstate, Arterial and primary Route, 1990 and 2002; VDOT, Annual Average Daily Traffic Volume Estimates by Section of Route, Primary and Interstate Routes, 2013; HDR traffic volume analysis.

The Virginia Chamber of Commerce identifies the improvement of freight mobility as an important way to improve overall economic competitiveness of the Commonwealth of Virginia (Blueprint Virginia, VA Chamber of Commerce). The majority of this freight will be arriving and departing from the ports of Hampton Roads. Waterborne freight shipments to, from, and within Virginia were projected to increase from 24 million tons in 1998 to 40 million tons by 2020 (FHWA). In 2005, this freight was estimated to be transported inland by rail (29 percent) and barge (12 percent) and trucks (59 percent) (Virginia Port Authority). In 2013, Port of Virginia cargo was transported by rail (34 percent), barge (four percent) and truck (62 percent). This represents a three percent increase in the share of goods traveling by highway from estimates included in the 2005 DEIS. The Virginia Port Authority (VPA) believes this split will generally stay the same, although the VPA has a long term goal of moving 50 percent of cargo by rail (J. Florin, personal communication, January 31, 2014).

As Virginia's ports grow, truck traffic is expected to increase. Shipping volumes at the ports are tracked monthly. Current data show 60 percent of container cargo moves through Norfolk International Terminal (NIT), and 40 percent moves through the APM Terminal (APMT). Cargo leaves the ports on both rail and trucks. Although VPA issues incentives for rail, mode splits are influenced by market factors such as gas

[4] AADT: The total volume of traffic on a highway segment for one year, divided by the number of days in the year. This volume is usually estimated by adjusting a short-term traffic count with weekly and monthly factors (AASHTO).

prices and trip distance. Overall distribution between truck and rail is heavily influenced by trip distance. According to the National Cooperative Highway Research Program (NHCRP): *Report 586-Rail Freight Solutions to Roadway Congestion*, three out of four loaded truck trips travel within 200 miles of their final destination and nine out of 10 trucks travel within 500 miles of their final destination. Therefore, 500 miles is referenced as a shorthaul distance as it is the overnight distance for a truck.

Route 460, along with Route 58, are the main freight routes for the APMT and the planned Craney Terminal because there are no tunnels and bridge crossings that would contribute to an unpredictable travel time. Route 460 is incorporated into VPA's Master Plan.[5]

In addition to the existing conditions described above, the Port of Virginia has been positioning itself to be the dominant east coast port when the Panama Canal expansion (Panamax) opens, currently planned for 2016. VPA is currently the only port that is fully post-Panamax ready, having the appropriate channel depths for the deeper draft container ships and state-of-the art marine terminals. In addition to these improvements, there is a need to implement planned transportation infrastructure projects such as Route 460 and the CSX National Gateway project.[6] According to VPA, there is a need for a transportation facility that provides more predictable travel times to I-95. [7]

According to the 2013 VPA Annual Report, over the next 20 years cargo is expected to triple the current capacity of the port network in the United States. In response to these projected increases, new port facilities have been constructed or are under construction in Virginia since publication of the 2005 DEIS. In 1972, VPA purchased NIT, which is VPA's largest container terminal and was completely rebuilt between 2003 and 2008. NIT can be expanded an additional 10 acres and can be reconfigured to provide additional container capacity. APMT opened in 2007 and is under lease to the VPA until 2030. This terminal can be expanded to double its container throughput. Additionally, the Port of Virginia has long-term plans to construct a new container terminal on the east side of Craney Island. These new terminals will double the container capacity of the Port. Since both of these mega terminals (APMT and future Craney Island Marine Terminal) are on the western side of the harbor, cargo arriving or departing to them is not hindered by the Region's tunnels and bridges.

Trucks are anticipated to remain the primary mover of domestic freight in and out of Hampton Roads over the next 20 to 30 years, according to FHWA Freight Analysis Framework (FAF). The most heavily used gateway in Hampton Roads by trucks is I-64, which is the only interstate route into and out of the region. Currently, Route 460 (Heartland Freight Corridor) has been classified as a Gateway Freight Corridor, carrying approximately 2,199 trucks each weekday in 2010, and is the third highest gateway (Route 58 is the second highest) for trucks entering and exiting Hampton Roads. Comparatively, 5,165 trucks per day entered or exited the region via I-64 in 2010 (HRTPO Freight Study).

Operational problems have been identified by both car and truck drivers that travel on Route 460. During August 2003, public involvement meetings were held in two locations in the study area. Ninety-three (93) comment sheets were returned after the meetings. When asked what transportation problems the

[5] http://www.portofvirginia.com/pdfs/about/vpamasterplan052113.pdf.

[6] The National Gateway corridor will address several key freight rail corridors as vital links between the Mid-Atlantic seaports and key Midwest distribution points and population centers and include: The I-95/I-81 Corridor between North Carolina and Baltimore, Maryland via Washington, D.C.; the I-70/I-76 Corridor between Ohio via Pittsburgh, Pennsylvania; and the I-40/Carolina Corridor between Wilmington, North Carolina and Charlotte, North Carolina.

[7] Jeff Florin, Virginia Port Authority, January 2014, personal communication.

public would like addressed by the study, the largest percentage of respondents (38 percent) indicated traffic, particularly related to trucks, was the most important concern. In September 2003, telephone interviews were conducted with transportation managers at several distribution and shipping facilities that use Route 460. Every manager contacted has experienced problems with their truck fleets using Route 460. Specific concerns mentioned included the undivided roadway, narrow travel lanes, the lack of left-turn protection, and the impact of delays due to crashes.

Needs related to freight and port activity include:

- *Safely accommodate truck traffic in the Route 460 corridor;*
- *Accommodate increasing future truck volumes as a result of port expansion;*
- *Support the VPA's need for a transportation facility that provides more predictable travel times to I-95 and points west; and,*
- *Implement needed transportation infrastructure improvements identified in the VPA's planning documents to support the expected growth in freight traffic associated with the expansion of the port system in Virginia.*

1.3.4 Reduce Travel Delays

Traffic volumes along the Route 460 corridor are projected to grow between one and a half and two and a half percent annually between 2013 and the design year of 2040. Anticipated growth in daily and peak period traffic volumes will result in increased travel delays due to capacity constraints at signalized intersections on Route 460. Based on projected traffic volume growth and characteristics of the project alternatives, the 2030 Tidewater Superregional Model (the model) assignment results for the alternatives analysis are representative of the anticipated diversion of traffic to and from other facilities such as I-64, I-664, Route 10, and Route 35.

To estimate the impact future traffic volumes would have on future travel time conditions, congested speed values were calculated using a volume-delay function[8] to determine travel times for segments along the corridor. Forecasted travel times increase from approximately 61 minutes under existing conditions to 70 minutes under future 2040 No Build traffic conditions. The nine additional minutes required to travel from I-295 to Route 58 in the forecast year represents an increase of approximately 15 percent, and a reduction in average travel speed from 49 mph to 43 mph.

In addition to travel time, the existing vehicle miles traveled (VMT) (2013) for Route 460 is 637,510 miles. Forecasts show that in 2040, No Build VMT is forecasted at 1,143,210 miles, which represents an increase of approximately 44 percent. It can be expected that VMT will continue to increase annually based on the expansion of the ports described in **Section 1.3.3**, forecasted employment, population growth, and land use changes. Similarly, delay calculated along the corridor can be expected to increase.

Travel times will continue to be constrained by the numerous towns and speed zones, as well as access conflicts created by the number of full movement access points along the corridor. HRTPO produced a 20-

[8] The volume-delay function used was the BPR equation developed by the Bureau of Public Roads, the predecessor of the FHWA. The BPR equation is used extensively for estimating travel time in travel demand models and is documented in the *Highway Capacity Manual* (TRB, 2000) and National Cooperative Highway Research Program [NCHRP]. (2012). Report 716 Travel Demand Forecasting: Parameters and Techniques. Washington, DC; Transportation Research Board.

year forecast of truck volumes, including congested and uncongested speeds by time-of-day and roadway segment, to estimate future travel conditions for trucks in order to guide transportation planning decisions. As discussed in **Section 1.3.3**, there is a need to accommodate increasing future truck volumes in the region as a result of port expansion. In 2010, total truck delay in the Hampton Roads region ranged from five to 10 hours during the weekdays and is predicted in 2030 to degrade to 10 to 15 hours west of Windsor and greater than 15 hours east of Windsor to Route 58.[9] Total truck delay is determined by multiplying the delay for a given travel segment by the truck volume (number of trucks). Time delays result in additional cost for freight transport.[10]

Accidents, mechanical breakdowns, and similar incidents are the principal causes of unreliability in transportation systems. VDOT's Virginia Traffic Information Management System (VATraffic) stores traffic data including traffic events and incidents, which are assigned a priority level for notification procedures as defined in **Table 1.3-6** (VDOT, 2013c).

Table 1.3-6: Virginia Traffic Information Management System Priority Levels

Term	Definition and Examples
Minor	Minimum impact on travel and minimum notifications, no lane closures, minor injuries, minor HAZMAT that is contained, Rest Area closures due to mechanical problems.
Major	Significant impact on travel, one or more lanes closed for 15 minutes or longer, on or off ramp closed for 30 minutes or longer, one or more vehicles involved with serious or multiple injuries; delays caused by bridge openings, etc.
High Profile	Severe traffic disruption; incidents involving fatalities; med-flight, public transportation, significant HAZMAT, police activity, road closures involving all lanes in one or both directions, AMBER Alerts, incidents involving state or contract employees, vehicles or property damage, incidents that occur in work zones and incidents involving state or contract employee injuries. Events or incidents that may not have a direct impact on traffic, but may be of interest to the public or VDOT Executive Team: criminal or police activity on VDOT property – a bomb threat at a tunnel.

VATraffic data were reviewed for the Route 460 corridor between Petersburg and Suffolk for the period January 2011 to January 2014. The majority of incidents recorded during this period received a priority classification of "Major" or High Profile." The average duration of the 65 incidents recorded was two hours and four minutes.

Needs related to travel time include:

- *Minimize travel delays including delays caused by incidents.*

1.3.5 Provide Adequate Emergency Evacuation Capability

Route 460 is a primary route for motorists evacuating from South Hampton Roads and is signed as a designated "Hurricane Evacuation Route." Nearly 1.5 million people in approximately one million vehicles may evacuate the Hampton Roads area in advance of a tropical storm or hurricane weather event. These figures do not include the employment-based population and freight operations that may also be evacuating during an emergency. Additionally, these figures do not include the residents and tourist populations for northeastern North Carolina, including portions of the Outer Banks that will evacuate using Route 168 in

[9] Belfield, S., *Existing and Future Truck Delay in Hampton Roads: Preparation for Project Prioritization*. http://www.hrtpo.org/uploads/docs/Existing%20and%20Future%20Truck%20Delay%20in%20HR%20Final%20Report.pdf (2013).
[10] Weisbrod, G., Vary, D. & Treyz, G., *NCHRP Report 463: Economics Implications of Congestion*, pp. 15, 17, 23 (2001).

Chesapeake. It can be expected that a large-scale evacuation of southeastern Virginia would have consequences for a simultaneous evacuation in North Carolina, possibly impeding the North Carolina evacuation. Motorists evacuating the communities on the Outer Banks (Dare, Currituck and Hyde beaches in North Carolina) use Route 158W, Route 168N, Route 17N, Route 32N and other roads to evacuate into or through North Carolina and Virginia.

According to the Virginia Hurricane Evacuation Guide, updated as of July 2013, Southside Hampton Roads residents south of I-264 are directed to use I-64/I-264; I-664 North Monitor Merrimac Memorial Bridge-Tunnel; Route 17 North; Route 58 West; Route 10 West; and Route 460 West for hurricane evacuation. Norfolk and Virginia Beach residents located north of I-264 are directed to use I-64 in the event of a hurricane evacuation. Route 460 is shown as a primary east-west hurricane evacuation route for portions of Chesapeake, Suffolk, Norfolk, and Virginia Beach. Due to wind restrictions, the Chesapeake Bay Bridge Tunnel is not a designated evacuation route, which forces all traffic from south Hampton Roads through the Hampton Roads Bridge Tunnel (HRBT) or west on Route 58, Route 460 and other routes.

Since hurricanes that form in the Atlantic generally follow a northwest travel pattern, North Carolina will usually come under a Hurricane Watch or Warning prior to the coastal areas of Virginia. The North Carolina/Virginia Border Traffic Control Plan is intended to divert northbound evacuation traffic flow to a westbound evacuation flow via Route 158; however evacuees that follow Route 168, Route 17, and Route 32N will eventually merge with Southside Hampton Roads traffic funneling onto Route 460 and other aforementioned westbound hurricane evacuation routes in Virginia (VDEM, 2013).

According to the Commonwealth of Virginia Emergency Operations Plan (COVEOP), no later than 48 hours prior to the arrival of a tropical storm force winds, residents and tourists in the Hampton Roads region will be encouraged to evacuate voluntarily. COVEOP also indicates that at or before 48 hours, a mandatory evacuation for all at-risk evacuees using Routes 58 and 460 will be issued, as authorized by the Governor. According to the *Hampton Roads Hurricane Evacuation: Evaluation of Incident Effects and Network Treatments* report prepared by the Virginia Transportation Research Council (formerly, the Virginia Center for Transportation Innovation and Research), Route 460 headed westbound out of the region has a 23.8 hour clearance time during a Category 3 hurricane and is expected to carry approximately 42,800 vehicles.

As shown earlier in **Table 1.3-1**, Route 460 has a narrow right-of-way, which contributed to the amount of storm debris blocking the travel lanes during Hurricane Isabel in September 2003. In 1999, heavy rainfall from Hurricane Floyd caused flooding along the Blackwater River with the resulting river crest (about nine feet above the surface of the roadway) rendering Route 460 impassible for over a week. While the pre-hurricane evacuation would have been unaffected by these storm events, the damage caused by them did interfere with post-hurricane emergency response and recovery efforts as well as efforts to provide support to damaged areas and re-establish needed services such as electricity.

In April 2010, the U.S. Department of Transportation (USDOT) prepared a Report entitled "Highway Evacuations in Selected Metropolitan Areas: Assessment of Impediments." This report focused on the highway system's ability to safely evacuate large numbers of people from 26 metropolitan areas that are high-threat, high-density areas. The Hampton Roads area, identified in this report as Virginia Beach, Norfolk and Newport News, was the 31st most congested area in the country and 35th most densely populated. It identifies five top highway impediments to effective large-scale, mass evacuations. While each of the impediments can be addressed by this project, Flood-Prone Infrastructure is specifically identified in the report as a problem on Route 460. There is a clear need to make improvements to the

corridor that protects it from flooding in the event of a hurricane. While there are a number of areas that experience some flooding during a storm event, as discussed in Chapter 2, three primary flood-prone areas have been identified, which are located in or near Zuni, Wakefield and Waverly.

As described above, Route 460 in the study area is not an effective evacuation route. Although the facility is identified as an important evacuation route, it is subject to closure during events because of flooding and blockage by roadside debris. Even when the road remains passable, it experiences lengthy clearance times. The presence of numerous driveways and intersections contribute to clearance delays along Route 460. These conditions limit the potential for effective lane reversal to be implemented along Route 460 during an evacuation.

Needs related to evacuation include:

- *Increase the capacity of the transportation system for evacuation;*
- *Reduce evacuation clearance times;*
- *Afford flexibility to implement lane reversal plans during times of evacuation;*
- *Avoid flood prone evacuation routes; and,*
- *Provide adequate clear zones to minimize evacuation delays caused by debris on the road.*

1.3.6 Improve Strategic Military Connectivity

The Hampton Roads region includes numerous important military installations, including the Norfolk Naval Station, Oceana Naval Air Station, Joint Base Langley – Eustis (U.S. Air Force and U.S. Army), Fort Lee (U.S. Army), and Little Creek Naval Amphibious Base. Fort Lee (U.S. Army) is located near Petersburg.

Due to the importance of highway transportation for mobilizing the nation's military, the FHWA, in partnership with the DoD, has identified a series of highways and connecting roadways that create a STRAHNET. The STRAHNET is a system of about 61,000 miles of inter-connected highways, including the interstate system. An additional 2,000 miles of STRAHNET Connectors link important military installations with ports. Together, STRAHNET and the Connectors define the total minimum public highway network necessary to support DoD deployment needs and sustain military preparedness. As part of the STRAHNET system, Route 460 (from I-95 to Route 58) performs a critical role in preserving the nation's security and military preparedness by connecting the many military facilities located in Hampton Roads with the interstate system and Fort Lee near the Petersburg/Richmond area.

The Military Surface Deployment and Distribution Command Transportation Engineering Agency (SDDCTEA) supports the National Military Strategy with timely and accurate deployment and surface distribution-related analyses. Within SDDCTEA, the Highways for National Defense (HND) Program identifies the minimum public highway infrastructure that the DoD requires in the STRAHNET and integrates public highway needs into civil policies, plans, and programs in order to ensure the defense readiness capability of public highway infrastructure. All non-interstate roadways that are part of the STRAHNET, such as Route 460, should follow design guidelines based upon the functional classification of the roadway. As indicated in **Section 1.3.1**, Route 460 currently does not meet design standards for a rural principal arterial highway.

In addition, the Ports for National Defense (PND) Program identifies the adequacy and responsiveness of defense-important infrastructure at ports. The PND Program has identified the Port of Virginia as one of

the designated strategic seaports on the east coast. According to a recent study (*Ports for National Defense (PND) Study – Port of Virginia, March 2013*) wheeled vehicles (convoys) normally travel via the highway system when distances are less than one day.[11] Cargo originating outside this radius is transported via commercial rail and/or commercial truck. There are 37 military installations within a day of the VPA. The PND Study reported that highway access routes in the Hampton Roads region have significant potential to cause delays to a military deployment due to vehicular rush hour traffic; during a deployment at a strategic seaport the roadways would need to be managed with adequate speed limits. Because travel times on Route 460 are not predictable, the PND Study did not identify Route 460 as an alternate route.

Needs related to Strategic Military Connectivity include:

- *Advance transportation infrastructure improvements that enhance the military's readiness capability; and,*
- *Advance transportation infrastructure improvements that accommodate seaport deployment strategies and meet their need for reliable responsiveness.*

1.3.7 Address Local Economic Development Goals

The Virginia Chamber of Commerce prepared *Blueprint Virginia* to provide business leadership, direction and long-range economic development planning for the Commonwealth of Virginia. The transportation element of the *Blueprint Virginia* makes recommendations that include improving multimodal facilities throughout the Virginia port system to handle anticipated increases in freight as a result of the Panama Canal expansion. In addition, it promotes development of the 2008 preferred alternative for the Route 460 project, and encourages completion of unfinished PPTA solicitations. As noted in **Section 1.3.3**, Route 460 is an important freight route for a number of Hampton Roads ports and is incorporated into VPA's Master Plan.

Local governments along the corridor have included improvements to Route 460 in their comprehensive plans, and/or supported the project via resolutions passed by the Boards of Supervisors. These jurisdictions include: Prince George County, Surry County, Sussex County, Southampton County, Isle of Wight County and the City of Suffolk, as well as the incorporated towns of Wakefield and Windsor.

The City of Suffolk adopted its *City of Suffolk Comprehensive Plan, 2035: A Vision For The Future,* in April 2015. The Comprehensive Plan states that investment in the Route 460 corridor is critical to the City's economic development and crucial to the City's access to regional markets (City of Suffolk, 2015).

Isle of Wight County adopted a new *Comprehensive Plan* in 2008. The County has identified three "Development Services Districts" (DSDs) to provide for moderate growth over the next twenty years (County of Isle of Wight, 2008). As a means to provide improved infrastructure to the Windsor DSD, the County Board of Supervisors passed a resolution in support of a "new limited access road in close proximity to the existing Route 460 corridor" (County of Isle of Wight, 2008). According to the County's Director of Economic Development, "The Route 460 corridor represents the short term and intermediate future of economic development potential for our community. Longer term it represents the key to the diversification of our corporate employment and tax base."[12]

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[11] U.S. Army Field Manual 3-35.4 - Deployment Fort-to-Port.

[12]Memorandum from Patrick J. Small, CED [Director of Economic Development] to W. Douglas Caskey [County Administrator] Re: Route 460 – Modified Study Area. October 9, 2003.

In their *Vision 2025: The Southampton County Comprehensive Plan*, Southampton County states that it needs a diversified economic base less reliant upon agriculture and forestry (paper and wood products). The plan cites that, "the majority of new business or commercial development will occur in and around towns and major transportation corridors, such as the planned US 460 Expressway" (County of Southampton, 2015).

Surry County's *Comprehensive Plan Update* indicates, "The location of a limited access highway between Richmond and Norfolk and south of the James River with improvements to Route 460, benefits the County's growth and development. Better access to Richmond, the state capital, and faster access to ports in the Hampton Roads area will increase the County's ability to attract new commercial and industrial opportunities. This will enlarge the County's employment base providing employment closer to home for the County's residents" (County of Surry, 2005).

Sussex County recognizes Route 460 as an economic generator. In its *Comprehensive Plan Update*, the County recommends either commercial or industrial site development along Route 460. Commercial centers are currently along Route 460, mostly within the town limits of Wakefield and Waverly. The Comprehensive Plan also recommends two stretches of Route 460 for commercial sites (County of Sussex, 2005).

In the Prince George County *2014 Comprehensive Plan Update* land east of the I-295/Route 460 interchange is planned for industrial use. The County has designated an Enterprise Zone that provides special incentives to industries that locate there. The Enterprise Zone covers approximately six square miles, and includes the interchange of I-295 and Route 460, as well as the entire Route 460 corridor within the County. The plan indicates that the county will continue to monitor on-going developments related to the Route 460 project, especially for the western terminus area and the proposed interchange at Route 156 in the vicinity of the J.E.J. Moore Middle School; however, the plan references the 2005 Draft EIS CBA 1 alignment.

Needs related to economic development include:

- *Improve access to areas designated for economic development in the corridor by the local governments; and,*
- *Support local comprehensive planning efforts that endorse improvements to the Route 460 corridor.*

CHAPTER 2.0 | ALTERNATIVES

Chapter 2.0 ALTERNATIVES

Regulations for the implementation of the National Environmental Policy Act (NEPA) require that the project sponsors consider a reasonable range of alternatives prior to making any decisions to proceed with a particular course of action (40 CFR § 1505.1). The range of alternatives considered in the September 2014 Draft Supplemental Environmental Impact Statement (SEIS) was the result of efforts that occurred over the course of the decade-long history of the Route 460 Location Study. The alternatives carried forward for evaluation in the Draft SEIS evolved through these previous efforts and were formulated based on a comprehensive development process that incorporated input from the public as well as coordination with local, state, and federal agencies.

Described below is the process for developing the initial range of alternatives considered in the 2005 Draft Environmental Impact Statement (DEIS), which ultimately contributed to the alternatives considered as part of the Draft SEIS. Alternatives that were not advanced for detailed evaluation are also documented in the sections that follow. This chapter summarizes the alternative analyses and evaluation processes that have contributed to the development and selection of alternatives studied in the Draft SEIS, as well as the identification, recommendation, and refinement of Federal Highway Administration (FHWA)/Virginia Department of Transportation's (VDOT) Preferred Alternative, described in detail in **Section 2.4**. The formulation of alternatives has primarily been based upon the development of the Purpose and Need (See **Chapter 1.0**) and the establishment of design and screening criteria. Using this alternatives development process and the screening criteria for this study, six alternatives (five Build Alternatives and the No Build Alternative) were retained for detailed analysis in the Draft SEIS.

Following the publication of the Draft SEIS, VDOT determined that none of the five Build Alternatives evaluated over the extent of the study corridor would be viable options based on public comments that were received, input from the resource and regulatory agencies regarding the estimated environmental impacts, including potential Council of Environmental Quality (CEQ) referral, and the cost opinions that had been developed. As a result, VDOT carefully reconsidered each of the Draft SEIS alternatives – in whole, in parts, and in hybrid combination with one another – in order to identify a single alternative that would sufficiently address the identified project Purpose and Need, while minimizing environmental impacts and providing a cost effective project.

FHWA/VDOT's Preferred Alternative was developed by VDOT in close coordination with FHWA and approved by the Commonwealth Transportation Board (CTB). In accordance with the 404(b)(1) Guidelines, the U.S. Army Corps of Engineers (USACE) does not identify a preferred alternative but instead can only authorize the Least Environmentally Damaging Practicable Alternative (LEDPA), which will be identified following receipt of a complete permit application and the conclusion of a public interest review. To be the LEDPA, an alternative must result in the least impact to aquatic resources while being practicable, which means it is available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes. It should be noted that the USACE makes these considerations in light of project purpose; it should also be noted that any consideration of the LEDPA prior to making a permit decision is only a preliminary assessment. As noted in **Chapter 1.0**, the USACE stated in January 2015 that it did not find reason to disagree with the assessment that the FHWA/VDOT Preferred Alternative appears to be the LEDPA (Note: the Preferred Alternative identified

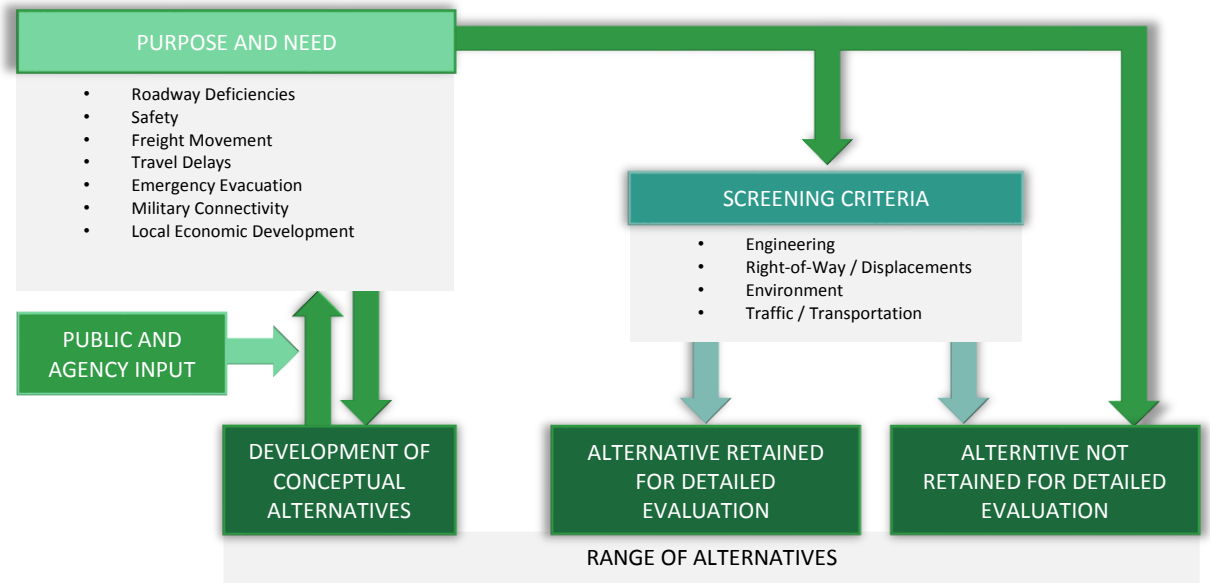
in tables and figures throughout the Final SEIS and Technical Reports refers to the FHWA/VDOT Preferred Alternative)[1].

Additional details on the history of alternatives development, alternatives eliminated from detailed evaluation, alternatives retained for further study, and the FHWA/VDOT Preferred Alternative are provided in the ***Alternatives Technical Report*** (VDOT, 2014e) and the ***Supplemental Alternatives Technical Report*** (VDOT, 2016e).

2.1 ALTERNATIVES DEVELOPMENT AND SCREENING PROCESS

This section provides a summary of the alternatives development process for the 2005 DEIS as well as a description of the alternatives considered in that development process and the justifications for their elimination or retention for detailed evaluation in the Draft SEIS. This early alternatives development and screening process is illustrated in **Figure 2.1–1**.

Figure 2.1–1: Alternative Development and Screening Process



2.1.1 Alternative Development

2.1.1.1 Project Initiation

FHWA and VDOT began the environmental review process for the Route 460 Location Study in July 2003 with the issuance of a Notice of Intent (NOI) to prepare an Environmental Impact Statement (EIS) for proposed highway improvements between Route 58 Bypass in Suffolk and Interstate 295 near Petersburg (78 Fed. Reg. 127, 2003).

Upon publication of the NOI, the scoping process was initiated by inviting interested individuals, organizations, and agencies to provide their ideas, comments and concerns regarding proposed transportation solutions within the approximately 50-mile long and 10-mile wide study corridor. In order

[1] Olsen, Colonel Paul B. Letter to Aubrey Lane, Jr. 9 Jan. 2015. Norfolk, Virginia.

to solicit public and agency input, public scoping meetings were held and coordination was conducted, as appropriate, with federal, state, and local resource agencies.

2.1.1.2 Purpose and Need

Chapter 1.0 of this Final SEIS describes in detail the Purpose and Need for the Route 460 Location Study, which was also considered in the initial stages of the alternatives development process. While the current Purpose and Need has been revised slightly for this SEIS to take into account new information, the Route 460 improvements considered for evaluation have consistently been intended to: address roadway deficiencies; improve safety; accommodate increasing freight traffic; reduce travel delays; provide adequate emergency evacuation capabilities; improve strategic military connectivity; and meet local economic development goals. Once conceptual alternatives were identified, these options were evaluated to ensure that they would address the elements of the Purpose and Need. Alternatives that were not considered to adequately satisfy the Purpose and Need were not retained for detailed evaluation.

2.1.2 Screening Approach and Criteria

During the development of alternatives for the 2005 DEIS, alternatives that met the established Purpose and Need were carried forward for screening and evaluation based on a number of criteria. Consideration was given to design standards, construction costs, hydraulics, displacements, public facilities and services impacts, agricultural and forested land impacts, wetland impacts, endangered species impacts, Section 4(f) resource impacts, and travel forecasts for each alternative. Throughout this process, input from the public, local jurisdictions, and the Crater and Hampton Roads Planning District Commissions (PDCs) was solicited to ensure informed decision making in the identification of alternatives to be carried forward for detailed analysis.

2.2 ALTERNATIVES EVALUATED IN THE 2005 DEIS, 2008 FEIS, AND ROD

The conceptual alternatives identified at the initiation of the Route 460 Location Study were refined and additional alternatives were identified by combining segments of these conceptual alternatives into new end-to-end hybrid alternatives during the alternatives screening process in an effort to further reduce known impacts to the human and natural environments. From this effort, three Candidate Build Alternatives (CBAs) as well as the No Build Alternative and Transportation System Management (TSM) Alternative, were established for evaluation in the 2005 DEIS, which was published by FHWA in May 2005.

Following the publication of the 2005 DEIS, VDOT held two public hearings presenting the technical findings of the draft analysis. In November 2005, the CTB selected the new location alternative south of existing Route 460, with an alignment shift in Isle of Wight County to reduce residential impacts (referred to as Modified CBA 1) as the preferred alternative. A Final EIS (FEIS) was prepared that analyzed the environmental consequences of the preferred alternative in greater detail and was approved by FHWA in June 2008.

In September 2008, FHWA issued a Record of Decision (ROD) selecting the preferred alternative to address the identified Purpose and Need. In November 2012, FHWA completed a NEPA Re-evaluation of the FEIS. There were no changes proposed to the selected alternative; however, consideration was given to funding the project through the implementation of tolls. The purpose of the following section is to describe the alternatives that were evaluated in the original EIS in order to better understand the considerations that went into the development of alternatives included for evaluation in the Draft SEIS.

2.2.1 2005 DEIS Alternatives

2.2.1.1 Initial Range of Conceptual Alternatives

A number of conceptual alternatives were considered for evaluation in the 2005 DEIS. These alternatives were developed based on VDOT standards and guidelines set forth in the VDOT *Road Design Manual* (1998[2]) and the standards for the National Highway System (NHS). These alternatives included a No Build Alternative, TSM Alternative, Mass Transit Alternative, Improve-Existing-Route-460 Alternative, and five Conceptual Build Alternatives (A through E).

Of these Conceptual Build Alternatives, Alternative A was the southernmost alignment within the project study area, and Alternative E was the northernmost alignment. Located in between Alternatives A and E, three additional alignment configurations (Alternatives B through D) along the Route 460 corridor were included as part of the Conceptual Build Alternatives. In addition, improvements to the existing Route 460, which included adding a center two-way left turn lane (TWLTL) or a combination of raised and flush medians, were included for evaluation in the 2005 DEIS.

Following the initial establishment of these Conceptual Build Alternatives, segments of the alternatives were examined to see if they could be linked together to form additional discrete alternatives. This process led to the addition of four "hybrid" conceptual alternatives that met the established Purpose and Need while reducing impacts to one or more environmental constraints under study. These four hybrid conceptual alternatives were identified and evaluated.

2.2.1.2 Alternatives Selected for Detailed Analysis in 2005 DEIS

The hybrid alternatives were then evaluated based on the criteria referenced in **Section 2.1.2**. Following the initial analyses of these alternatives, which included input from various federal agencies, three CBAs were developed to be carried forward for detailed analysis in the 2005 DEIS study, in addition to the No Build and TSM Alternatives.

The alternatives retained for detailed evaluation in the 2005 DEIS included the following:

- *CBA 1 (south of existing 460)*;
- *CBA 2 (along existing 460 with bypasses around towns)*;
- *CBA 3 (north of existing 460)*;
- TSM Alternative; and
- No Build Alternative.

2.2.2 Alternative Selected in the 2008 FEIS and 2008 ROD

Following the publication of the 2005 DEIS and consideration of public and agency comments, the CTB selected the location of CBA 1, with an alignment shift in Isle of Wight County developed to reduce residential impacts (Modified CBA 1), as the preferred alternative subject to further analysis in the FEIS.

The FEIS analyzed the environmental consequences of Modified CBA 1 in greater detail, and the FEIS was approved by FHWA in June 2008. FHWA issued a ROD in September 2008 selecting Modified CBA 1 to address the identified Purpose and Need.

[2] VDOT Road Design Manual has since been updated to 2005 version, revised in January 2016.

In November 2012, FHWA completed a NEPA Re-evaluation of the FEIS and in particular, Modified CBA 1, giving consideration to funding the project through the implementation of tolls. In reviewing the information presented in the 2008 Final EIS and the 2012 NEPA Re-evaluation, the USACE indicated that the Commonwealth's preferred alternative did not appear to be the LEDPA when compared to improving the existing road. Further development of additional information and analyses of the Commonwealth's preferred alternative resulted in an increase in the acreage of wetlands identified in the Modified CBA 1 corridor compared to the acreage of wetlands presented in the 2008 FEIS.

In 2013, FHWA and USACE determined that the preparation of an SEIS would be necessary in order to analyze new information with a bearing on the environmental impacts, including aquatic resource impacts. The SEIS also was determined to be necessary in order for the USACE to fulfill its statutory obligations under NEPA and as part of its decision making process to issue or deny authorization for impacts associated with the Route 460 corridor improvements.

2.3 2014 DRAFT SEIS ALTERNATIVES

In developing the alternatives to be studied in the Draft SEIS, VDOT, FHWA, and USACE considered again the previous preferred alternative as well as a range of other alternatives that addressed the Purpose and Need. In December 2013, FHWA and the USACE issued individual NOIs, which acknowledged that other alternatives identified during the DEIS process could be considered, other than the alternatives evaluated in the FEIS, and input was solicited from the public on the proposed project to inform the development of a Draft SEIS. The Draft SEIS noted that after review of public comments submitted in response to it, USACE would make a preliminary assessment regarding the LEDPA for consideration by FHWA and VDOT in their identification of a preferred alternative. That assessment would be made while considering all available information, including but not limited to, information gathered during the NEPA process, information provided in the public comments, and VDOT and/or FHWA input on technical aspects of the alternatives. This is discussed further below in **Section 2.4.3**.

This section documents the alternative development and screening process used for the Draft SEIS, discloses those alternatives that were eliminated from further consideration, and describes the alternatives that were evaluated in the 2014 Draft SEIS.

2.3.1 Draft SEIS Alternative Development and Screening

Alternatives evaluated in the 2014 Draft SEIS and their associated typical sections were developed based upon previous studies and applicable engineering guidelines and standards. This effort reviewed the alternatives screening process used for the 2005 DEIS as a starting point and focused primarily on the CBAs that were carried forward for detailed study in the 2005 DEIS. Additional alternatives were considered based on comments received from federal and state agencies as well as the public on the NOIs along with meeting the requirements for the USACE alternatives analysis. The potential Draft SEIS Alternatives were then evaluated based on their ability to meet the design standards associated with the elements of the Purpose and Need (See **Chapter 1.0**) including the number of lanes, median treatment, design speed, type of access control, etc.

2.3.2 Alternatives Eliminated From Detailed Study

The following alternatives were eliminated in 2005 and/or 2008 and were reconsidered in 2014 but were eliminated again for the Draft SEIS:

- Mass Transit Alternative - this alternative was eliminated because it would not address roadway deficiencies, safety, projected increases in freight traffic, evacuation capability, strategic military connectivity, or local economic development goals.
- Improvements to the existing alignment using a rural principal arterial with a TWLTL – this alternative was eliminated because pursuant to AASHTO's updated guidance ("A Policy on Geometric Design of Highways and Streets 2011" Chapters 4, 7 and 9), the application as proposed for this alternative does not meet the guidelines. As such, the application of the five lane TWLTL section is appropriate only in the towns where the posted speed along Route 460 reduces as a result of closely spaced, low-volume commercial entrances. Since this alternative does not apply this typical section in areas such as those described above, these alternatives have been determined to be non-compliant with the above Federal guidelines. This non-compliance has a direct relationship to the Safety and Travel time objectives outlined in the Purpose and Need.
- TSM Spot Improvement Alternative – this alternative was eliminated because it did not meet the project Purpose and Need for accommodating increasing freight shipments, reducing travel delay, enhancing emergency evacuation capabilities, improving strategic military connectivity, or addressing local economic development.

For additional detailed discussion on the elimination of these alternatives refer to the ***Alternative Technical Report*** for the Draft SEIS for the Route 460 Location Study (VDOT, 2014e).

2.3.3 Alternatives Retained for Detailed Study in Draft SEIS

The Draft SEIS provided detailed analysis of five Build Alternatives (Alternatives 1-5, see **Figure 2.3-1**) that addressed the Purpose and Need for the project, along with the No Build Alternative. Along each of the individual alignments, a variety of additional design elements were considered in refining the typical section including interchanges, intersecting road overpasses and the transition between the existing road and bypasses.

2.3.3.1 No Build Alternative

The No Build Alternative was considered alongside the Build Alternatives as a potential action available to the federal agencies; it also was included to serve as a baseline for comparison to the Build Alternatives. The No Build Alternative includes all planned transportation improvements in the study area that have been programmed for construction and adopted for implementation by 2040, as identified in the VDOT Six Year Improvement Program (SYIP). These planned and programmed improvements are independent of the implementation of the FHWA/VDOT Preferred Alternative. The No Build projects within the study area and projects that have the potential to affect capacity within the study area are listed in **Table 2.3-1**.

Figure 2.3-1: Draft SEIS Build Alternatives

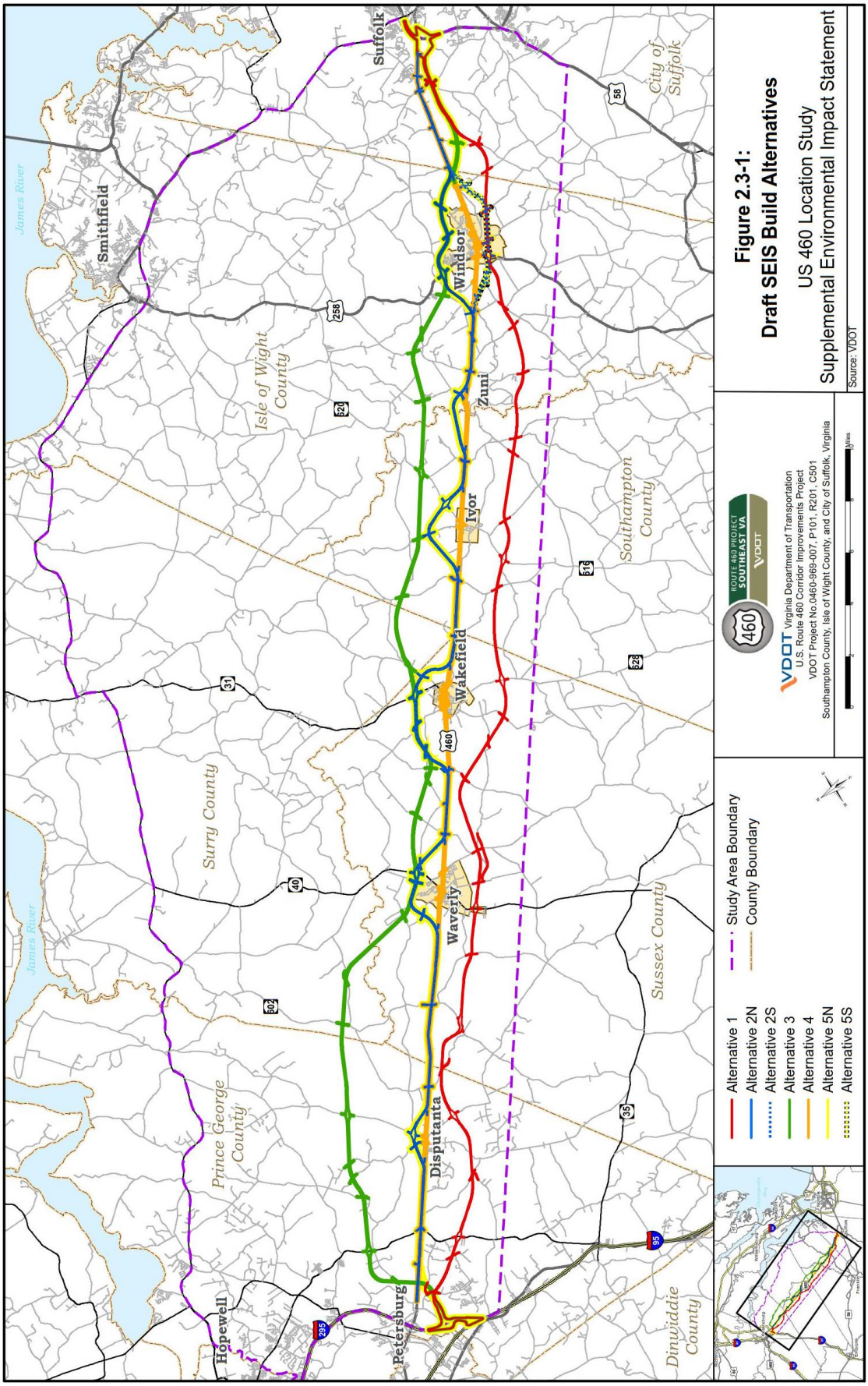


Table 2.3-1: Route 460 No Build Projects

Locality	VDOT UPC	Description
Prince George	100499	Construction of added left turn lane on westbound Route 460 at Enterprise Drive (Route 657).
	82849	Construction of added left turn lanes on northbound Bull Hill Road (Route 630) onto Route 460 in Prince George County.
	105110	Construction of right turn lanes on Courthouse Road (Route 106) at its intersection with Prince George Drive (Route 616).
	104847	Construction of added left turn lane on Route 156.
Surry	107529	Improvements to Route 627 by widening, improving the drainage and straightening the roadway.
Sussex	N/A	No projects listed.
Southampton	N/A	No projects listed.
Isle of Wight	58297	Construction of added left and right turn lanes on Courthouse Highway (Route 258) at its intersection with Scotts Factory Road (Route 620).
	103021	Construction of a right turn lane on Turner Drive (Route 644) at the intersection with Benns Church Boulevard (Route 10/32).
Suffolk	104333	Improvements to drainage and stormwater management facilities along Pruden Boulevard (Route 460).
	102994	Intelligent transportation system (ITS) improvements to 11.6 miles of the Suffolk Bypass (Route 58) from the City of Chesapeake to Holland Road.
	100937	Reconstruction with added capacity on Route 58/Holland Road between the Route 58/13/32 bypass to just west of Manning Bridge Road.
	102998	Intersection improvements to Suffolk Bypass Off-Ramp at Godwin Boulevard. Construction of second exclusive right turn lane and traffic signal improvements.
	104332	Improvements to the intersection of Godwin Boulevard (Route 10) and Kings Highway (Route 125).

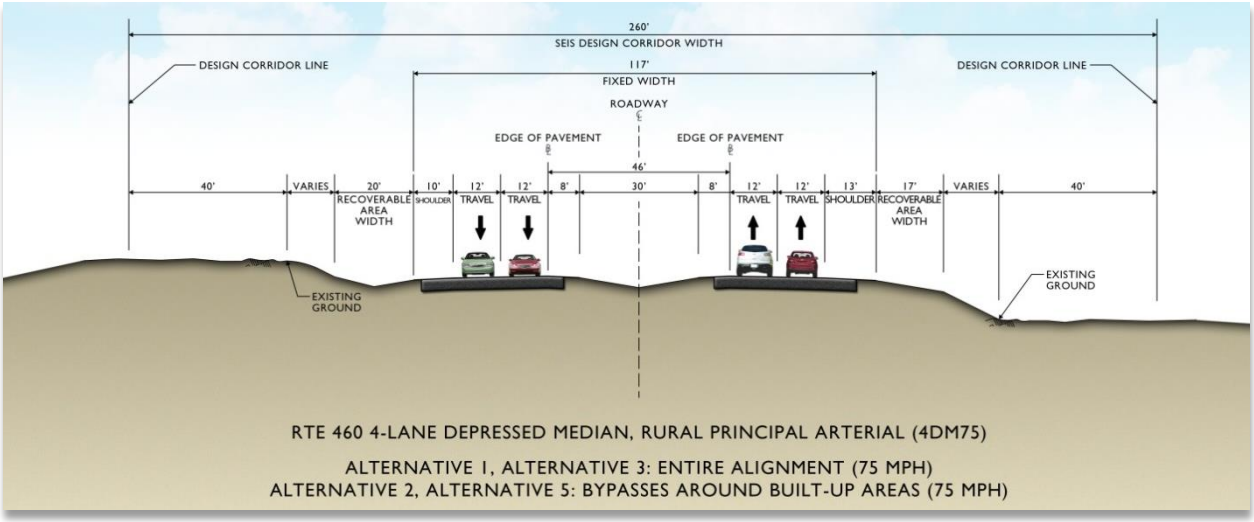
Sources: Virginia Department of Transportation FY 2016 Final SYIP; Hampton Roads 2040 Long Range Transportation Plan: Committed and Candidate Transportation Projects, September 2014.

Under the No Build Alternative, no additional transportation infrastructure improvements, beyond those listed above, are assumed to be in place by 2040.

2.3.3.2 Alternative 1

Alternative 1 generally followed the alignment of the preferred alternative identified in the 2008 ROD as Modified CBA 1. This alternative originated at I-295 in Prince George County, immediately north of its convergence with I-95, and continued on the south side of existing Route 460 until reaching the Route 58 Bypass, just south of the existing interchange with Route 460, in Suffolk. This limited access rural principal arterial consisted of four lanes divided by a depressed median and was anticipated to be contained within a 260-foot Design Corridor, safely accommodating design speeds of 75 miles per hour (mph) (See Typical Section A illustrated in **Figure 2.3–2**). This alternative was evaluated as a tolled facility to be constructed on new alignment. As part of Alternative 1, existing Route 460 was assumed to remain in its present condition.

Figure 2.3–2: Typical Section A



Access to Alternative 1 from intersecting roadways was provided via nine interchanges located along the alignment at: the western terminus at I-295, Prince George Drive (Route 156), Arwood Road/Hines Road (Route 625), Cabin Point Road (Route 602), Main Street/Sussex Drive (Route 40), Courtland Road (Route 628), Ivor Road (Route 616), Walters Highway/Courthouse Highway (Route 258) and the eastern terminus at Route 58 (see **Section 2.3.4** for discussion of alternative termini). In addition, Alternative 1 included 22 locations where side roads were presumed to span the Route 460 mainline with overpasses and 15 bridge structures where environmental resources including wetlands and streams were identified and/or where required for stormwater conveyance.

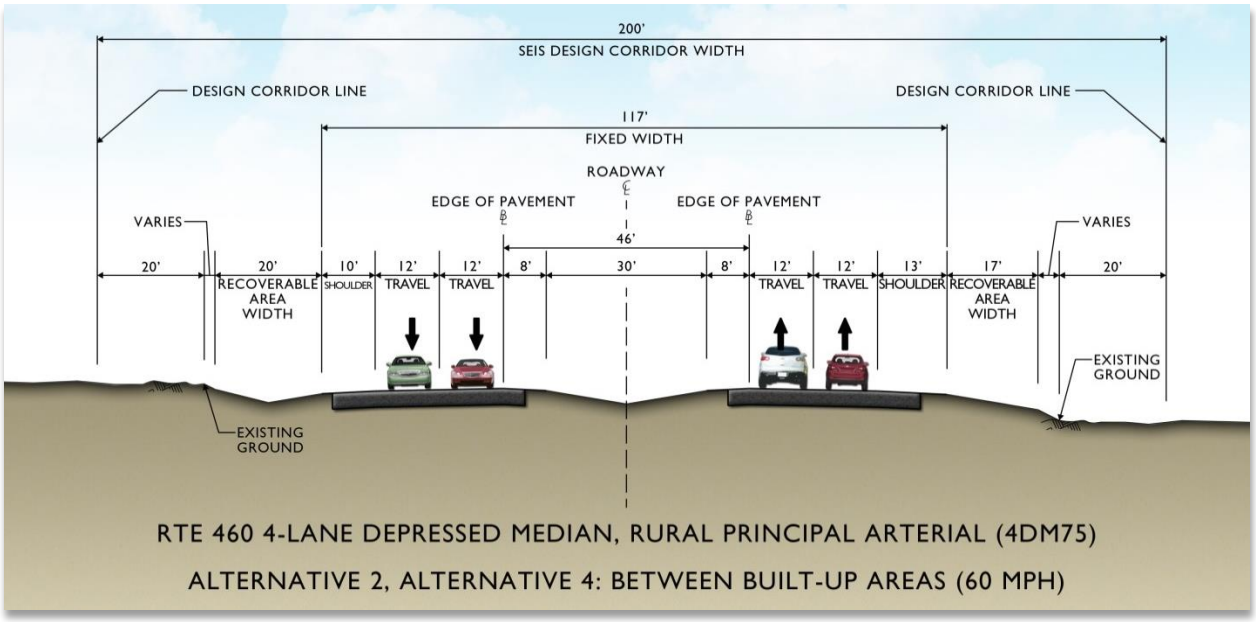
2.3.3.3 Alternative 2N/2S

Alternative 2 would primarily follow the alignment of existing Route 460 between the six communities located along the roadway, but would incorporate bypasses around Disputanta, Waverly, Wakefield, Ivor, Zuni and Windsor. This roadway facility was considered to be a four-lane rural principal arterial with managed access along the existing Route 460 alignment and limited access along the six bypasses around each town. In places where the improvements were along existing Route 460, a complete reconstruction of the roadway was assumed to be required as the proposed typical section and alignment did not match the existing roadway geometry. Additionally, the existing pavement condition was considered to be structurally inadequate, the existing storm sewer infrastructure was likely inadequate, and the locations and conditions of the existing subsurface utility lines was unknown.

During the analysis of the bypass north of Windsor, consideration was given to changes in the existing and future land use since the publication of the 2008 FEIS. It was determined that an adjustment to the northern bypass around Windsor at its interchange with Route 258 was necessary to avoid impacts to a new school, affordable housing units and a nursing home (Alternative 2N). In addition, since the growth in Windsor was concentrated to the north, a southern bypass of Windsor was considered to minimize impacts to existing and planned land uses (Alternative 2S). As a result, Alternative 2 was analyzed as both Alternative 2N and 2S, to distinguish between the alignments of the bypass of Windsor to the north and south.

All of the bypasses were designed for 75 mph with depressed medians inside a 260-foot Design Corridor width (See Typical Section A in **Figure 2.3–2**). Between each bypass, Alternative 2 consisted of a 200-foot Design Corridor width to accommodate a depressed median and 60 mph design speed (See Typical Section B in **Figure 2.3–3**). Alternative 2 tied into the existing Route 460 typical sections in the west approximately 3,100 feet east of the Interstate 295/Route 460 interchange at Quaker Road and tie into Route 460 in the east approximately 2,100 feet west of the Route 58/Route 460 interchange near the entrance to the Virginia Regional Commerce Park, just east of General Early Drive. The bypasses associated with Alternative 2 were evaluated as a tolled facility (Alternative 2A) and an untolled facility (Alternative 2B).

Figure 2.3–3: Typical Section B



Access to the bypasses around the towns was provided via interchanges at the following locations: Arwood Road/Hines Road (Route 625), Main Street/Sussex Drive (Route 40), Birch Island Road (Route 31), Broadwater Road (Route 620), and Walters Highway/Courthouse Highway (Route 258). The bypasses associated with Alternative 2 included nine locations where side roads span the main travel lanes with an overpass. An additional two locations where side roads traversed the main lanes with an overpass were included for Alternative 2N and an additional four overpasses were included for Alternative 2S. There were 12 bridge structures anticipated along the alignment of Alternative 2N and ten bridges along the alignment of Alternative 2S for the conveyance of stormwater and/or traversing environmental resources including wetlands and streams.

Sections of Alternative 2 that improve the Route 460 mainline between the built up areas included two types of at-grade intersections. Rural intersections were proposed to be located where existing side roads intersected Route 460 and included accommodations for left turning movements in the median. There were 17 locations along Alternative 2 where rural intersections were accounted for in the Design Corridor. Additional at-grade intersections were proposed where the Alternative 2 alignment tied into the bypasses around the built up areas. It was assumed that the transition from Alternative 2 between the built up areas and the bypasses were signalized intersections that would allow those continuing on to the bypasses to proceed unimpeded while the movements of those travelling into or out of the towns were to be controlled

by a signal. There were 12 locations where these intersections were utilized: on both the east and west sides of each of the six bypasses.

2.3.3.4 Alternative 3

Alternative 3 was a limited access facility originating at I-295 in a configuration similar to that of Alternative 1. The alignment crossed over Route 460 and continued on the north side of Route 460 until approximately one mile west of King's Fork Road (Route 634) where it crossed back to the south side of Route 460 near the border of Suffolk and Isle of Wight County and connected to the eastern terminus at the Route 58 Bypass, just south of the existing interchange with Route 460 in Suffolk. Alternative 3 was a divided four-lane facility with a depressed median and design speeds of 75 mph. Consistent with the new location alignment of Alternative 1, Alternative 3 was expected to be accommodated within a Design Corridor width of 260 feet (See Typical Section A in **Figure 2.3–2**).

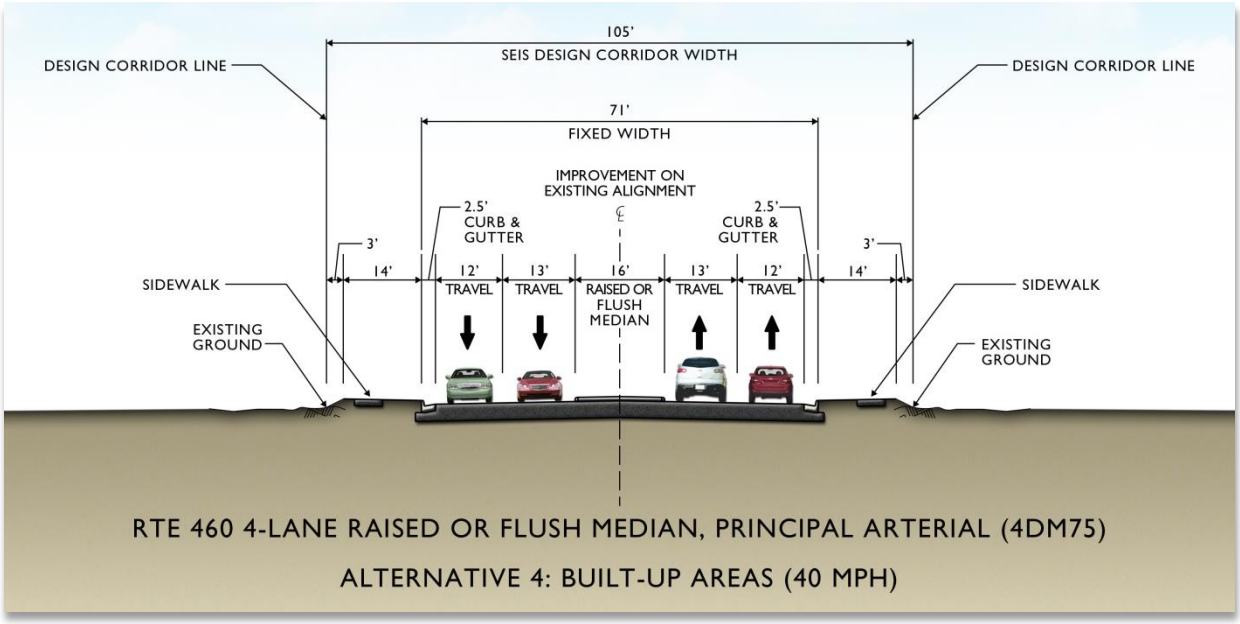
Alternative 3 was evaluated as a tolled facility with access provided at nine interchanges located along the alignment: I-295 (western terminus), Prince George Drive (Route 156), Arwood Road/Hines Road (Route 625), Main Street/Sussex Drive (Route 40), Birch Island Road (Route 31), Broadwater Road (Route 620), Walters Highway/Courthouse Highway (Route 258), Route 460 (Windsor Boulevard/Pruden Boulevard) and Route 58 (eastern terminus). Since Alternative 3 was proposed to be a limited access facility, all side roads crossing the proposed alignment were anticipated to be on overpasses (25 locations). See **Section 2.3.4** for discussion of alternative termini. In addition, Alternative 3 incorporated 13 bridge structures due to the presence of environmental resources including wetlands and streams and/or for the conveyance of stormwater.

2.3.3.5 Alternative 4

Alternative 4 included improvements along the existing Route 460 alignment using both Typical Section B (**Figure 2.3–3**) between the built-up areas and Typical Section C (**Figure 2.3–4**) through each of the built-up areas or developed communities along the alignment. As described for Alternative 2 in **Section 2.3.3.3** above, a complete reconstruction of Route 460 was assumed to be required under Alternative 4. This alternative utilized signalized and unsignalized at-grade intersections, and entrances maintained and governed by access management criteria. Within each community, a divided four lane facility with sidewalks and a raised or flush median, including curb, gutter and sidewalks, was accommodated within a 105-foot Design Corridor with a design speed of 40 mph. Between each built up area, the roadway was a four-lane road with a depressed median accommodated within a 200-foot Design Corridor with a design speed of 60 mph, like Alternative 2. As with Alternative 2, Alternative 4 tied into the existing Route 460 in the west approximately 3,100 feet east of the I-295/Route 460 interchange at Quaker Road and tied into Route 460 in the east approximately 2,100 feet west of the Route 58/Route 460 interchange just east of General Early Drive. Due to lack of limited access along the alignment, there were no tolling options considered for Alternative 4.

Since the entire alignment of Alternative 4 was proposed to be located along existing Route 460, at-grade intersections were proposed at all existing intersections. Under Alternative 4, there were 50 intersections located within the built-up areas and 17 intersections between the built-up areas.

Figure 2.3-4: Typical Section C



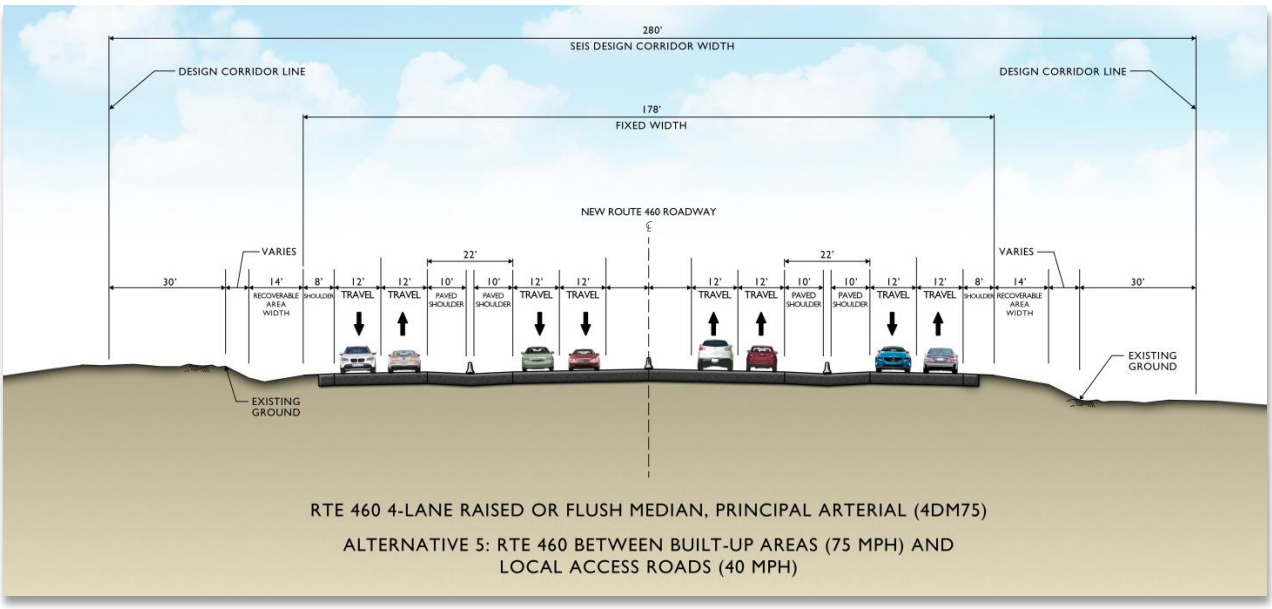
Several bridges were proposed along Alternative 4 and were sized for the conveyance of stormwater. Along sections where the location of Alternative 2 and Alternative 4 were the same (outside of the built up areas), proposed bridge locations were the same; however, Alternative 4 would include an additional bridge over the Blackwater River just west of Zuni, which was bypassed by Alternative 2 with a bridge over the Blackwater River to the north.

2.3.3.6 Alternative 5N/5S

Alternative 5 followed a nearly identical alignment to that of Alternative 2 along the existing Route 460 alignment between the six communities located along the roadway, with bypasses to the north of Disputanta, Waverly, Wakefield, Ivor, Zuni and Windsor, but with different termini on the west and east ends. Similar to Alternative 2, a southern bypass around Windsor was also considered for Alternative 5 to avoid impacts to existing and planned land uses. The alternatives were differentiated as Alternative 5N and 5S to distinguish between the bypass of Windsor to the north and south. Under Alternative 5, the bypasses were four lanes with a depressed median and accommodated within a Design Corridor of 260 feet (See Typical Section A in **Figure 2.3–2**).

Unlike Alternative 2, Alternative 5 featured four limited access lanes on the existing Route 460 alignment between built up areas with a barrier divided median and two-lane bi-directional local access roads located to the north and south. This eight lane facility located between the existing communities was accommodated within a 280-foot Design Corridor (See Typical Section D in **Figure 2.3–5**). As described for Alternative 2 in **Section 2.3.3.3** above, a complete reconstruction of the sections where the improvements are along existing Route 460 was assumed to be required. The limited access travel lanes were designed for 75 mph and the adjacent two-lane, bi-directional, local access roads were designed for 40 mph.

Figure 2.3-5: Typical Section D



The limited access lanes along the entire length of the alignment were considered for tolling, and there were eight interchanges, six of which would be intermediate interchanges associated with the bypasses: I-295 (western terminus), Arwood Road/Hines Road (Route 625), Main Street/Sussex Drive (Route 40), Birch Island Road (Route 31), Broadwater Road (Route 620), Walters Highway/Courthouse Highway (Route 258), Route 460 (Windsor Boulevard/Pruden Boulevard) north bypass only and Route 58 (eastern terminus). With the exception of Windsor, Alternative 5 included ten locations where it was assumed that side roads would span over mainline travel lanes of the bypasses with overpasses. The northern bypass around Windsor included an additional four overpass locations, and an additional six overpasses were proposed for the southern bypass option. Similar to Alternative 2, there were 12 bridge structures that were located along the alignment of Alternative 5N and ten bridge structures that were located along the alignment of Alternative 5S for the conveyance of stormwater and/or spanning of environmental resources including wetlands and streams.

2.3.4 SEIS Alternative Termini

The alternative alignments and Design Corridor typical sections evaluated in the Draft SEIS were developed for the purposes of estimating potential impacts to natural and human resources. At either end of the project study area, termini configurations were established to conceptualize how the alternatives under evaluation would tie into existing roadway facilities. Under Alternatives 2 and 4, the improvements terminated at either end of the study area on the existing Route 460 alignment, as previously described. However, for the new location alignments (Alternatives 1 and 3) and Alternative 5, conceptual layouts were developed to maximize the operational efficiency of the connection and reduce community impacts. These conceptual layouts for the eastern terminus and western terminus are illustrated in **Figure 2.3–6** and **Figure 2.3–7**, respectively.

Figure 2.3-6: Conceptual Layout for Eastern Terminus

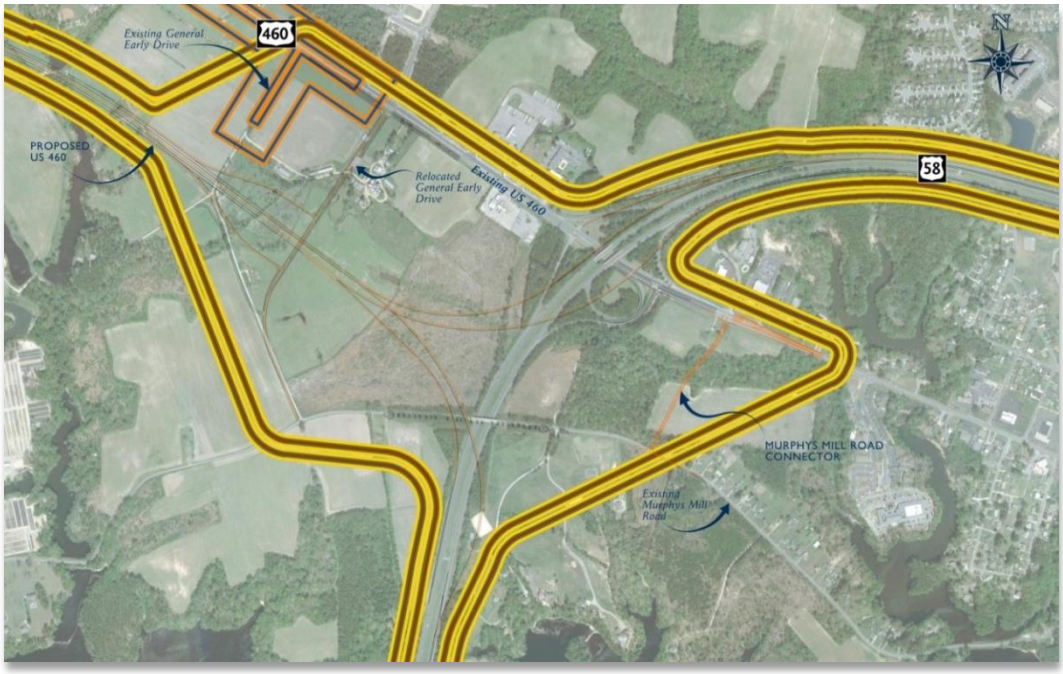
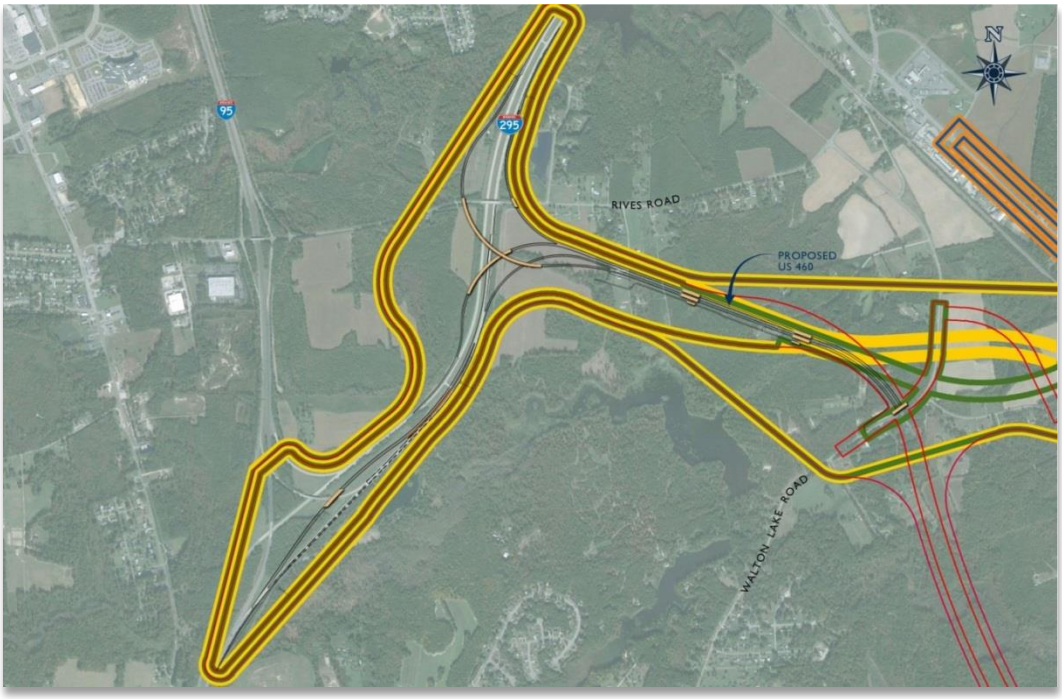


Figure 2.3-7: Conceptual Layout for Western Terminus



2.3.5 Inventory Corridor and Design Corridor

In order to identify resources along the Build Alternatives analyzed in the Draft SEIS, a 500-foot wide Inventory Corridor was developed to identify resources within a reasonable proximity of each alignment. None of the alternatives were anticipated to impact all of the resources identified within their respective Inventory Corridors as these corridors did not reflect the actual impacts of each of the alternatives in comparison to one another. Instead the Inventory Corridors were developed for the purposes of providing greater flexibility to further avoid and minimize impacts as design advanced.

In order to estimate impacts and compare alternatives, the conceptual designs and typical sections were applied to each Build Alternative in the Draft SEIS to develop a Design Corridor to represent the likely "footprint" for each alternative. The reported impacts in the Draft SEIS were based upon the Design Corridor, which included roadway width, proposed right-of-way, and construction limits. The Design Corridor for each alternative was able to be shifted within the Inventory Corridor to avoid or minimize impacts to resources with knowledge of the consequences of those shifts. In addition, both the SEIS Inventory and Design Corridors were adjusted as necessary to account for design elements associated with each Alternative, including interchanges, at-grade intersections, side road overpasses, interface geometry with bypasses, etc. Details regarding the design elements that were factored into the development of each alternative and the typical sections developed for them are included within the appendices of the ***Alternatives Technical Report*** (VDOT, 2014e).

Design and engineering were advanced in order to develop the permit application for the FHWA/VDOT Preferred Alternative. As a result, the planning level design associated with the Draft SEIS Design Corridor assumptions for the FHWA/VDOT Preferred Alternative was refined to more accurately reflect the anticipated impacts of the project, known as the Limits of Disturbance (LOD). As described in the sections that follow, the typical sections and Design Corridor assumptions were refined to include both temporary and permanent impacts, including stormwater management facilities and construction access. To the extent practicable, the LOD was developed to avoid and minimize impacts to resources, including wetlands and streams. This LOD has been used to calculate predicted impacts of the FHWA/VDOT Preferred Alternative as discussed in detail in **Chapter 3.0**.

2.4 FHWA/VDOT PREFERRED ALTERNATIVE DEVELOPMENT

In **Section 2.3.6** of the Draft SEIS, the public was alerted to the possibility that hybrid alternatives could be considered and one advanced as the preferred alternative. Following the publication of the Draft SEIS, VDOT determined that none of the five Build Alternatives evaluated over the extent of the study corridor would be viable options based on public comments that were received, input from the resource and regulatory agencies regarding the estimated environmental impacts including potential CEQ referral, and the cost opinions that had been developed. In order to identify a single alternative that was less impactful, as well as less costly, while sufficiently addressing the Purpose and Need, VDOT explored a combination of segments from the Draft SEIS alternatives in various configurations to develop hybrid alternatives. The goal of the hybrid development was to arrive at a recommendation for a preferred alternative that could be considered the LEDPA while sufficiently addressing the project's Purpose and Need and providing a cost effective solution. Following the development of initial hybrids, as described below, further refinement and modifications were analyzed and evaluated in an effort to identify FHWA/VDOT's recommended Preferred Alternative.

While developing and analyzing theses hybrids, consideration was given to the viability of tolling. As the hybrids were further refined, tolling was determined not to be a viable option as the hybrid combinations and configurations considered included variations of tolled and untolled alternatives from the Draft SEIS, including improvements along existing Route 460 where tolling would be impractical due to lack of limited access. For the areas that would be limited access, the revenue anticipated to be generated by the facility was expected to be insufficient to cover the cost of installation, operation, and maintenance of the required tolling infrastructure and equipment. As a result, tolling is not being considered for the FHWA/ VDOT Preferred Alternative.

The following sections describe the hybrid development, refinement, and modification that followed the Draft SEIS as well as the ultimate selection of the FHWA/VDOT Preferred Alternative.

2.4.1 Hybrid Development and Evaluation

The **Executive Summary** and **Section 2.3.6** of the Draft SEIS described the potential to advance a hybrid alternative as a preferred alternative in the Final SEIS, noting that decision makers could combine sections of multiple alternatives to advance an alternative that balances cost, impacts and the alternative's effectiveness at meeting the primary components of the Purpose and Need. VDOT evaluated combinations of sections of the five Build Alternatives, as well as the No Build Alternative, analyzed in the Draft SEIS to form hybrid conceptual alternatives. All hybrids are comprised of portions of the No Build and the Build Alternatives analyzed in the Draft SEIS.

2.4.1.1 Initial Hybrids Considered

VDOT's development of initial hybrids went through many iterations starting with the development of end-to-end combinations and/or spot improvements along the length of the study corridor, then looking at shorter segments that focused on either end of the study corridor. As the process continued, adjustments to the typical sections were made in an effort to reduce environmental impacts and costs. **Table 2.4-1** summarizes the variety of hybrids initially considered, the combination of Draft SEIS Alternative segments comprising each hybrid and the issues associated with each initial hybrid. This process allowed VDOT to understand the benefits and flaws associated with the variety of hybrids initially considered and to help identify the priorities of the project.

Table 2.4-1: Initial Hybrids Evaluated

Initial Hybrids	Draft SEIS Alternative Segments	Result of Evaluation*
1) Improvements along existing Route 460 between Prince George to west of Waverly and east of Wakefield to west of Windsor with new location from west of Windsor (bypass south of Windsor) to the Eastern Terminus (new system to system interchange).	Alternatives 4, 2S, 1, and No Build	Not carried forward because of wetland impacts (255 Ac.) and cost ($1.025 B).
2) Improvements along existing Route 460 between Prince George to west of Waverly, east of Wakefield to west of Zuni, and east of Zuni to west of Windsor, with new location on bypasses north of Zuni and Windsor, and from Windsor to the Eastern Terminus (new system to system interchange).	Alternatives 4, 2N, 3, and No Build	Not carried forward because of wetland impacts (209 Ac.) and cost ($1.051 B).
3) Improvements along existing Route 460 between Prince George to west of Waverly and east of Wakefield to west of Windsor with new location from west of Windsor (bypass north of Windsor) to the Eastern Terminus (new system to system interchange).	Alternatives 4, 2N, 3, and No Build	Not carried forward because of wetland impacts (187 Ac.) and cost ($998 M).

Initial Hybrids	Draft SEIS Alternative Segments	Result of Evaluation*
4) Improvements along existing Route 460 between Prince George to west of Waverly and east of Wakefield to west of Windsor and improvements to the existing Eastern Terminus interchange.	Alternatives 4 1,and No Build	Not carried forward because of wetland impacts (129 Ac.) and cost ($677 M).
5) Improvements along existing Route 460 between towns with bypass north of Zuni.	Alternatives 4, 2, and No Build	Not carried forward because of wetland impacts (100 Ac.) and cost ($677 M).
6) Improvements along existing Route 460 between towns with new location on bypasses north of Zuni and Windsor, and from Windsor to the Eastern Terminus (new system to system interchange).	Alternatives 4, 2N, 3, and No Build	Not carried forward because of wetland impacts (149 Ac.) and cost ($858 M).
7) Improvements along existing Route 460 between all of the towns, from Route 295 to Route 58 with new location on bypasses north of Zuni and south of Windsor, and from Windsor to the Eastern Terminus (new system to system interchange).	Alternatives 4, 2S, 1, and No Build	Not carried forward because of wetland impacts (205 Ac.) and cost ($885 M).
8) Bypass north of Zuni and new location for the Eastern Terminus (new system to system interchange).	Alternatives 2, 1, and No Build	Not carried forward because it does not adequately address the Purpose and Need for economic development, freight movement, and safety.
9) New location between Western Terminus and east of Disputanta, providing a system to system interchange at Route 295 and bypassing Disputanta to the south.	Alternatives 1 and No Build	Not carried forward because it does not adequately address the Purpose and Need for economic development, freight movement, and safety.

**Cost includes estimated values for engineering, right-of- way acquisition, environmental mitigation, construction, and contingency.*

As listed in **Table 2.4-1**, the initial hybrids, in their entirety within the study corridor, were eliminated due to one or more reasons – they were too impactful, too costly, or did not adequately address the project Purpose and Need. As a result, VDOT further refined the evaluation of hybrid alternatives, by exploring smaller portions of the initial hybrids that would better balance impacts and cost, while adequately satisfying the Purpose and Need.

Through this evaluation, the following were identified as being key improvements necessary for addressing the individual elements of the Purpose and Need, even if these improvements involved a hybrid alternative less than the full length of the Route 460 corridor should be advanced.

- Improvements that meet current design standards are needed along Route 460 at the Blackwater River to address longstanding flooding issues which relate to the safety, emergency evacuation, and roadway deficiency elements of the Purpose and Need.
- Improvements are needed at the Route 58/Route 460 interchange to provide efficient high-speed traffic movements between the two facilities. The Purpose and Need elements related to travel time, freight mobility, military connectivity, and emergency evacuation need to be addressed at this interchange.
- Improvements to the eastern portion of the corridor are needed as this area has the largest number of conflict points compared to the rest of the corridor. The Purpose and Need elements related to safety would be addressed and better realized with improvements to the eastern portion of the corridor.

Based on the identification of these key components, VDOT reexamined the initial hybrids to consider sections in the eastern portion of the study corridor, where these key project components were focused and the elements of need had been demonstrated in the Draft SEIS as more pronounced. As a result, the eastern 16 miles of the Route 460 study corridor formed the basis for a refined hybrid analysis. West of Zuni was established as the new western limit within which the refined hybrid analysis was focused in order to ensure that flooding issues on Route 460 associated with the Blackwater River would be addressed. The Eastern Terminus at Route 58 identified in the Draft SEIS was maintained as the eastern limit for analysis. While taking into account costs and in an effort to focus improvements in the corridor where they could most effectively address the Purpose and Need, no planned improvements were considered beyond the western limit, and the No Build Alternative was recommended for this remaining portion of the corridor.

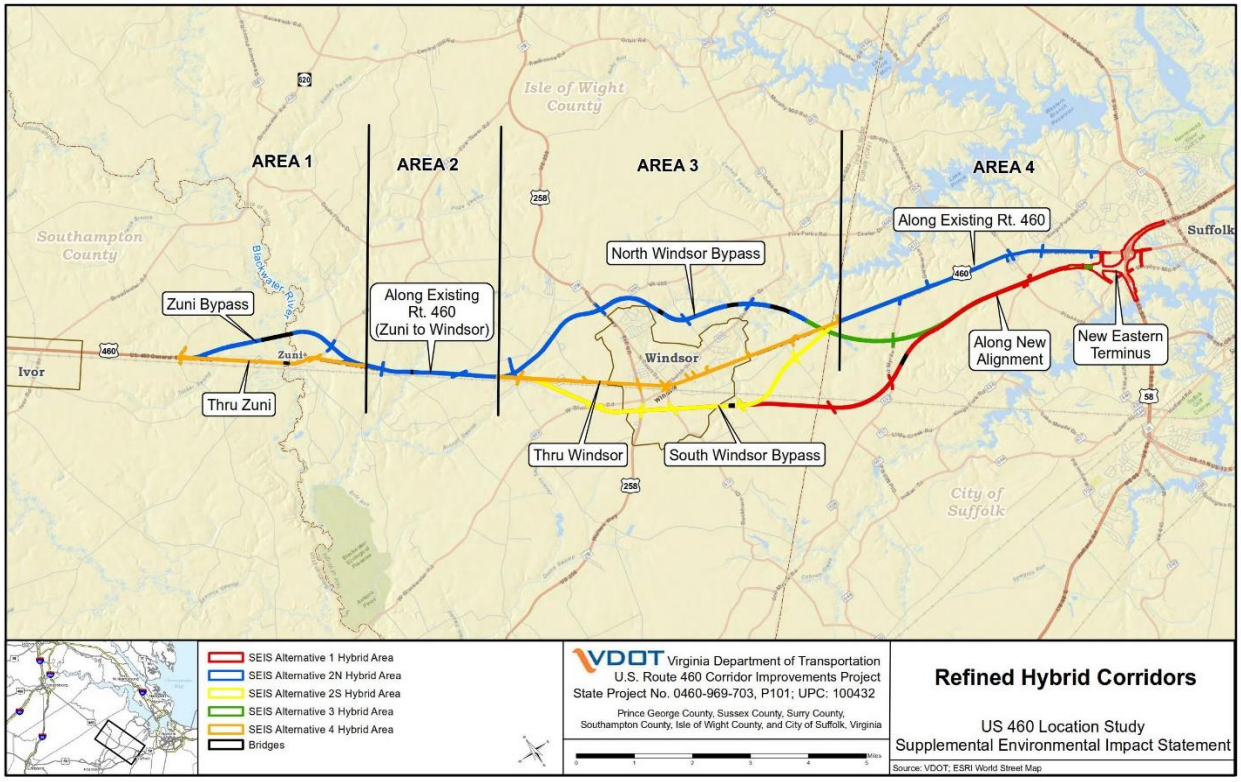
2.4.1.2 Refined Hybrids Considered

Twelve refined hybrids were developed that focused on the area between west of Zuni and Suffolk. These 12 refined hybrids combined the No Build Alternative between Prince George and west of Zuni with variations of the Draft SEIS Alternatives through the following four areas to better compare impacts and costs between alternatives:

- Area 1: West of Zuni to east of Zuni - around Zuni along new location on the north (Alternative 2) or through Zuni along existing Route 460 (Draft SEIS Alternative 4);
- Area 2: East of Zuni to west of Windsor - along existing Route 460 (Draft SEIS Alternative 4);
- Area 3: West of Windsor to east of Windsor - along new location around Windsor on the north (Draft SEIS Alternative 2N), through Windsor along existing Route 460 (Draft SEIS Alternative 4), or around Windsor on the south (Draft SEIS Alternative 2S); and
- Area 4: East of Windsor to Route 58 - along existing Route 460 (Draft SEIS Alternative 4) or along new location on the south connecting to a new system to system interchange (Draft SEIS Alternatives 1 and 3).

A graphic illustration of the four areas noted above and the corridors considered within each area is shown in **Figure 2.4–1**.

Figure 2.4-1: Refined Hybrid Corridors



Within the limits for the refined hybrid analysis, opportunities were considered to minimize environmental impacts, such as displacements and aquatic resources, and to minimize costs when comparing the refined hybrids to the Draft SEIS alternatives and the initial hybrids discussed above. The refined hybrids were then compared based upon this information.

The twelve refined hybrids generally fell into two groups based on the section between Windsor and Suffolk: those that remained on the existing Route 460 with no new interchange at Route 58, and those that were on new location south of Route 460 with a new interchange. The results of the analysis of the refined hybrids are summarized in **Table 2.4-2**. At this point in the analysis wetland impacts were assessed using the results of the photointerpretation that was performed for the Draft SEIS, as that was the latest wetland information available for all of the alternatives at the time of evaluation.

To better compare the impacts and costs associated with each refined hybrid, as well as to identify potential opportunities for avoiding and minimizing impacts, additional engineering was performed to further develop the assumptions discussed in the Draft SEIS and applied in the refined hybrid analysis. While the original Draft SEIS assumptions remain valid, these refinements were an appropriate next step to further evaluate each of the refined hybrid's features and benefits.

Table 2.4-2: Refined Hybrids

Refined Hybrids	Draft SEIS Alternative Segments	Photo-interpreted Wetland Impacts (Ac)	Displace-ments (No.)	Cost (Mil $)
Along Existing Route 460 East of Windsor				
10) Zuni bypass, existing Route 460, Windsor bypass north; existing Route 460	Alternatives 4 and 2N	49	23	393
11) Through Zuni, existing Route 460, Windsor bypass north; existing Route 460	Alternatives 4 and 2N	26	27	338
12) Zuni bypass, existing Route 460, through Windsor; existing Route 460	Alternatives 4 and 2	32	45	367
13) Through Zuni, existing Route 460, through Windsor; existing Route 460	Alternative 4	10	50	312
14) Zuni bypass, existing Route 460, Windsor bypass south; existing Route 460	Alternatives 4 and 2S	88	25	391
15) Through Zuni, existing Route 460, Windsor bypass south; existing Route 460	Alternatives 4 and 2S	66	30	337
Along New Location East of Windsor to a New Eastern Terminus				
16) Zuni bypass, existing Route 460, Windsor bypass north; along new location with new Eastern Terminus	Alternatives 4, 2N, 3, and 1	74	17	480
17) Through Zuni, existing Route 460, Windsor bypass north; along new location with new Eastern Terminus	Alternatives 4, 2N, 3, and 1	52	22	427
18) Zuni bypass, existing Route 460, through Windsor; along new location with new Eastern Terminus	Alternatives 4, 2, 3, and 1	59	40	448
19) Through Zuni, existing Route 460, through Windsor; along new location with new Eastern Terminus	Alternatives 4, 3, and 1	37	45	394
20) Zuni bypass, existing Route 460, Windsor bypass south; along new location with new Eastern Terminus	Alternatives 4, 2S and 1	130	16	507
21) Through Zuni, existing Route 460, Windsor bypass south; along new location with new Eastern Terminus	Alternatives 4, 2S and 1	108	21	453

Note: Highlighted rows denote refined hybrids carried forward for further analysis.

From each of these groups of refined hybrids, identified in in **Table 2.4-2**, VDOT identified one option that best balanced anticipated wetland impacts, displacements and cost most effectively, compared to the other similar refined hybrids. From the first group (remaining on existing Route 460 east of Windsor), Refined Hybrid 11 was selected, due to the potential for reduction in wetland impacts, as well as costs. From the second group (new location east of Windsor along the Draft SEIS Alternative 3 alignment with a new interchange), Refined Hybrid 17 was selected for continued evaluation, because it adequately addressed the key project elements and Purpose and Need, while providing a cost effective solution that balanced anticipated wetland impacts and displacements.

In addition to considering the key factors outlined above, the practicability of each hybrid was examined. To be practicable, an alternative must be available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall purposes. In identifying the refined hybrids appropriate for further evaluation, VDOT determined that a refined hybrid through the Town of Windsor was not practicable due to the substantial impacts to existing homes, businesses, and other important components of the community. Furthermore, a bypass around the Town of Windsor was considered to offer more effective operational benefits over improvements through the Town, such as improved traffic

mobility and travel time. Therefore, hybrids that did not bypass Windsor were not considered further. While some of the Refined Hybrids had less wetland impact, they either cost more or had substantially greater displacements and were not practicable. Similarly, projects with fewer displacements were more costly or had substantially more wetland impacts. The refined hybrids selected best balanced all of these factors. Following is a brief description of the two refined hybrids selected for consideration.

Refined Hybrid 17 – the existing Route 460 would be upgraded to a four-lane divided highway from west of Zuni to west of Windsor. From west of Windsor to Route 58 a new four-lane, grade separated, divided highway would be constructed. This would include a new system to system interchange with free-flow ramps at Route 58. The new highway alignment would run north around Windsor (i.e. bypass) and then south of the existing Route 460 from east of Windsor to Route 58. This refined hybrid is a combination of Draft SEIS Alternatives 4, 2N, 3, and 1, and is shown graphically in **Figure 2.4-2**.

Refined Hybrid 11 – the existing Route 460 would be upgraded to a four-lane divided highway from west of Zuni to west of Windsor and from east of Windsor to Route 58. From west of Windsor to east of Windsor a new four-lane grade separated divided highway would be constructed to run around Windsor (i.e. bypass). This refined hybrid is a combination of Draft SEIS Alternatives 4 and 2N and is shown graphically in **Figure 2.4-3**.

Figure 2.4-2: Refined Hybrid 17 – Between west of Zuni and Eastern Terminus

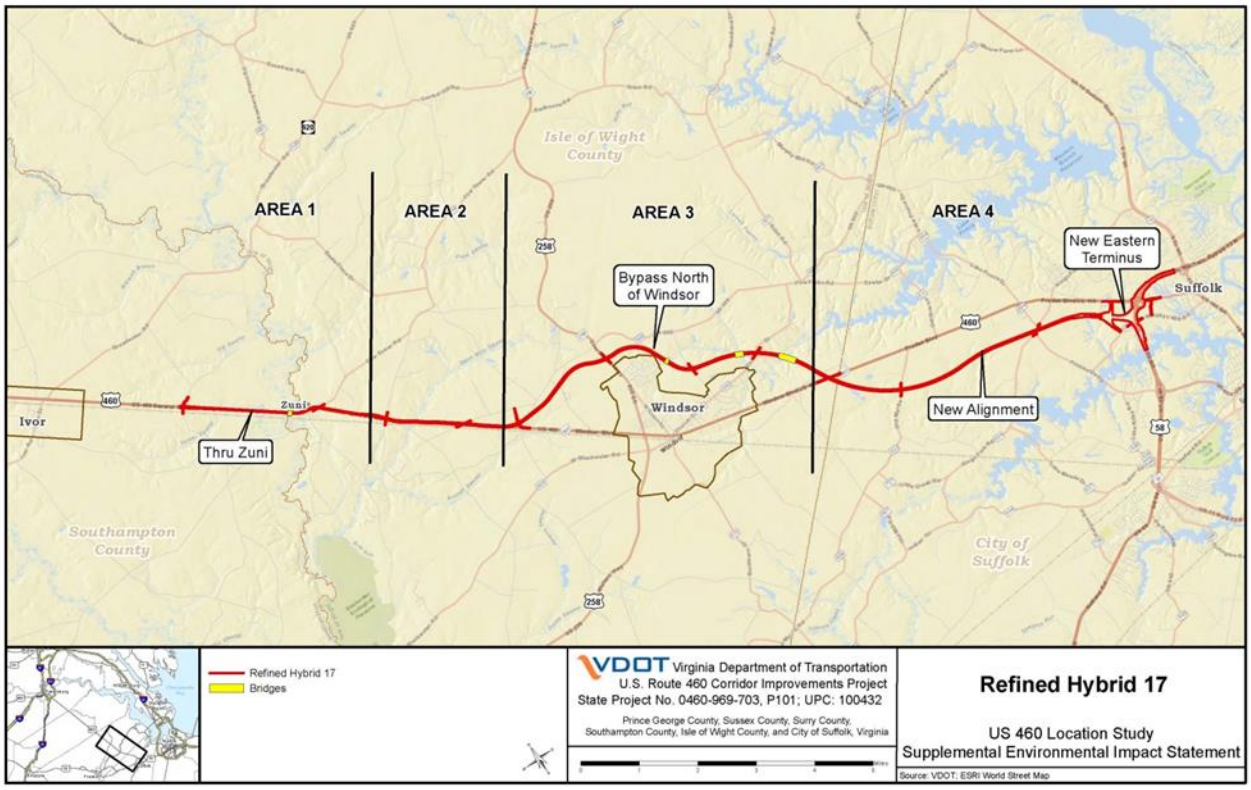
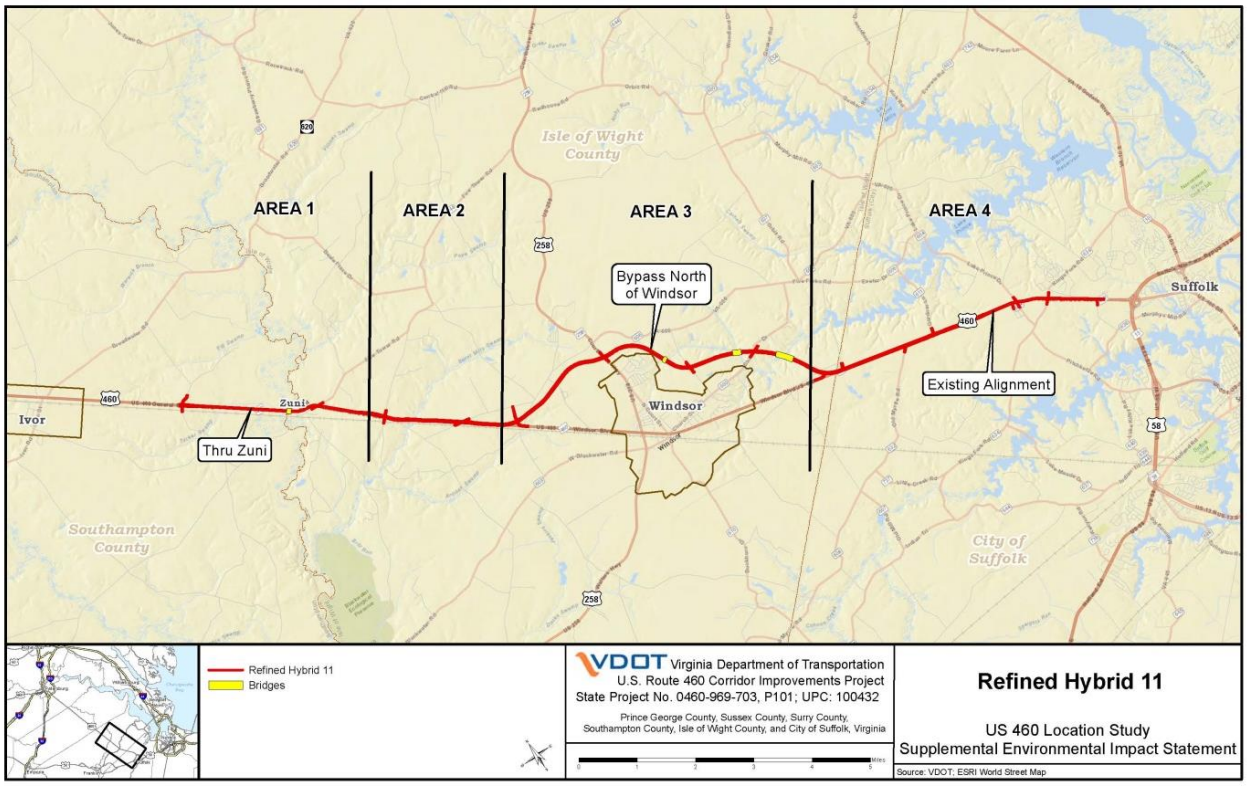


Figure 2.4-3: Refined Hybrid 11 – Between west of Zuni and Eastern Terminus



2.4.2 Refined Hybrids Comparison

VDOT prepared a technical memorandum that compares the benefits of Refined Hybrid 17 to Refined Hybrid 11 (in the memorandum Refined Hybrid 17 is referenced as Hybrid B and Refined Hybrid 11 is referenced as Hybrid X). This technical memorandum was developed to support FHWA/VDOT's identification of a Preferred Alternative. This memorandum is included in Appendix A of the ***Supplemental Alternatives Technical Report*** (VDOT, 2016e).

As a result of the comparative analyses, it was determined that Refined Hybrid 17 is the most effective improvement option for the 16 miles for which the improvements were considered that sufficiently addresses the project's Purpose and Need, while balancing cost, displacements, and wetlands. VDOT also determined that Hybrid 17 appears to be practicable. As described below, Refined Hybrid 17 yields the lowest corridor crash rate, maximum evacuation capacity, greatest travel time savings, and would be the most effective new route for freight. Unlike Refined Hybrid 11, Refined Hybrid 17 offers an efficient high-speed through connection while maintaining local access. Refined Hybrid 17 also includes a free-flow direct connection from the new highway to existing Route 58. The following metrics compare the 16-mile improvement portions of Refined Hybrid 17 and Refined Hybrid 11:

- Refined Hybrid 17 has the lower predicted crash rate (49 crashes/100 Million Vehicle Miles), which is 11% lower than Refined Hybrid 11 (55 crashes/100 Million Vehicle Miles).
- Refined Hybrid 17 has 28 traffic conflict points. Refined Hybrid 11 has 72 traffic conflict points. Refined Hybrid 17 has 61% fewer traffic conflict points than Refined Hybrid 11.

- Refined Hybrid 17 provides greater evacuation capacity (maximum of 13,400 vehicles per hour just west of Route 58) which is 160% higher than Refined Hybrid 11 (maximum of 5,200 vehicles per hour just west of Route 58).
- Refined Hybrid 17 provides the ability to reverse the traffic flow on all four new highway lanes and three of the four lanes on existing Route 460 in an evacuation event. Refined Hybrid 11 provides the ability to reverse only one of the eastbound lanes providing three westbound evacuation lanes in an evacuation event.
- Refined Hybrid 17 improves safety and mobility by separating local and regional traffic. Refined Hybrid 11 does not separate local and regional traffic because all traffic must pass through the existing Route 460/58 interchange.
- Refined Hybrid 17 separates regional traffic away from the Nansemond Suffolk Academy (a pre-K-12 school with approximately 730 students) on Route 460 east of Windsor. The presence of the school creates safety and traffic issues, especially during the hours around the start and end of the school day. The school also includes a speed zone that reduces speeds in the corridor. The presence of the school on Route 460, which includes school bus traffic, is not compatible with the high truck traffic volumes in the corridor. Refined Hybrid 11 does not separate traffic away from the school entrance.
- Refined Hybrid 17 provides a practicable opportunity to divert through truck traffic from existing Route 460 between the western boundary of Town of Windsor and Route 58; Refined Hybrid 11 does not.
- Refined Hybrid 17 provides greater annual travel time cost savings ($12.6M) of both alternatives. This annual cost savings is twice as much as Refined Hybrid 11 ($6.3M).
  Refined Hybrid 17 provides greater corridor travel time savings of both alternatives with 840,000 hours saved per year. This is twice as much as the 422,000 annual hours saved by Refined Hybrid 11.
- Refined Hybrid 17 separates truck traffic from local traffic and shifts trucks to a facility with lower anticipated crash rates. This improves safety because 45% of fatal crashes in the Draft SEIS study area involved tractor trailers. Refined Hybrid 11 does not separate trucks from the local traffic traveling on Route 460 between east of Windsor and Route 58. Separation of trucks from local traffic also accommodates improved Freight Mobility.
- Refined Hybrid 17 better addresses the U.S. Department of Transportation (USDOT) initiative to incorporate consideration of climate adaptation and coastal resiliency into their planning processes and investment decisions by providing redundant infrastructure that addresses future environmental risks such as flooding and projected sea-level rise.
- Refined Hybrid 17 provides a coastal risk reduction measure that would improve regional preparedness for evacuation through nonstructural interventions (evacuation planning with redundant infrastructure and elevating Blackwater Bridge structure).
- Refined Hybrid 17 also contributes to greater system resiliency compared to Refined Hybrid 11, due to the interdependency of its new roadway component's access to the Virginia Ports and the mobility of freight. Refined Hybrid 11's contribution to system resiliency would be less than Hybrid 17 due to a lower Route 58 interchange capacity and lack of a separate alternative route.
- Refined Hybrid 17 has an increased capital cost of $89 million over Refined Hybrid 11. According to the Benefit-Cost Analysis performed to compare Refined Hybrids 17 and 11, using a seven percent discount rate, per USDOT guidelines, Refined Hybrid 17 is expected to result in $128 million in additional benefits over Hybrid 11, generating a benefit to cost ratio of 1.5 for this

additional expenditure. At a three percent discount rate, Refined Hybrid 17 generates $269 million in additional benefits over Hybrid 11 and a benefit to cost ratio of 2.8.

2.4.3 Recommendation of FHWA/Preferred Alternative

Based on this assessment, VDOT determined that Refined Hybrid 17 has a number of advantages over Refined Hybrid 11 and that it is more effective at addressing the Purpose and Need where the improvements would be made. As a result, Refined Hybrid 17 was identified and selected as FHWA/VDOT's recommended Preferred Alternative. FHWA/VDOT's Preferred Alternative is comprised of the 16 miles of improvements noted above for Refined Hybrid 17 with 36 miles of the No Build Alternative between the western terminus and western Zuni.

On January 5, 2015 VDOT sent a letter, along with the Technical Memorandum comparing Refined Hybrids 11 and 17, to the USACE noting the proposed recommendation and their opinion that their Preferred Alternative appears to be the LEDPA. The USACE replied in a letter dated January 9, 2015, that it did not find reason to disagree with VDOT's assessment that their Preferred Alternative (Refined Hybrid 17) appears to be the LEDPA. However, the letter notes that this does not constitute a final LEDPA determination or an indication of a Section 404 permit decision.

2.5 FHWA/VDOT PREFERRED ALTERNATIVE

2.5.1 Approval of the FHWA/VDOT Preferred Alternative Location

On January 13, 2015 the CTB was presented with FHWA's/VDOT's recommended Preferred Alternative. The CTB passed a resolution on February 18, 2015 approving FHWA's/VDOT's recommended Preferred Alternative as the location for the Route 460 corridor improvements, consistent with the FHWA/VDOT Preferred Alternative presented at the January CTB meeting. The resolution also officially rescinded the CTB's previous 2005 selection of a preferred alternative.

The 2015 recommended FHWA/VDOT Preferred Alternative presented combines a portion of the No Build Alternative with portions of four Build Alternatives from the Draft SEIS (4, 2N, 3, and 1). The FHWA/VDOT Preferred Alternative is a 52-mile corridor between I-295 in Prince George County and Route 58 in Suffolk. **Figure 2.5-1** (see Volume II of the Final SEIS) illustrates the FHWA/VDOT Preferred Alternative compared to the Build Alternatives from the Draft SEIS; **Figure 2.5-2** (see Volume II of the Final SEIS) illustrates how these alternatives were combined to form the FHWA/VDOT Preferred Alternative. Following is a description of the FHWA/VDOT Preferred Alternative, from west to east:

- from I-295 to approximately one mile west of Zuni the No Build Alternative would be implemented (approximately 36 miles);
- from approximately one mile west of Zuni to two miles west of Windsor (Areas 1 and 2) the existing Route 460 would be upgraded to a four-lane divided highway and include a new bridge across the Blackwater River to eliminate long standing flooding problems (approximately four miles); and
- from approximately two miles west of Windsor to the Route 460/58 interchange in Suffolk (Areas 3 and 4), a new four-lane divided highway would be constructed, running north around Windsor, then east of Windsor running south of the existing Route 460 (approximately 12 miles).

In approving the location of the Preferred Alternative, the CTB recognized the inability to fund the alternatives evaluated in the Draft SEIS in their entirety and acknowledged the Preferred Alternative minimizes wetland impacts while still effectively meeting the overall project purpose.

Through the development of this Final SEIS and VDOT's preparation of a permit application for the FHWA/VDOT Preferred Alternative, VDOT worked to avoid and minimize impacts to the extent practicable, while addressing the project's Purpose and Need. To support avoidance and minimization efforts, jurisdictional wetlands, streams, and ditches within the Inventory Corridor were delineated by VDOT and their consultants and field-confirmed by USACE.

2.5.2 Further Modifications to the FHWA/VDOT Preferred Alternative

2.5.2.1 Reduction of Property Impacts With an Adjusted Inventory Corridor

The FHWA/VDOT Preferred Alternative combines improvements along the existing Route 460 alignment between west of Zuni and west of Windsor and along new location bypassing Windsor to the north and crossing existing Route 460 east of Windsor then traveling south of existing Route 460 to Route 58. The new location portion passes through residential and agricultural properties in part in order to avoid jurisdictional wetland areas, just as some aquatic resources are impacted to minimize effects to properties; these impacts were balanced in working to arrive at a project that is practicable while minimizing impacts to wetlands and streams.

Working with the Virginia Department of Agriculture, VDOT met with impacted property owners and representatives in order to better understand the commercial operation and access needs of the agricultural properties along the 16-mile build portion of the FHWA/VDOT Preferred Alternative and to determine whether it would be feasible to modify the approved location of the alignment in order to reduce property impacts. Based upon feedback from these meetings, VDOT considered potential inventory corridor adjustments to better balance agricultural and access impacts with impacts to other resources, including wetlands and streams. Following this evaluation, two areas were identified for adjusting the inventory corridor:

- East of Windsor in the vicinity of Old Myrtle Road; and
- East of Route 258 in the vicinity of Deer Path Trail.

Both locations reduced agricultural and commercial operational impacts while still maintaining acceptable project cost and wetland impacts in these areas. Additionally, displacements were reduced and access to these parcels was improved.

2.5.2.2 Avoidance and Minimization

The Section 404 permitting process requires that efforts be taken to avoid and minimize impacts to waters of the U.S to the extent practicable. Impacts were identified by overlaying the FHWA/VDOT Preferred Alternative Design Corridor onto the field delineated boundaries of jurisdictional waters and wetlands along the FHWA/VDOT Preferred Alternative alignment. VDOT then evaluated the merits of modifying the following three design elements in order to avoid and minimize impacts to these resources:

1. Horizontal Alignment: A horizontal alignment shift to either avoid or minimize impacts to each wetland group. The bridges along the alignment were adjusted to span wetlands and reduce stream impacts where practicable. Where the bridges spanned wetlands, the abutments and slope protection were located outside the wetland limits.
2. Vertical Alignment: Vertical alignment shifts to reduce the impact of roadway fill slopes and in turn minimize wetland impacts.
3. Typical Section: A modification to the typical section to reduce wetland impacts based on reducing the section width and increasing the side slope steepness.

As the design was advanced for the FHWA/VDOT Preferred Alternative, opportunities to avoid or minimize impacts to delineated wetlands and streams within the Inventory Corridor were identified and the anticipated LOD was adjusted based on the elements listed above. After a particular avoidance and minimization technique was applied, the resulting wetland and stream impacts were recalculated and compared to the baseline impacts in order to evaluate the degree of the impact reduction, as well as associated changes in construction costs.

Horizontal Alignment Shifts

The first step of the avoidance and minimization methodology was an evaluation of the horizontal alignment of the FHWA/VDOT Preferred Alternative to determine if wetland impacts could be avoided or minimized by an alignment shift. Alignment shifts were evaluated at each wetland location and some wetland locations presented multiple alignment shift opportunities. Alignment shifts that could entirely avoid a delineated wetland area were preferred and considered first, followed by alignment shifts that minimized impacts to wetland. Bridge lengths along the shifted alignments were adjusted to reduce wetland and stream impacts where practicable

Vertical Alignment (Profile) Adjustments

The second step of the avoidance and minimization methodology was an evaluation of the vertical alignment of the preferred alternative. The difference between the height of the proposed roadway and the existing ground can have a significant influence on the width of disturbance for the proposed roadway. Lowering the profile and reducing the height above existing ground can significantly narrow the side slope limits and resulting direct effect on impacts to wetlands. Because, the delineated wetland areas are low lying areas and are prone to flooding during large storm events, the engineering team evaluated opportunities to lower the proposed vertical profile for the roadway in an attempt to reduce wetland impacts, while balancing any vertical alignment adjustments against drainage design requirements.

Typical Section Modifications

The third step of the avoidance and minimization methodology was evaluating modifications to the typical section that would reduce the width of improvements and, in turn, reduce wetland impacts. Seven typical sections were generated in accordance with VDOT design standards, and used to evaluate reductions in wetland impacts. Modifications to the typical sections included the use of guardrail at the outside shoulder to reduce clear zone requirements, retaining walls at the edge of shoulders to reduce the side slope footprint, and median barriers to reduce the median width. The construction costs, reduction in impacts, and practicality of each typical section modification were analyzed for each wetlands group. A preferred typical section was then identified for each wetland group, and this section was used to calculate the anticipated wetland impact area and anticipated construction costs.

2.5.2.3 Operational Considerations

To better understand the impacts, benefits, and costs of alternative designs for intersecting roadways including side road crossings as well as interchanges and intersections, VDOT performed a traffic operational analysis.

The evaluation of side roads determined that having the new Route 460 cross over the side roads, as compared to the side roads crossing over the new Route 460 (as presented in the Draft SEIS) would provide the least environmental and side road access impacts for a similar project cost. This approach also yielded fewer property displacements.

Additionally, at-grade intersections and grade separated interchanges were evaluated at four locations, comparing access options, potential wetland impacts, stream impacts, traffic operations, and costs. Following are the options that provided the best benefit with the least impacts. These interchanges/intersections are discussed further in **Section 2.5.3**:

- Route 460/existing Route 460 Interchange on the west side of Windsor – three leg intersection.
- Route 460 overpass of Route 258 with no interchange.
- Route 460/existing Route 460 Interchange on the east side of Windsor – full diamond interchange with a loop ramp.
- Route 460/Route 58 Eastern Terminus – full directional interchange with access from new route 460 to Route 58.

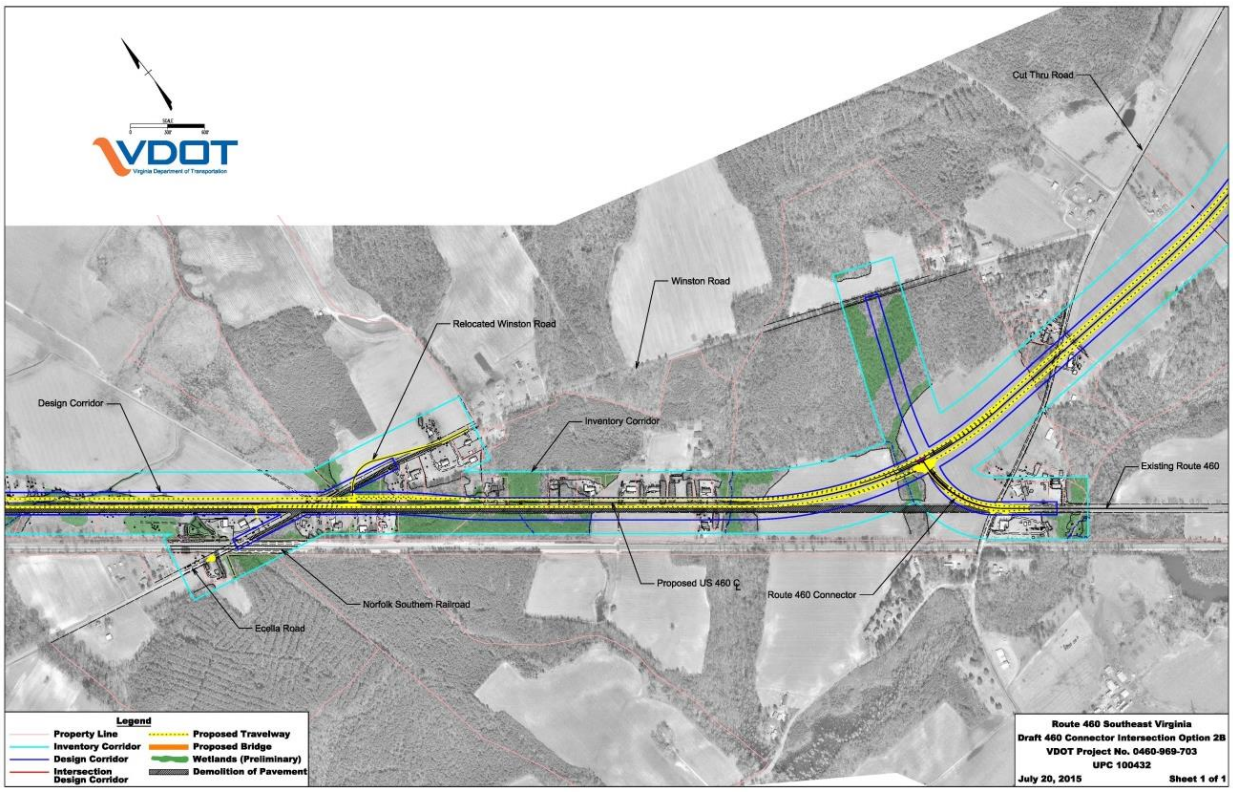
2.5.3 FHWA/VDOT Preferred Alternative, Detailed Description

As a requirement for the JPA, the design needed to be sufficiently advanced to identify impacts to areas determined to be jurisdictional (wetlands and streams) and to revise the design where feasible to avoid and minimize these impacts. As described above, the LOD of the FHWA/VDOT Preferred Alternative is used to estimate impacts of the project for both the permit application and the Final SEIS.

New Intersection Connecting Existing Route 460 and Improved Route 460 with New Route 460 West of Windsor

Immediately west of Antioch Road/Cut Thru Road, a three leg signalized intersection would connect the existing Route 460 with the new Route 460. Westbound New Route 460 traffic would flow uninterrupted from New Route 460 to Improved Existing Route 460. All other traffic movements would be controlled by a traffic signal. North of New Route 460, Cut Thru Road would be changed to a cul-de-sac. Traffic that formerly used Cut Thru Road to access Route 460 would use Winston Road, approximately one mile west of Cut Thru Road. This design avoided and minimized wetland impacts, while providing cost-effective operational benefits. The proposed intersection configuration is shown in **Figure 2.5-3**.

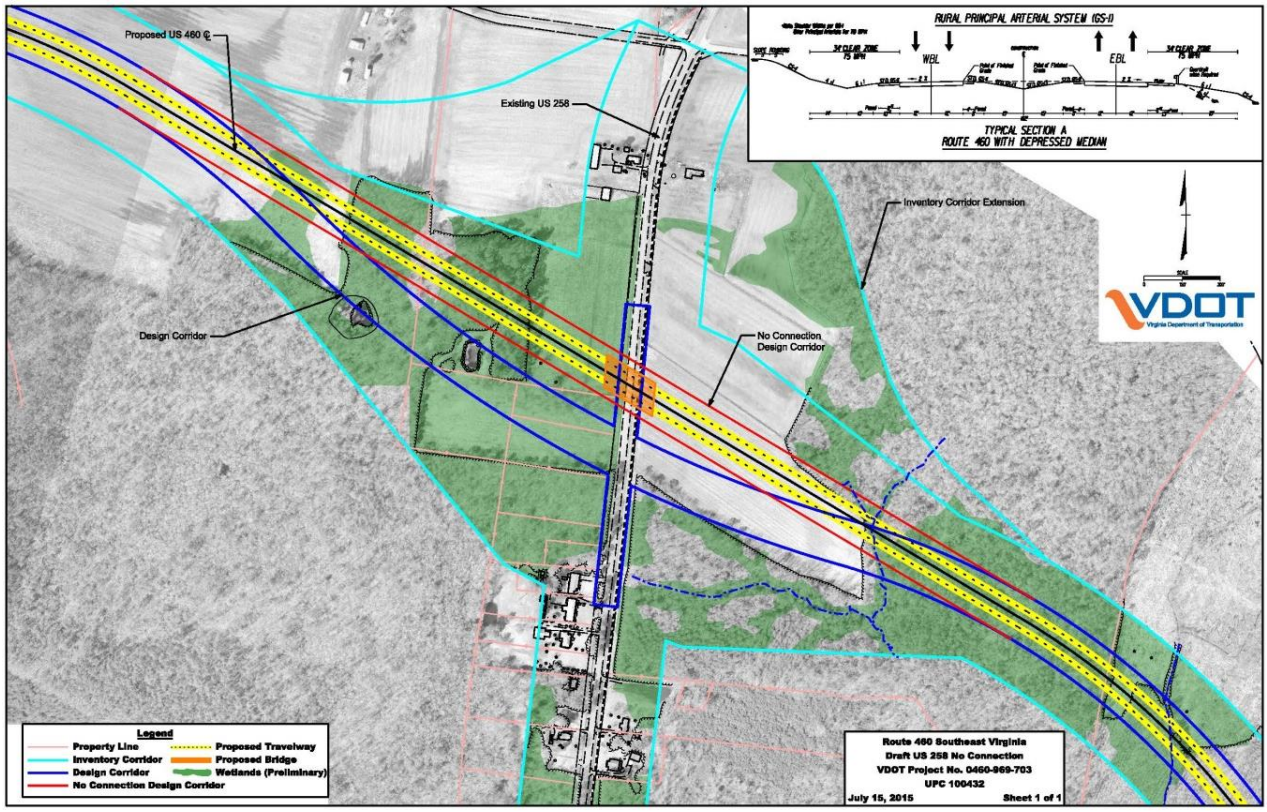
Figure 2.5-3: New Intersection Connecting Existing Route 460 and Improved Route 460 with New Route 460



Route 460 Crossing Over Route 258 with No Interchange

The Route 460 / Route 258 crossing on the east side of Windsor is located approximately five miles west of the existing Route 460 crossing on the Bypass of Windsor and represents another potential point of access from Route 460 to Windsor. Because wetlands are located in three quadrants of this crossing, a number of options for providing access were evaluated to determine an appropriate crossing improvement while balancing project cost and traffic operations with opportunities to avoid impacts to wetlands. Based on the operational analysis, traffic movements at the Route 460/Route 258 intersection were determined to be insufficient to justify the provision of a grade-separated interchange or at-grade intersection, given the cost and impacts of each of these crossing types. Local traffic can access the new Route 460 using the existing Route 460 intersection to the west side of Windsor as well as the interchange east of Windsor, and the absence of access at Route 258 will not cause the anticipated level of service (LOS) at the two access points to deteriorate to unacceptable levels. Therefore, the traffic that would have used this interchange can be adequately accommodated at the other two access points. This configuration, without an intersection or interchange connection, has the lowest cost, lowest impacts to jurisdictional wetland areas, and lowest property impacts of the options considered. The proposed Route 460 crossing configuration, along with the roadway typical sections for new Route 460, as shown in **Figure 2.5-4** includes an overpass of Route 258 with no interchange or intersection at this location.

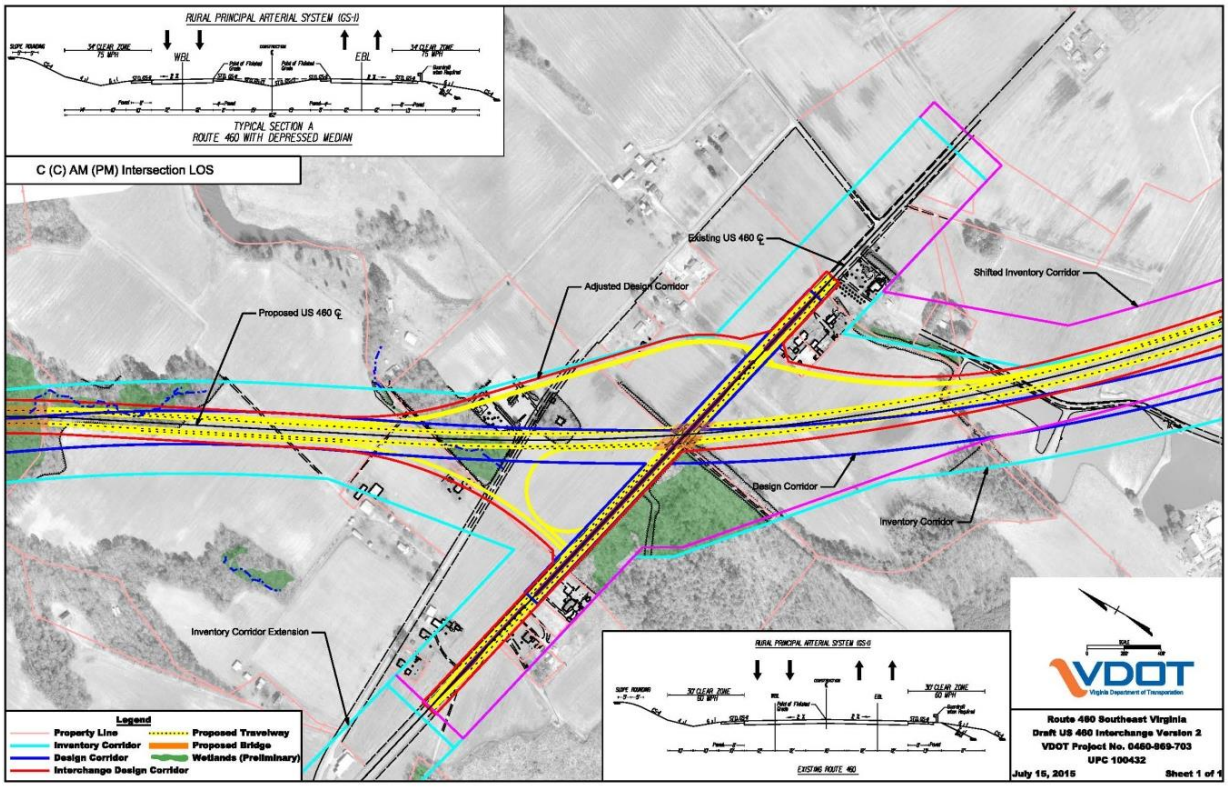
Figure 2.5-4: Route 460 Crossing Existing Route 258 with No Interchange



New Route 460/Existing Route 460 East of Windsor

The New Route 460/Existing Route 460 crossing on the east side of Windsor is located approximately five miles west of Route 58 and represents a potential point of access from Route 460 to downtown Windsor. Since the majority of the existing wetlands in the vicinity of this connection are located in the southeast quadrant of the crossing, a diamond interchange with a loop ramp in the northwest quadrant offers the best opportunity for grade separated access while minimizing the impacts to jurisdictional wetland areas and properties. The interchange accommodates access to and from the existing and planned expansion of the industrial area (including the Shirley T. Holland Intermodal Park) located south of town as well as the Town of Windsor via existing Route 460. The proposed interchange, along with the roadway typical sections for existing and new Route 460, is shown in **Figure 2.5-5**.

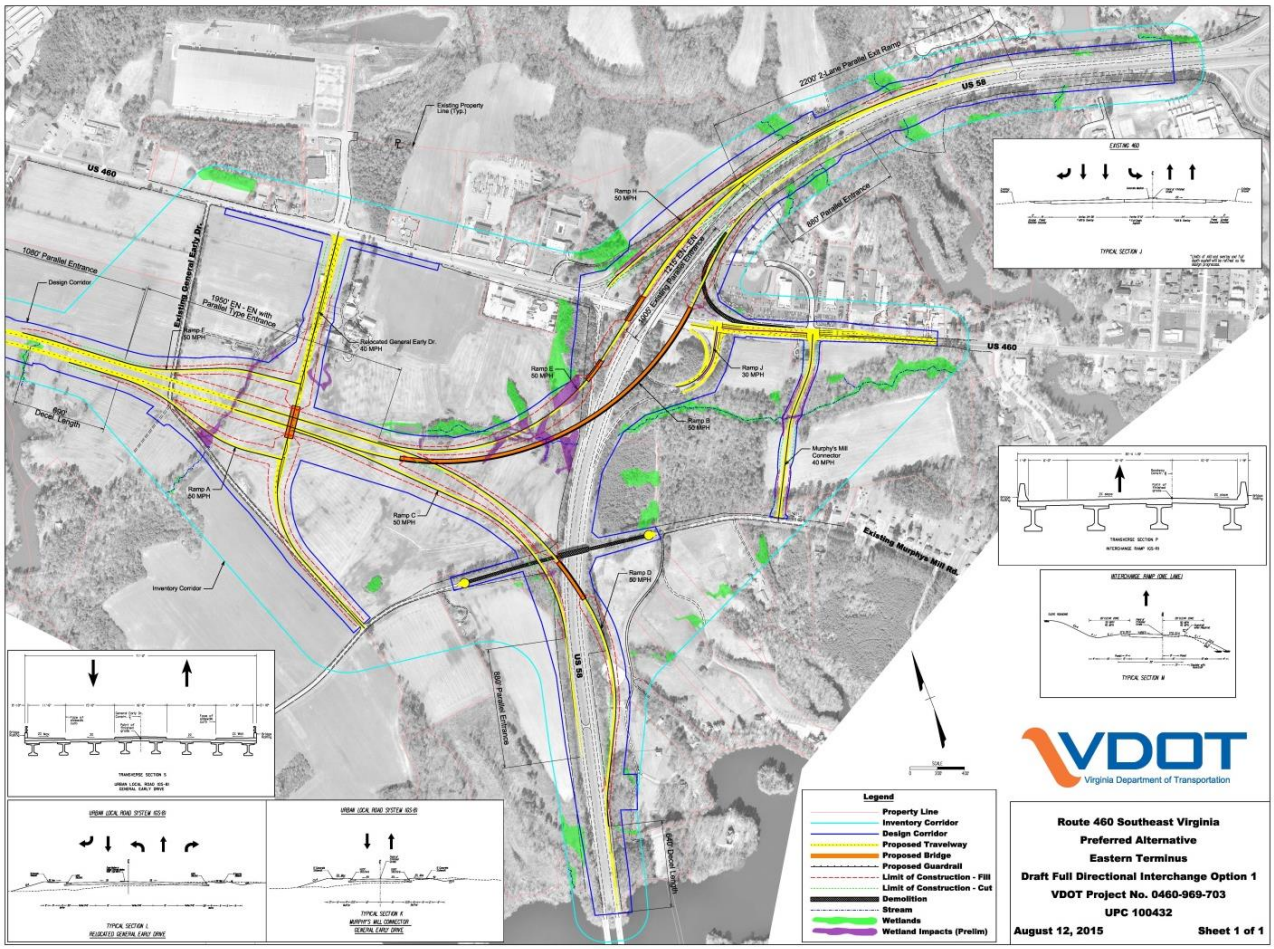
Figure 2.5-5: New Route 460/Existing Route 460 East of Windsor



Route 460/Route 58 - Eastern Terminus

Five design options were evaluated for this interchange. Operational function and efficiency were the most important considerations in that evaluation; cost and impacts to adjacent properties and wetlands and streams were also considered. The interchange design selected provides access from new Route 460 to Route 58 primarily using flyover ramps (bridge structures). Partial access is provided to existing Route 460 from relocated General Early Drive and a new Murphy's Mill Connector. Despite having the highest cost of options considered due to the extent of bridge structures, this option was determined to best address operational requirements. This option also had the least wetland and stream impacts. The interchange configuration, along with the proposed typical sections and associated local road improvements, is shown in **Figure 2.5-6**.

Figure 2.5-6: Route 460/Route 58 Interchange



Intersections

There are three main intersections within the Improved Route 460 section: Route 156 (Zuni Circle/Fire Tower Road); Route 645 (Yellow Hammer Road); and Route 639 (Ecella Road/Winston Drive). Routes 156 and 645 are proposed to remain in place, with accommodations for full turning movements. Route 639 would be modified, turning the four leg intersection into a three leg intersection to improve safety. The Ecella Road access would be eliminated, changing the road to a cul-de-sac just south of the Norfolk Southern Railroad crossing; the Winston Drive access would be realigned to reduce the intersection skew, improving sight distance and safety. Traffic that formerly used Ecella Road to access Route 460 would use Yellow Hammer Road, approximately one mile west of Ecella Road. A new driveway would be provided for the property owner located on Ecella Road north of the railroad crossing, providing eastbound access to Route 460.

Bridge Structures

The FHWA/VDOT Preferred Alternative includes 12 new bridge structures, excluding the structures associated with the Eastern Terminus. To minimize environmental impact, side road access impacts and displacements, new Route 460 would cross over the side roads, as compared to the side roads crossing over new Route 460 (as presented in the Draft SEIS). During the avoidance and minimization process, the new Route 460 alignment and corresponding bridges were adjusted to reduce wetland and stream impacts where

practicable. For example, the new Route 460 alignment just west of the existing Route 460 crossing was shifted north to avoid environmental impacts and the new bridges over Ennis Pond were reduced several hundred feet from those presented in the Draft SEIS. The FHWA/VDOT Preferred Alternative includes eight new bridge structures over existing roadways. Four additional bridges would be constructed to span waterways, thereby reducing environmental impacts. The bridge over Blackwater River would be the only new bridge within the improved section of Route 460 west of Windsor. The new bridge locations are listed in **Table 2.5-1**.

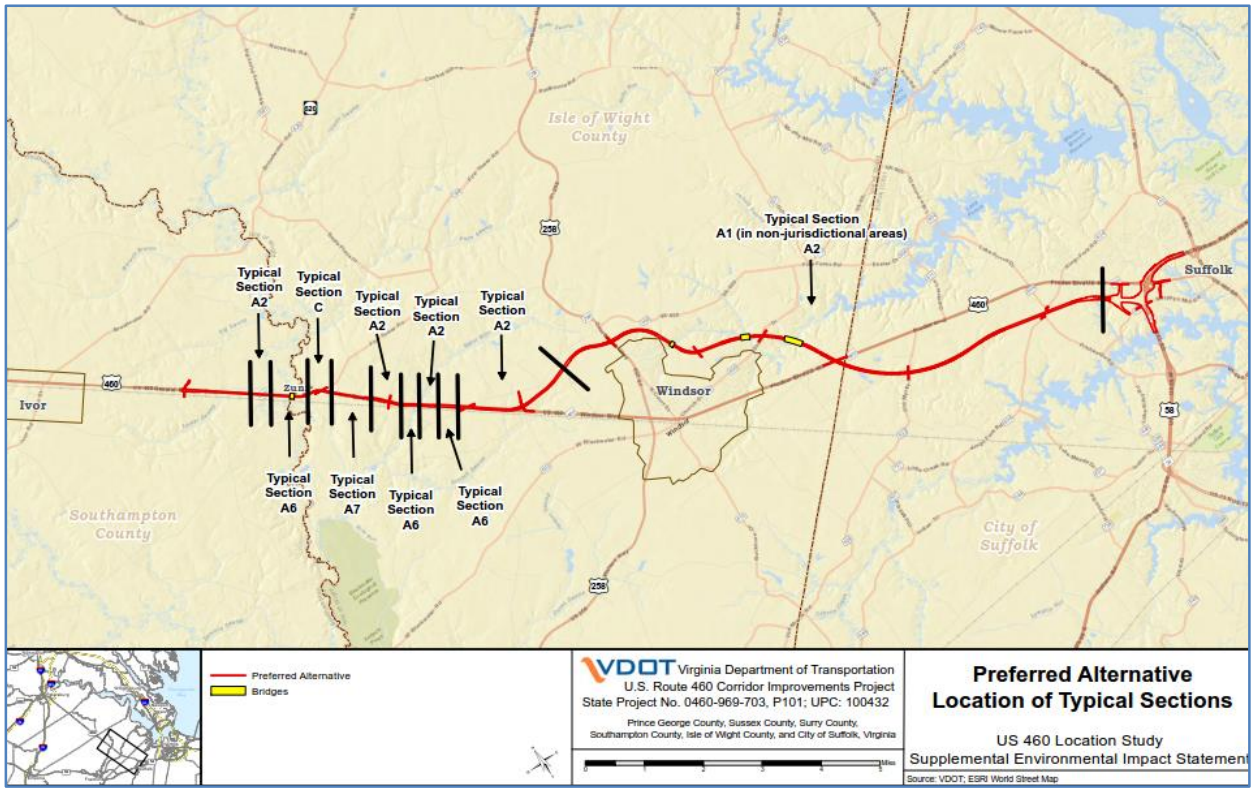
Table 2.5-1: New Bridging Locations

Bridge Location	Project Location	Jurisdiction
Blackwater River (west of Zuni Circle/Fire Tower Road)	Improved Route 460	Southampton County/Isle of Wight County
Route 646 (Stave Mill Road)	New Route 460	Isle of Wight County
US Route 258 (Courthouse Highway)	New Route 460	Isle of Wight County
Tributary to Ennis Pond (West of Route 600)	New Route 460	Isle of Wight County
Route 600 (Deer Path Trail)	New Route 460	Isle of Wight County
Tributary to Ennis Pond (West of Route 603)	New Route 460	Isle of Wight County
Route. 603 (Shiloh Drive)	New Route 460	Isle of Wight County
Ennis Pond	New Route 460	Isle of Wight County
Route 460	New Route 460	Isle of Wight County
Perry Minnow Farm Entrance	New Route 460	City of Suffolk
Route 632 (Old Myrtle Road)	New Route 460	City of Suffolk
Route 634 (Kings Fork Road)	New Route 460	City of Suffolk

Typical Sections

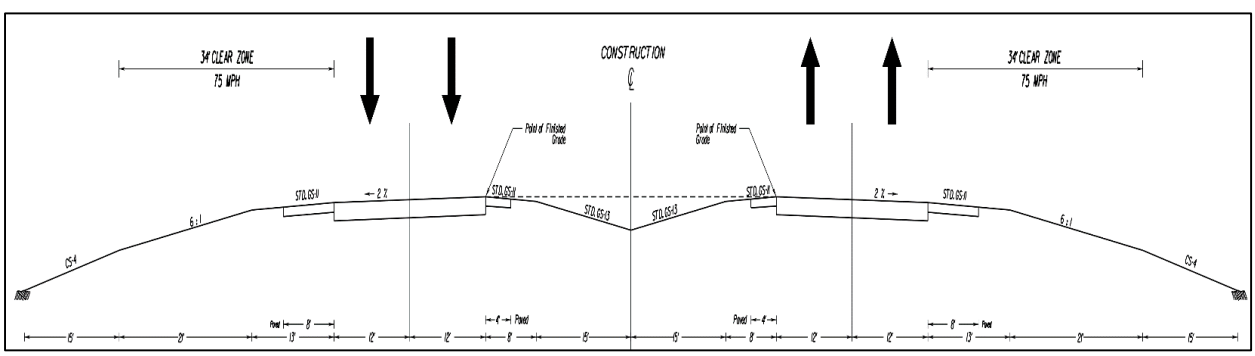
Typical Section C from the Draft SEIS was used for the area through Zuni because it provided the smallest footprint. Typical Section A from the Draft SEIS was used for the remainder of the corridor; however, modifications were made to reduce impacts to wetlands where feasible as discussed in **Section 2.5.2.2**. As a result, seven new typical sections (A1 through A7) were generated to apply combinations of guardrails, retaining walls, and median barriers along the FHWA/VDOT Preferred Alternative alignment. All of the new typical sections are consistent with the Department's current Geometric Design Standard for Other Principal Arterial System (GS-1) with a 75 mph design speed. Typical Section C has a 45 mph design speed. **Figure 2.5-7** shows the locations of each typical section. This figure is followed by descriptions of each typical section and a graphic illustrating each section.

Figure 2.5-7: FHWA/VDOT Preferred Alternative Typical Sections



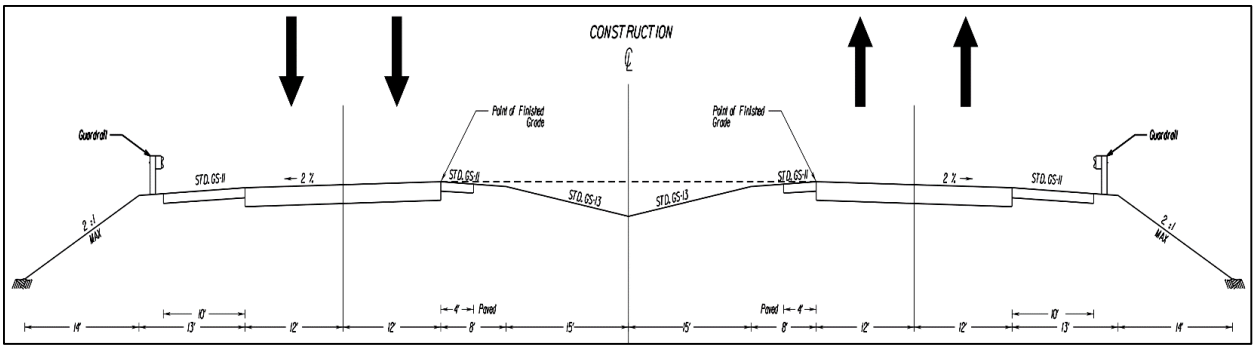
Typical Section A1 - This typical section represents the roadway section anticipated for the majority of areas where fill heights are relatively low and will not create an excessively large side slope footprint. The minimum section width for the application of this typical section is 162 feet (see **Figure 2.5-8**).

Figure 2.5-8: Typical Section A1



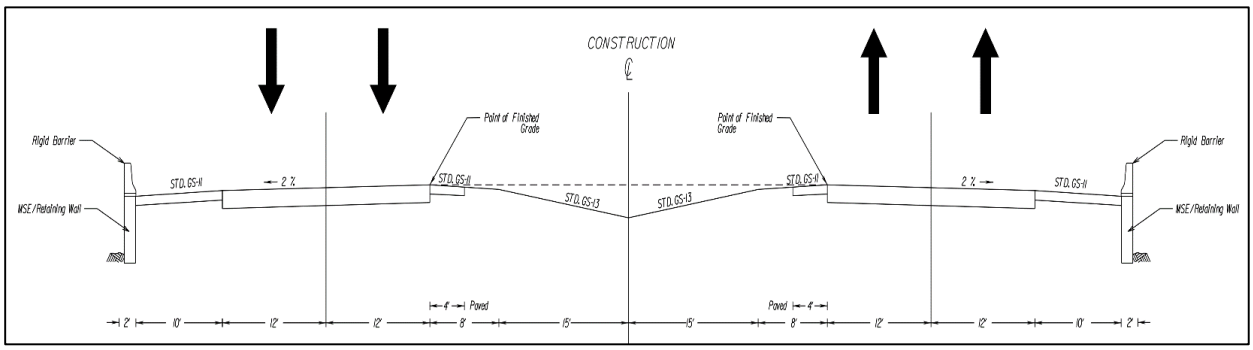
Typical Section A2 - This typical section represents the roadway section anticipated for the majority of areas where fill heights are relatively high and/or the intent is to further minimize the section's footprint as compared to Typical Section A1 by using outside guardrails. The minimum section width for the application of this typical section is 134 feet (see **Figure 2.5-9**).

Figure 2.5-9: Typical Section A2



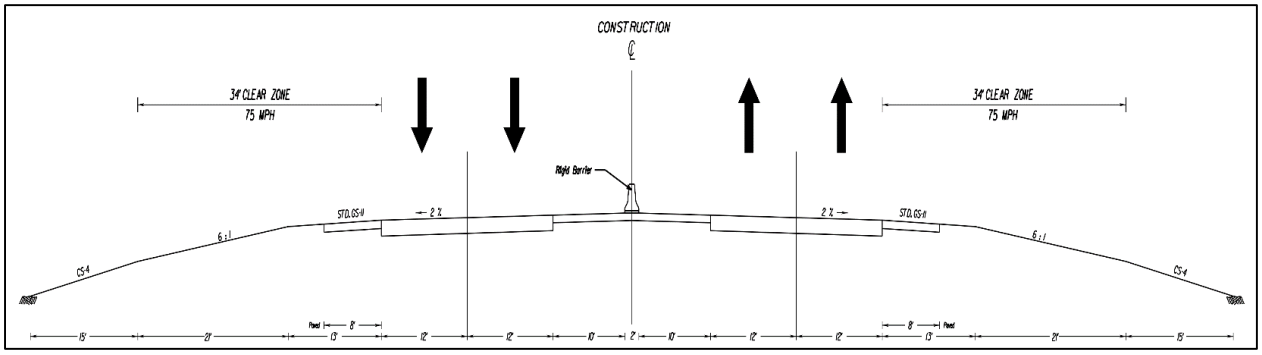
Typical Section A3 - This typical section represents the roadway section anticipated for areas where fill heights are relatively high and/or the intent is to achieve the minimum sectional footprint while maintaining a depressed median. The section width for the application of this typical section is fixed at 118 feet due to vertical walls being included to the outside of the travel way (see **Figure 2.5-10**).

Figure 2.5-10: Typical Section A3



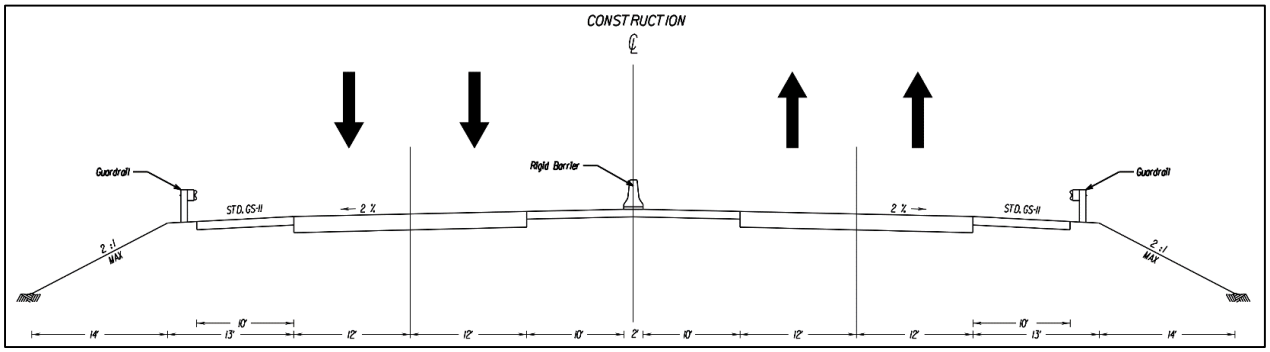
Typical Section A4 - This typical section represents the roadway section anticipated for areas where fill heights are relatively low and/or the intent is to further minimize the section's footprint as compared to Typical Section A1, using a concrete median barrier. The minimum section width for the application of this typical section is 138 feet (see **Figure 2.5-11**).

Figure 2.5-11: Typical Section A4



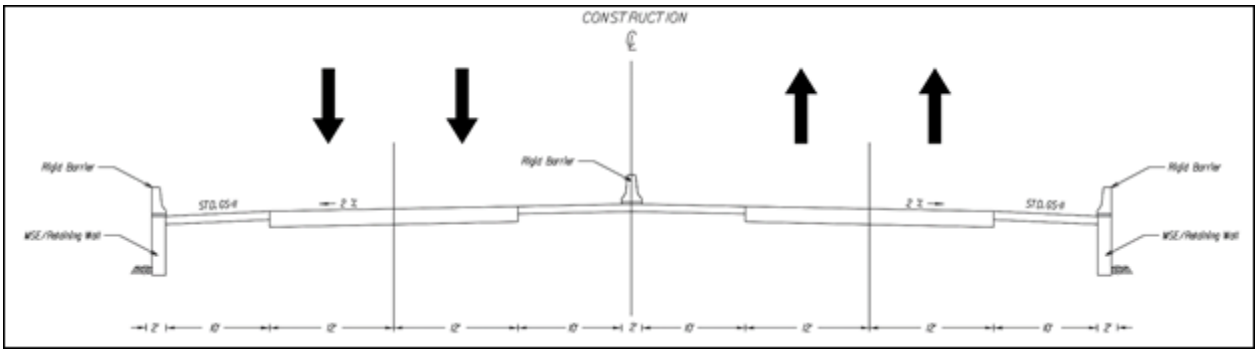
Typical Section A5 - This typical section represents the roadway section anticipated for areas where fill heights are relatively high and/or the intent is to further minimize the section's footprint as compared to Typical Section A2, using a concrete median barrier and outside guardrails. The minimum section width for the application of this typical section is 110 feet (see **Figure 2.5-12**).

Figure 2.5-12: Typical Section A5



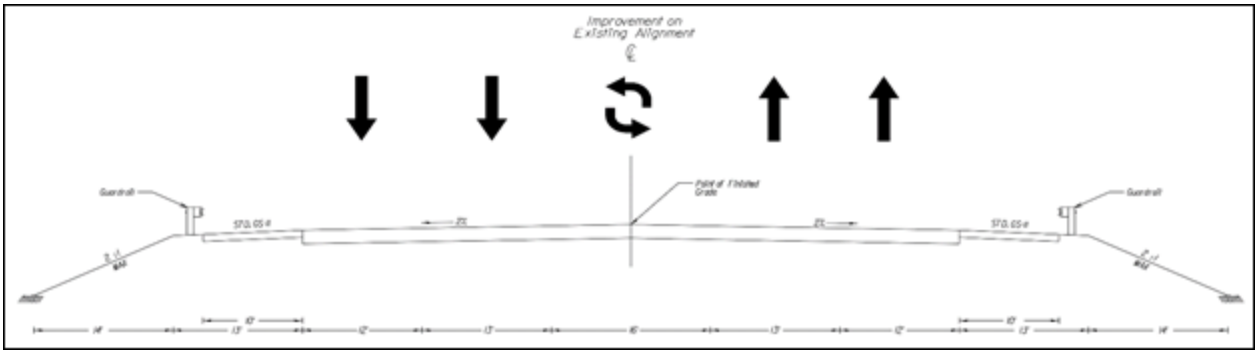
Typical Section A6 - This typical section represents the roadway section anticipated for areas where fill heights are relatively high and/or the intent is to achieve the minimum sectional footprint while providing a divided facility. The section width for the application of this typical section is fixed at 94 feet due to vertical walls being included to the outside of the travel way (see **Figure 2.5-13**).

Figure 2.5-13: Typical Section A6



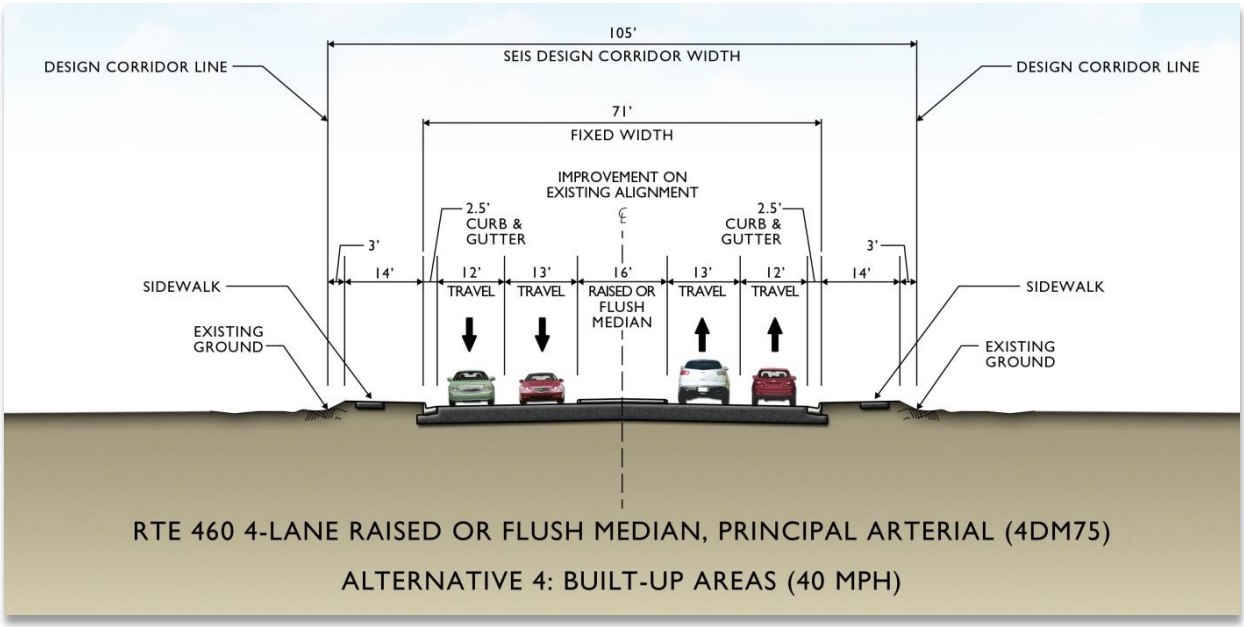
Typical Section A7 - This typical section represents the roadway section evaluated for the project area east of Zuni. The minimum section width for the application of this typical section is 106 feet (see **Figure 2.5-14**).

Figure 2.5-14: Typical Section A7



Typical Section C - This typical section represents the roadway section anticipated for the built up (urban) mainline area where the intent is to achieve the minimum sectional footprint to minimize impact on adjacent businesses and residences. The section width for the application of this typical section is fixed at 105 feet (see **Figure 2.5-15**).

Figure 2.5-15: Draft SEIS Typical Section C



2.6 PRELIMINARY COSTS

In support of the Final SEIS, preliminary cost opinions were developed to determine the anticipated project cost for the FHWA/VDOT Preferred Alternative. For typical NEPA evaluations for transportation projects in Virginia, the VDOT Project Cost Estimating System (PCES) would be used to generate costs for comparison of the alternatives. However, this system does not allow for the comparison of similar typical sections that have differing applications and lacks the flexibility to look at specific roadway configurations. Therefore, study specific cost opinions were developed.

Table 2.6-1 includes a total construction cost, including contingency and preliminary engineering for the FHWA/VDOT Preferred Alternative. In addition to preliminary engineering and construction items, costs were developed for the anticipated right-of-way requirements and utility relocations required. A detailed description of the methodology used to calculate the estimated right-of-way and utility relocation costs along with descriptions of the specific parcels anticipated to be acquired are found in the ***Supplemental Right-of-Way and Relocations Technical Report*** (VDOT, 2016g). Environmental mitigation costs include potential wetland, stream and noise impact mitigation. A detailed description of the methodology used to calculate wetland and stream mitigation costs can be found in the ***Supplemental Natural Resources Technical Report*** (VDOT, 2016f). A detailed description of the methodology used to calculate noise impact mitigation costs is included in **Appendix E.** Refer to **Appendix C** of the ***Supplemental Alternatives Technical Report*** (VDOT, 2016e) for the detailed documentation and supporting calculations for the Probable Opinion of Costs developed for each of the pay items, categories, and groups. Costs will be refined during future phases of project development as additional design information is developed.

Table 2.6-1: Cost Estimate for the FHWA/VDOT Preferred Alternative

Description	Cost (millions)
Preliminary Engineering	$27
Construction[1,2,3]	$314
Right-of-Way & Relocations[4]	$22
Utilities[4]	$17
Environmental Mitigation[5]	$13
SUB-TOTAL (without Construction Contingency)	**$393**
Construction Contingency[6]	$55
TOTAL	**$448**

NOTES

1. Construction costs are based on VDOT Historical Bid Listings from February 2011 through March 2013.
2. Construction cost assumptions are detailed in the Alternatives Technical Report - Appendix B.
3. Construction cost is the sum of raw construction cost, mobilization cost, and construction engineering and inspection cost.
4. Right-of-Way and Utilities costs are detailed in the Supplemental Right-of-Way and Relocations Technical Report.
5. Environmental mitigation costs include Wetland, Stream and Noise Impact Mitigation. Refer to Natural Resources Technical Report and the Noise Analysis Technical Report for cost methodology and assumptions.
6. Construction contingency assumed to be 20% of raw construction cost and is not applied to the Preliminary Engineering, Right-of-Way & Relocations, Utilities, or Environmental Mitigation costs.

2.7 TRAFFIC ANALYSIS

As discussed in the Draft SEIS, the need to address congestion is not a central component of the Purpose and Need for this project, as it is not a systemic problem along the existing Route 460 corridor; however, several intersections do have poor LOS and would benefit from improvements. Following is a summary of the traffic analysis, which was updated to evaluate the FHWA/VDOT Preferred Alternative. Detailed traffic analyses are documented in the ***Supplemental Traffic and Transportation Technical Report*** (VDOT, 2016h).

2.7.1 Volume Forecasts, Vehicle Miles Traveled, and Vehicle Hours Traveled

The traffic analysis considered the area between Ivor and Suffolk; Ivor was selected because the improvements extend past Zuni and the next major intersection on existing Route 460 is located in Ivor. **Table 2.7-1** summarizes the total traffic volumes for five locations along the Route 460 corridor. Using east of Windsor as a representative location, in the No Build scenario the average weekday daily traffic (AWDT) on Route 460 is expected to increase from 14,900 vehicles per day (vpd) in 2013 to 25,800 vpd by 2040. This is an increase of 10,900 vpd or 75 percent. With the FHWA/VDOT Preferred Alternative, the AWDT on Route 460 (existing and new Route 460 combined) in 2040 would be 34,900, which is 20,000 vpd (134 percent) higher than existing. It is also 9,100 vpd (35 percent) higher than the 2040 No Build scenario volume. This illustrates that the proposed project is forecasted to attract considerable additional traffic to the corridor compared to the No Build scenario.

Table 2.7-1: Route 460 Total Vehicle Volumes and Percentage Increases

Scenario	West of Ivor	West of Windsor	East of Windsor	East of Old 460/New 460	West of US-58
Existing (2013) Volumes	**8,900**	**10,100**	**14,900**	**15,100**	**22,400**
No Build (2040) Volumes	**16,800**	**19,400**	**25,800**	**26,400**	**34,900**
Change from Existing	7,900	9,300	10,900	11,300	12,500
Percent Growth	89%	92%	73%	75%	56%
Build (2040) Volumes	**19,400**	**26,600**	**34,900**	**40,500**	**47,900**
Existing Route 460	19,400	5,000	13,300	8,900	19,300
New Route 460		21,600	21,600	31,600	28,600
Change from Existing	10,500	16,500	20,000	25,400	25,500
Percent Growth	118%	163%	134%	168%	114%
Change from No Build	2,600	7,200	9,100	14,100	13,000
Percent Growth	15%	37%	35%	53%	37%

West of Ivor, the incremental increase in AWDT from the No Build to the Build scenario is 2,600 vpd (15 percent), which indicates that the majority of the additional traffic on Route 460 in the Build scenario is drawn from the area east of Ivor. The traffic increases projected on the eastern end of the project are originating from north-south roadways such as Route 10 and Route 258, traveling to points east.

Two useful measures of the effect of a proposed transportation improvement are the change in vehicle miles traveled (VMT) and vehicle hours traveled (VHT), both in the corridor and across the larger transportation system. The projected 2040 No Build VMT on existing Route 460 from one mile west of Zuni to Route 58 is 363,240 VMT per day. With the FHWA/VDOT Preferred Alternative, the 2040 daily VMT on Route 460 is projected to increase to 506,250 (including both existing Route 460 and new Route 460). This is an increase of 143,010 VMT (39 percent), reflecting the increase in traffic attracted to the new Route 460. With regard to VHT on Route 460, the increase in traffic is offset by the increase in travel speeds. The result is that there is essentially no change in the 2040 daily VHT on Route 460 between the No Build scenario and the FHWA/VDOT Preferred Alternative, despite the increase in traffic volume.

In conclusion, on a regional level, the inclusion of the FHWA/VDOT Preferred Alternative in the Tidewater Superregional Model results in a 0.07 percent predicted increase in the multi-region daily VMT, and a predicted 0.26 percent decrease in the multi-region daily VHT. This is consistent with the expectation that some traffic would shift to use the improved Route 460 corridor because it is faster and would save time (reduced VHT) even though the travel distances could increase (increased VMT). The shift in traffic to

Route 460 also reduces traffic (and therefore potential congestion) elsewhere in the system. For example, traffic is predicted to decrease on I-64 on the peninsula. The forecasted 0.26 percent reduction in daily VHT on I-64 from the travel model is equal to 7,810 hours per day. This yields over 2.8 million hours of saved travel time over a one-year period.

2.7.2 Level of Service Analysis

Capacity analyses were performed using the forecasted traffic volumes and truck percentages for the Build Year of 2040. The following discussion summarizes the predicted LOS for the Build portion of the corridor. **Table 2.7-2** presents a summary of the LOS for the mainline and intersections within the study area.

A detailed summary of all LOS is contained in the ***Supplemental Traffic and Transportation Technical Report*** (VDOT, 2016h).

In Windsor, the existing Route 460 at Route 258 signalized intersection will operate at LOS D during the AM peak hour and LOS E during the PM peak hour, similar to No Build conditions, with overall intersection delays under Build conditions within five seconds of No Build conditions.

The operation of existing Route 460 at Route 610/603/1810 signalized intersection in Windsor improves from LOS F to LOS E in both the AM and PM peak hours between No Build and Build conditions due to the reduction in traffic volumes along existing Route 460 and motorists using the new Route 460 around Windsor. Under Build conditions, overall intersection delays will decrease by 64 percent in the AM peak hour and 74 percent in the PM peak hour.

Immediately west of Antioch Road/Cut Thru Road, a new three-legged signalized intersection will connect the existing Route 460 with the new Route 460 allowing for the westbound new Route 460 through traffic to flow uninterrupted. Other traffic movements will operate under signal control. The intersection will operate at LOS A during both the AM and PM peak hours in the 2040 Design Year.

Traffic that formerly used Cut Thru Road to access Route 460 would use Route 639/Winston Road, approximately one mile west of Cut Thru Road to access Route 460. This unsignalized intersection will operate at a LOS D for the southbound left-turn movement in the PM peak hour due to minimal gaps in traffic along Route 460 for left-turning movements from Winston Drive.

All roadway segments along existing Route 460 as well as the new freeway segments along new Route 460 will operate at LOS B or better under 2040 Build conditions. This includes existing Route 460 west of the new three-legged intersection where four-lanes of traffic on new Route 460 will merge with four-lanes of traffic on existing Route 460. At the western project limits, existing Route 460 and new Route 460 merge at the proposed intersection located immediately west of the Antioch Road/Cut Thru Road intersection. The new intersection is projected to operate at LOS A in the design year indicating that the two westbound traffic flows of existing Route 460 and new Route 460 can be merged together efficiently without delays or operational issues. Additionally, the roadway segments along existing and improved Route 460 between Ivor and the Town of Zuni are projected to operate at LOS A in the design year for Build conditions. The existing Route 460 at Route 616/Main Street intersection within Ivor is also projected to operate at LOS A under design year Build conditions. Although traffic volumes are forecasted to increase between No Build and Build conditions by 2,600 ADT west of Ivor, the capacity analysis indicates that existing Route 460 can accommodate the increased traffic volumes west of the project limits where the two roadways merge into existing Route 460.

Table 2.7-2: Route 460 Level of Service Summary (1)

Location	Existing Peak (2013)		No Build Peak (2040)		Build Peak (2040)	
	AM	PM	AM	PM	AM	PM
Roadway/Freeway Segments						
EB and WB Route 460 between Main St and Kings Fork Road	A	A	A/B	A/B	A	A/B
EB and WB new Route 460 between Green-T intersection and Route 58 ramps					A	A/B
EB Route 58 west of new Route 460	B	B	C	B	C	B
WB Route 58 west of new Route 460	A	C	B	C	B	C
EB Route 58 between Route 460 and Godwin Blvd	C	B	C	B	D	C
WB Route 58 between Route 460 and Godwin Blvd	B	C	B	D	C	D
EB Route 58 east of Godwin Blvd	C	B	D	C	D	C
WB Route 58 east of Godwin Blvd	C	D	C	E	C	E
Intersections (2)						
Route 460 at Route 616/Main Street, signalized	B	B	A	A	A	A
Route 460 at Winston Dr/Route 639, unsignalized	B	B	C	D	C	D
Existing Route 460 at new Route 460 (Green-T) west of Windsor, signalized					A	A
Existing Route 460 at Route 258/ Prince Blvd, signalized	D	D	D	E	D	E
Existing Route 460 at Routes 610/603/1810, signalized	E	D	F	F	E	E
Existing Route 460 at EB new Route 460 ramps, east of /Windsor, signalized					B	B
Existing Route 460 at WB new Route 460 ramps, east of Windsor, signalized					B	C
Route 460 at Route 634/Kings Fork Rd, signalized	C	C	D	D	C	C
Existing Route 460 at Relocated General Early Dr/Northfield Dr, signalized	A	A	A	A	B	C
Existing Route 460 at WB Route 58 Ramps, unsignalized (3)	C	E	A	A	A	A
Existing Route 460 at EB Route 58 Ramps, signalized	B	A	C	C	B	A
Existing Route 460 at Sadler Pond Dr/Murphy's Mill Connector, unsignalized (4)	B	B	C	D	F	F
General Early Dr at EB/WB New Route 460, unsignalized					A/B	A/B
WB Route 58 ramps at Godwin Blvd, signalized	D	D	D	D	C	D
EB Route 58 ramps at Godwin Blvd, signalized	B	B	D	C	C	C

Notes:

(1) Traffic analysis performed in accordance with the *Highway Capacity Manual 2010* and the *VDOT Traffic Analysis Tool Guidebook Version 1.1*.

(2) For unsignalized intersections, the LOS reported is for the movement with the worst LOS.

(3) Intersection currently operates unsignalized but is assumed to be signalized in the future pending assessment of signal warrants.

(4) Intersection currently operates unsignalized; installation of a traffic signal (when warranted) will address the LOS deficiency; however, the volumes on the minor street approaches that are causing the LOS deficiency are relatively low (less than 100 vehicles per hour in the AM and PM peak hours) and a traffic signal is not likely to be warranted.

LOS Legend	
	LOS C or better
	LOS D
	LOS E
	LOS F

The new Route 460/existing Route 460 crossing on the east side of Windsor consists of a diamond interchange with a loop ramp in the northwest quadrant. The two signalized intersections serving the interchange ramps will operate at LOS B in the 2040 Design Year with one exception. The intersection of

the westbound new Route 460 ramps and existing Route 460 will operate at LOS C during the PM peak hour. All merge and diverge junctions along new Route 460 at the existing Route 460 interchange will operate at LOS B or better under 2040 Build conditions.

The new interchange will provide access from new Route 460 to Route 58 using four flyover ramps, which will remove a substantial portion of traffic from the existing Route 460 and Route 58 interchange. All of the interchange ramp movements associated with the Eastern Terminus new interchange will operate at LOS C or better in the 2040 Design Year in both the AM and PM peak hours. All of the existing and future intersections associated with the interchange will also operate at LOS C or better with one exception. The unsignalized intersection of Route 460 at Sadler Pond Drive will be converted to a four-legged intersection with the Murphy's Mill Connector forming the south leg of the intersection. The northbound left-turn lane on the Murphy's Mill Road approach to existing Route 460 intersection will operate at LOS F in the 2040 Design Year in the AM and PM peak hours. All other intersection movements will operate at LOS D or better. The installation of a traffic signal would address this LOS deficiency; however, the volumes on the minor street approaches that are causing the LOS deficiency are relatively low (less than 100 vehicles per hour in the AM and PM peak hours) and a traffic signal is not likely to be warranted.

Increases in traffic volumes in the Route 460 corridor when considering both existing Route 460 and new Route 460 will contribute to increased traffic along the Route 58 corridor. This causes some additional degradation of operations along the Route 58 freeway segments compared to No Build conditions. Specifically, eastbound Route 58 between Route 460 and Route 10/Godwin Boulevard will operate at LOS D during the AM peak hour (compared to LOS C under No Build conditions). No other segments will degrade to LOS D or worse compared to No Build conditions. Westbound Route 58 east of Route 10/Godwin Boulevard will continue to operate at LOS E during the PM peak hour corresponding to the segment and direction of Route 58 with the highest peak hour traffic volumes.

As a result of the increases in traffic volumes along Route 58 in the 2040 Design Year, some degradation in LOS will be experienced at the ramp junctions at the Route 10/Godwin Boulevard interchange. During the AM peak hour, the eastbound and westbound Route 58 off-ramps to Route 10/Godwin Boulevard and the southbound Route 10/Godwin Boulevard on-ramp to eastbound Route 58 will operate at LOS D under Build conditions (compared to LOS C under No Build conditions). All other ramp junctions will remain the same as No Build conditions.

The intersections along Route 10/Godwin Boulevard serving the interchange will operate at the same LOS compared to No Build conditions with two exceptions. The eastbound Route 58 ramps intersection will improve to LOS C in the AM peak hour (compared to LOS D under No Build conditions). The westbound Route 58 ramps intersection also improves to LOS C in the AM peak hour (compared to LOS D under No Build conditions.). This is due to reductions in traffic volumes at the intersections including the off-ramps and on-ramps serving Route 58 under Build conditions.

2.8 PREFERRED ALTERNATIVE'S ABILITY TO ADDRESS THE PURPOSE AND NEED

This section describes the ability of the FHWA/VDOT Preferred Alternative (which includes 16 miles of improvement and 36 miles of the No Build Alternative) to address the identified components of the project Purpose and Need as presented in **Chapter 1.0**. Impacts of the No Build and the FHWA/VDOT Preferred Alternative to various resources are described in **Chapter 3.0**.

2.8.1 Address Roadway Deficiencies

Route 460 was designed and constructed using geometric standards that are now outdated. This substandard design in turn contributes to the other identified transportation needs of improving safety, reducing travel delays, accommodating the movement of increasing freight traffic, enhancing emergency evacuation and supporting military preparedness.

The FHWA/VDOT Preferred Alternative includes upgrades and improvements for the 16 miles of the corridor that experience the most traffic conflicts that would meet current VDOT design standards and provide better traffic service as intended by the functional roadway classification[3]. Specifically, the FHWA/VDOT Preferred Alternative would have appropriately sized lanes, shoulders, and clear zones for the 16-mile corridor.

Additionally, the FHWA/VDOT Preferred Alternative would address flooding issues in Zuni, discussed in the preliminary flooding analysis and described in the Draft SEIS. The elevation of the existing Blackwater River Bridge is approximately eight feet below the Federal Emergency Management Agency (FEMA) calculated 100-year flood elevation. Four times in the past 15 years, the elevation of the Blackwater River has risen to an elevation approximately five feet higher than the FEMA calculated 100-year flood elevation. The existing Norfolk-Southern Railroad is over 18 feet higher than existing Route 460 and is located immediately downstream of the Blackwater River bridge.

The Blackwater River flood profiles included in the Isle of Wight Flood Insurance Study (FIS), dated September 4, 2002, indicate that the railroad bridge creates an increase in upstream water surface elevations for major flood events which overtops existing US 460 and therefore influences upstream flood profiles. The FIS flood profile revealed that for the 100-year event storm event, the railroad bridge created an increase in the upstream 100-year flood elevation of approximately one foot and that that the flood profile over the existing Route 460 Bridge is approximately elevation 34 feet. Appendix B, Preliminary Flood Study: Zuni included in the ***Alternative Technical Report*** for the Draft SEIS for the Route 460 Location Study, documented observed flood elevations over the existing Route 460 Blackwater River Bridge at elevation 38.0. Based on the FIS flood profile, for an observed flood at elevation of 38.0 feet upstream of the railroad bridge, the water surface is at the same elevation as the top of the railroad bridge. For the 500-year storm event, the increase in the water surface elevation upstream of the bridge was 2.5 feet and is at elevation 40.5.

The design improvements to the Route 460 Blackwater River Bridge included in the FHWA/VDOT Preferred Alternative considers these recent storm events and accordingly will result in a roadway and bridge elevation more than fourteen feet higher than it is today. Consequently, over 4,000 feet of existing roadway will need to be elevated in the approaches to this improved bridge structure. Additionally, a new bridge approximately 500 feet in length will be required to satisfy the hydraulic requirements of the state and federal agencies. The encroachment into jurisdictional areas along with the Right-of-Way and property impacts to the parcels adjacent to Route 460 in Zuni will be significantly reduced by adding retaining walls along both sides of the roadway embankment leading to the new bridge. Similar to other VDOT roadway projects, these roadway and bridge improvements are not specifically designed to reduce the flooding experienced by adjacent properties in this area, although such reductions may occur during some flood events. Providing the improvements to the FHWA/VDOT Preferred Alternative that address flooding

[3] VDOT Functional Classification is Other Principal Arterial GS-1 on the 2014 VDOT Functional Classification Map.

enables the new roadway to adequately address the emergency evacuation component of the Purpose and Need at the Blackwater River (see **Section 2.8.5**).

For the improved section of Route 460 between Tucker Swamp Road and the new intersection with New Route 460 west of Windsor, the minor flooding problem areas will be mitigated with typical, relatively low cost, infrastructure improvements that are standard for Principal Arterial roadway projects. These minor improvements are incorporated into the FHWA/VDOT Preferred Alternative and include the following:

- Raise the road elevation a few feet and add an additional pipe or box culvert to increase the ability of the stormwater to pass from one side of the road to the other; and,
- Replace the existing storm sewer infrastructure (drainage inlets, storm sewer pipes, and/or cross culverts) with larger pipes that meet current VDOT drainage design criteria.

2.8.2 Improve Safety

The FHWA/VDOT Preferred Alternative addresses several critical higher crash rate segments within the overall Petersburg to Suffolk corridor. In fact, 172 (45 percent) of the 380 reportable crashes from January 2010 to December 2012 in the overall corridor occurred in the approximately 16-mile segment that would be improved by the FHWA/VDOT Preferred Alternative. This includes the higher crash rate segments in Windsor and just west of Route 58. **Table 2.8-1** compares the existing crash rates for the approximately 16-mile segment (western project limit to Route 58) to the entire Route 460 corridor between Petersburg and Suffolk. It also provides the Petersburg to western project limit data for comparison. As shown in the table, the total crash rate in the project area is 60 percent higher than the crash rate for the No Build comparison section. The injury rate is 65 percent higher than the crash rate for the No Build comparison section. The fatality rate is 36 percent lower, as the No Build portion includes longer sections of higher posted speed limits than the more developed eastern portion of the study area, which likely results in slightly higher fatality incidences.

Table 2.8-1: Crash Rates Comparisons (2010 to 2012 Crashes)

Crashes and Crash Rates by Facility Type	Route 460 (Petersburg to Suffolk)	No Build Section (of the Preferred Alternative)	Build Section (of the Preferred Alternative)	Comparison of Build Section to No Build Section
Analysis Length (Miles)	50.6	34.5	16.1	--
Total Crashes	380	208	172	--
# Persons Killed (per 100 MVMT)	1.8	2.0	1.3	36% less
# Persons Injured (per 100 MVMT)	37.3	30.6	50.4	65% greater
Total Crash Rate (per 100 MVMT)	55.9	46.4	74.1	60% greater

MVMT = million vehicle miles traveled

A safety analysis was conducted to examine the crash rates and patterns from one mile east of Ivor (western project limit) to Route 58 in Suffolk. Of the 172 reportable crashes in this section between 2010 and 2012, there were three fatal crashes (three fatalities), 71 injury crashes (117 injuries), and 98 property damage only crashes. **Figure 2.8-1** shows dense clusters areas of darker shading where the locations of the crashes are concentrated. This figure shows that the majority of crashes were located in Windsor and in the more developed eastern portion of the study area. **Table 2.8-2** presents fatal, injury, and total crash rates for the five Route 460 analysis segments shown on **Figure 2.8-1**. As shown, segments 3 and 5 have the highest total crash rates and segments 3 through 5 have the highest injury rates. The FHWA/VDOT Preferred

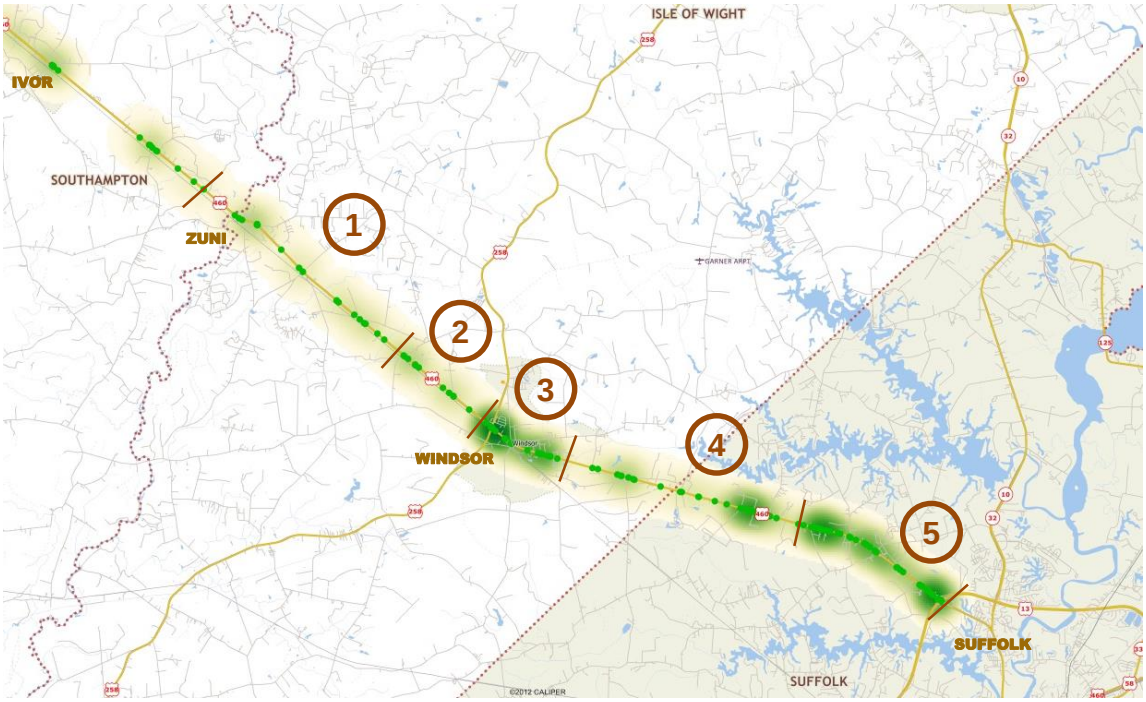
Alternative directly addresses these highest crash rate sections by providing a new grade separated four-lane highway from west of Windsor to Suffolk.

Table 2.8-2: Existing Route 460 Crash Rates

Segment	1	2	3	4	5	All
Crash Rates by Segment	West of Zuni to West of Antioch	West of Antioch to West of Route 258	West of Route 258 to .3 miles West of Lover's Lane	0.3 miles West of Lover's Lane to West of Lake Prince Dr.	West of Lake Prince Dr to Route 58 Overpass	Entire Corridor
Length (miles)	5.1	2.1	1.8	5.1	2.1	16.1
Total Crashes	23	14	39	54	42	172
Fatal Rate	0.0	4.2	3.5	0.0	2.4	1.3
Injury Rate[1]	35.6	25.5	66.6	56.8	59.3	50.4
Total Crash Rate	43.1	59.5	136.8	63.9	99.6	74.1

These rates are based on the total number of fatalities or injuries, not the number of crashes.
Source: VDOT crash data.

Figure 2.8-1: Study Area Crash Map



Crash patterns on Route 460 within the study area over the three-year period serve to illustrate the design deficiencies present under existing conditions and the expected benefits of the FHWA/VDOT Preferred Alternative.

- Rear end and angle crashes, concentrated in Windsor and the eastern portion of the corridor, reflect the problems that typically arise with a transition from higher posted speeds to lower posted speeds and increased intersection densities. Rear-end and angle accounted for approximately 104 (60

percent) of the total observed crashes. Approximately 80 percent of these rear-end and angle crashes (84 crashes) occurred in Windsor and the eastern portion of the corridor;

- Crashes with fixed objects off the road reflect the limited shoulder widths and lack of recovery space which would typically help to reduce this kind of crash. These fixed object crashes accounted for approximately 26 (15 percent) of the total observed crashes; and,
- Head-on crashes, which are frequently more severe than other crash types, accounted for an additional eight crashes (5 percent).

The four crash types noted above account for 80 percent of the total crashes in the corridor. They are also all addressed by the proposed improvements included in the FHWA/VDOT Preferred Alternative. Rear-end, angle, and head-on crashes are reduced by providing medians, turn-lanes, and access control. Fixed object crashes are reduced by providing increased clear zones. All of these improvements are part of the FHWA/VDOT Preferred Alternative.

To further evaluate the potential safety benefits of the FHWA/VDOT Preferred Alternative a safety analysis was prepared for the corridor using Highway Safety Manual (HSM) methods. The HSM analysis was conducted for Route 460 from the western project limit to Route 58 (including the interchange ramps). The HSM evaluation yielded predicted crash rates for both the No Build condition and the FHWA/VDOT Preferred Alternative (the FHWA/VDOT Preferred Alternative prediction included crashes on both the existing Route 460 and the new alignment).

The predicted crash rate along this section in 2040 under the No Build was approximately 133 crashes per 100 million vehicle miles (100 MVM) traveled. The predicted crash rate in 2040 for the FHWA/VDOT Preferred Alternative was approximately 67 crashes per 100 MVM on the improved highway and approximately 117 crashes per 100 MVM on the existing highway for a combined rate of 78 crashes per 100 MVM. Thus the FHWA/VDOT Preferred Alternative would be anticipated to reduce overall crash rates by approximately 41 percent compared to the No Build Alternative along these 16 miles, even though more vehicles are attracted to the improved section of Route 460. A qualitative factor considered in the comparison of the FHWA/VDOT Preferred Alternative to the No Build Alternative is the presence of the Nansemond Suffolk Academy on Route 460 east of Windsor. The school creates the potential for safety and traffic issues, especially around the hours of the start and end of the school day. Through the school zone, a reduced speed limit is posted in the existing Route 460 corridor. The presence of the school on Route 460 – with buses, parents dropping off children, and student drivers – is not compatible with the high truck traffic volumes in the corridor. The FHWA/VDOT Preferred Alternative removes potential conflicts with school related traffic issues because it shifts the truck traffic to a new route.

Likewise, improved mobility due to truck traffic diversion to a new route and decreased conflict points along the FHWA/VDOT Preferred Alternative would offer improved response times for emergency vehicles.

2.8.3 Reduce Travel Delays

In the No Build scenario, as traffic increases between 2013 and 2040 in the approximately 16-mile corridor, travel speeds will decrease. The predicted 2040 No Build travel time from the western project limit to the westbound Route 58 ramp terminals is 25 minutes, with an average speed of 37 mph.

The FHWA/VDOT Preferred Alternative travel time from the western project limit to the ramps to/from Route 58 (on the new highway) is 18 minutes, with an average speed of 52 mph. Thus the FHWA/VDOT

Preferred Alternative will decrease the travel time in this section by nearly seven minutes per vehicle. Travel time on the existing Route 460 would also decrease; travel time would be 22 minutes, with an average speed of 43 mph, a savings of three minutes. The weighted average travel time savings for all vehicles traveling the corridor in 2040 is approximately six minutes. Applying that to the 2040 No Build volume results in over 840,000 hours of annual travel time savings in 2040. To better account for all travel time savings that would result from the FHWA/VDOT Preferred Alternative, including traffic shifts to new Route 460 from other roadways, it is necessary to examine the model results from the Tidewater Superregional Travel Demand Model. Based on the model outputs, it is forecasted that the FHWA/VDOT Preferred Alternative could reduce regional travel times in 2040 by as much as 7,810 hours per day or 2.85 million hours per year.

The FHWA/VDOT Preferred Alternative also provides two routes of connectivity between west of Windsor and Route 58. Therefore, if a major incident were to congest or close one route, traffic could shift to the other route.

2.8.4 Accommodate Freight Movement

Currently, Route 460 has been classified as a Gateway Freight Corridor and is the third highest gateway (I-64 is highest and Route 58 is second highest) for trucks entering and exiting Hampton Roads. The FHWA/VDOT Preferred Alternative will provide an opportunity to facilitate a more efficient movement of truck traffic over the 16 miles of associated improvements by separating truck traffic from local traffic and limiting the number of intersections along the new location portion of the alignment. **Table 2.8-3** compares the truck volumes for three sections of Route 460.

The 2040 No Build scenario truck volume east of Ivor is forecasted to be 3,980 trucks per day (tpd). With the FHWA/VDOT Preferred Alternative this increases to 4,650 tpd, an increase of 670 tpd. West of Route 258, the increase is from 4,000 tpd in the No Build scenario to 4,920 tpd with the FHWA/VDOT Preferred Alternative with 4,420 tpd (90 percent) on the new Route 460 highway. Approximately one-half mile west of the Route 460/58/13 overpass of Pruden Boulevard (west of Northfield Road), the 2040 prediction is for an increase from 3,730 tpd to 5,700 tpd, an increase of 1,970 tpd, with 81 percent of the trucks on the new Route 460 highway. The increased truck volumes in the FHWA/VDOT Preferred Alternative scenario show the attractiveness of the improved corridor to truck traffic. The truck traffic in the corridor would benefit from the improved safety and travel time benefits discussed previously.

Table 2.8-3: Daily Truck Volume Comparison

Location	Highway	Existing (2013)	No Build (2040)	FHWA/VDOT Preferred Alternative (2040)
East of Ivor	Existing Route 460	2,150	3,980	4,650
West of Route 258 (in Windsor)	Existing Route 460	2,190	4,000	500
	New Route 460	--	--	4,420
	Total	*2,190*	*4,000*	*4,920*
West of Northfield Road	Existing Route 460	2,520	3,730	1,080
	New Route 460	--	--	4,620
	Total	*2,520*	*3,730*	*5,700*

The FHWA/VDOT Preferred Alternative offers further benefits by providing a direct high-speed free-flow connection between Route 58 and the new highway. This connection would simplify and speed access through the corridor.

2.8.5 Enhance Emergency Evacuation

Route 460 is a designated hurricane evacuation route for Southside Hampton Roads communities and is designated as such in the Virginia Hurricane Evacuation Guide[4]. Presently the facility is subject to closure during events because of flooding and blockage from roadside debris. In addition, the presence of driveways and intersections along existing Route 460 increase clearance times and limit the potential for lane reversal to be implemented, making it a less effective route for evacuation.

As part of the Final SEIS, the potential hurricane evacuation benefits of the FHWA/VDOT Preferred Alternative were considered and modeled. Working with the Virginia Department of Emergency Management, VDOT evaluated the anticipated hurricane evacuation traffic flows and travel times both in the Route 460 corridor and within the larger Hampton Roads and Richmond regions. The evaluations were conducted with and without the FHWA/VDOT Preferred Alternative improvements in place.

With the FHWA/VDOT Preferred Alternative the Route 460 corridor was forecasted to serve 7,300 additional vehicles (approximately 14,750 people, an increase of 15.6 percent) over an approximately 25-hour hurricane evacuation event when compared to the No Build Alternative. Even with the additional 7,300 vehicles on Route 460, the clearance times between the FHWA/VDOT Preferred Alternative and the No Build would remain similar. With the FHWA/VDOT Preferred Alternative, over 7,000 vehicles were predicted to shift away from the congested northern corridors (Route 60 and I-64), which would ease congestion on those routes. This shift in traffic was predicted to result in a one-hour reduction in the hurricane evacuation clearance time on the reverse flow lanes on I-64, and a 36-minute reduction on the primary direction lanes of I-64. Overall, the combined clearance times of the six highest volume evacuation routes, I-64 (including primary and reverse directions), Route 60, Route 10, Route 58, and Route 460, are predicted to decrease by over three percent. The FHWA/VDOT Preferred Alternative would also provide overall transportation benefits for evacuation to the larger Hampton Roads and Richmond regions, including a reduction of 66,000 vehicle hours of travel time (122,000 person hours) to all transportation system users during the 25-hour evacuation period.

In addition to the increased capacity in the Route 460 corridor and the reduced corridor clearance times, the FHWA/VDOT Preferred Alternative also provides additional system redundancy and the ability to accommodate incidents during evacuations in the stretch of highway from Route 58 to west of Windsor. Instead of traffic having to use the existing Route 460 / Route 58 interchange and pass through downtown Windsor, there are now three routes that can be used to travel from Route 58 to west of Windsor (both sets of lanes on the new Route 460 alignment and the existing Route 460 highway). Also system redundancy can be very beneficial in situations where vehicle breakdowns or other incidents may occur and emergency response is required.

Overall, the new corridor removes the constraint points at the existing Route 460 / Route 58 interchange and on Route 460 in downtown Windsor, which limit evacuation on the existing facility. With the removal of these constraint points the evacuation traffic can flow more smoothly all the way to Zuni. By removing the most limiting locations, overall evacuation movements during the peak times can increase. Prior to reaching Zuni, some traffic will use Route 258 and Route 10 to travel to the west. Thus there will be some

[4] Most recent May 2014 Hurricane Evacuation Guide available at: http://www.vaemergency.gov/sites/default/files/Final2014hurricaneguide.pdf

dispersion along the route, reducing the amount of traffic that will travel to Zuni and Ivor and points west on Route 460.

Furthermore, the increase in speeds from Route 58 to Zuni will increase the amount of traffic using this corridor during the evacuation period, which will lower the system-wide average travel time. It will also delay the point at which I-64 or other facilities reach capacity during an evacuation scenario. The improved Route 460 corridor will be a relatively high speed alternative to some of the other routes, decreasing travel times for the overall system-wide clearance times from Hampton Roads.

2.8.6 Support Military Preparedness

Route 460 is a designated part of the Strategic Highway Network (STRAHNET) by the Department of Defense (DOD) and FHWA. The FHWA/VDOT Preferred Alternative would provide infrastructure improvements that would enhance connectivity to and from the DOD facilities in the Hampton Roads area, allowing for a more reliable and efficient deployment, enhancing the military's responsiveness to defense-important infrastructure at Virginia's ports. Additionally, the FHWA/VDOT Preferred Alternative would contribute to the resiliency of the defense highway network due to the new roadway's proximity to military facilities and the mobility offered by its associated improvements.

2.8.7 Address Local Economic Development Goals

In addition to statewide and regional economic development needs, jurisdictions along the Route 460 study area have identified economic development priorities related to transportation improvements. Improvements to Route 460 are included in the comprehensive plans and/or supported by the local jurisdictions of Prince George County, Surry County, Southampton County, Isle of Wight County and the City of Suffolk, as well as the incorporated towns of Wakefield and Windsor. Based on the history of the Route 460 Location Study, the majority of the local plans accounted for the improvements associated with Draft SEIS Alternative 1, because it was selected in 2008 as the FHWA/VDOT Preferred Alternative in the original FEIS.

Based on the information presented in this Final SEIS, improvements to transportation within the study area will provide for increased mobility for freight movement and address local plans to varying degrees. The FHWA/VDOT Preferred Alternative would address the plans of the City of Suffolk and Isle of Wight County for economic development. Both municipalities identify the area around the new 460 interchanges/ intersections as growth areas. The Isle of Wight County plan acknowledges Route 460 as representing short and long term economic development potential for the community. Likewise, Suffolk's Comprehensive Plan notes that investment in the Route 460 corridor is critical to the City's economic development and crucial to the City's access to regional markets (City of Suffolk, 2015). Additionally, the FHWA/VDOT Preferred Alternative, by improving traffic movement through and around the Town of Windsor and by providing an interchange of existing 460 with the new roadway east of Windsor in proximity to the planned industrial area, would provide access to the existing and planned expansion of the industrial area (Shirley T. Holland Intermodal Park), giving potential businesses access to freight routes and ports in Hampton Roads. The proposed Route 460/Route 460 interchange east of Windsor would tie into the left-turn lane and intersection of existing Route 460 at Old Mill Road (Route 607), which would accommodate the anticipated traffic movements to and from the Shirley T. Holland Intermodal Park.

CHAPTER 3.0 | ENVIRONMENTAL RESOURCES, IMPACTS, & MITIGATION

Chapter 3.0 ENVIRONMENTAL RESOURCES, IMPACTS, AND MITIGATION

3.1 OVERVIEW AND SUMMARY OF EFFECTS

The implementation of a transportation improvement project has the potential to affect social, economic, historic, and natural resources; therefore it is essential that the existing environmental conditions and potential project related impacts are identified and understood. The study area (see **Figure 3.1-1**) for the Route 460 Location Study contains a number of environmental resources that have been identified through detailed technical research, field inspections, and analytical scrutiny. The purpose of this chapter is to present the results of the detailed resource investigations that were conducted for the Route 460 Location Study. In addition to the identification of resources, these analyses included identifying the anticipated impacts and mitigation for those impacts in relation to the FHWA/VDOT Preferred Alternative carried forward in this SEIS. The environmental conditions evaluated and their relevance to the project are summarized in **Table 3.1-1**.

Table 3.1-1: Summary of Environmental Resources

Resource Category	Resource Summary
Demographics	The study area is home to over 52,000 residents of varied ages and races (see **Section 3.2.2.1, 3.2.2.2, 3.2.2.3,** and **3.1.1.1**).
Environmental Justice	This project has been evaluated in accordance with Title VI of the Civil Rights Act of 1964, as amended, and Executive Order (EO) 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, and U.S. Department of Transportation (USDOT) Order 5610.2(a). Minority populations have been identified within the Limits of Disturbance (LOD) for the FHWA/VDOT Preferred Alternative (see **Section 3.2.2.4, 3.2.3.2.3**, and **3.2.4.2**).
Right-of-way and Relocations	In order to implement the FHWA/VDOT Preferred Alternative under study, right-of-way acquisition from residential, business, farm, and non-profit parcels would be required, resulting in the relocation of some property owners. Property acquisitions and relocations were determined based on professional engineering judgment using aerial photography, Google Street View, and geographic information system (GIS) analysis, examining the LOD applied along the proposed corridor. In general, a greater number of relocations would be required within the more built up areas along existing Route 460 (see **Section 3.2.3.2.1**).
Public Facilities and Public/Private Institutions	The study area contains a large number of public and private community facilities and institutions, including schools, healthcare facilities, religious institutions, emergency services facilities, government services, airports, and museums. These facilities provide a variety of services for public benefit. Some partial property takes would directly impact these facilities and one relocation is anticipated of a post office facility in Zuni (see **Section 3.2.2.7** and **3.2.3.2.2**).
Economics	Employment within the study area is largely dependent on the timbering and agricultural businesses, as well as long- and short-haul distribution due to the proximity of Route 460 to the Virginia Port Authority. A variety of businesses are located along Route 460 and within each of the seven communities in the study area. These businesses provide services to local residents and through-traffic, employment opportunities for local residents, and tax revenues for their respective jurisdictions (see **Sections 3.2.2.8**, **3.2.3.2.4**, and **3.2.4.3**).
Travel Patterns	Travel patterns within the study area consist of both through trips and local trips between and among the communities along Route 460. The private vehicle is the dominant form of travel as bicycle/pedestrian trails are limited to sidewalks within portions of Waverly and Windsor and there is no public transit. The implementation of the FHWA/VDOT Preferred Alternative is likely to result in more efficient mobility as it would provide roadway improvements that reduce travel delays (see **Section 3.2.2.9, 3.2.3.2.5**, and **3.2.3.2.5**).

Resource Category	Resource Summary
Land Use	Land use information was compiled from: U.S. Census Bureau, National Oceanic and Atmospheric Administration (NOAA) Coastal Change Analysis Program (C-CAP), local comprehensive plans, and various internet resources. General descriptions of the development in the study area are based on the compiled land use information and field visits during 2014. Since land use decisions are made by the localities, conversion of existing and future land uses as a result of the implementation of the FHWA/VDOT Preferred Alternative would require coordination with appropriate localities, agencies, and affected property owners to ensure that land use conversions are consistent with local land use policies and plans (see **Section 3.3.2.1**, **3.3.2.2**, **3.3.2.3**, and **3.3.3.2.1**).
Farmlands	Farmland, as defined by the Farmlands Protection Policy Act (FPPA) of 1981 (7 USC § 4201, et seq.), is located throughout the rural study area. Specifically in Isle of Wight County, agricultural and forestal (A&F) Districts have been established to preserve and protect open spaces, forested areas, and agricultural lands. The FPPA states that "increasingly higher levels of consideration for protection" be given to farmlands impacted by projects that have a Farmland Conversion Impact Rating exceeding a total score of 160. The FHWA/VDOT Preferred Alternative scored below 160 and thus no further action is recommended to mitigate farmland conversion. Although the LOD of the FHWA/VDOT Preferred Alternative is located in close proximity to both the Knoxville A&F District and the Courthouse A&F District, the LOD of the FHWA/VDOT Preferred Alternative is not within either district. Therefore, conversion of land in the A&F District would not need to be performed and in accordance with State Code and no coordination is necessary (see **Section 3.3.2.4** and **3.3.3.2.2**).
Recreational Resources	For the purposes of this study, the identification of outdoor recreational resources in the Route 460 study area included any protected area under the jurisdiction of a municipal, state, federal, or conservation entity; or a publicly or privately-owned area where recreation or preservation is a primary function or resource. In total, 61 recreational resources have been identified in the Inventory Corridor; the LOD of the FHWA/VDOT Preferred Alternative would potentially impact one of these resources (see **Section 3.3.2.5** and **3.3.3.2.3**).
Section 4(f) Properties	Section 4(f) protects publically owned parks, recreation areas, wildlife, and/or waterfowl refuges, as well as significant historic sites, both publicly and privately-owned, that are listed in the National Register of Historic Places (NRHP) or eligible for listing in the NRHP. No protected properties would be affected by the LOD of the FHWA/VDOT Preferred Alternative. Therefore, a Section 4(f) Evaluation is no longer required (see **Section 3.11)**.
Wetlands and Streams	Located in the Coastal Plain Province of Virginia, the study area is rich with natural resources, including wetlands. These water resources have been identified using photointerpretive and field delineation methodologies. The FHWA/VDOT Preferred Alternative would permanently impact 39.77 acres of vegetated wetlands and 6,874 linear feet of streams. Impacts to wetlands and streams were reduced through avoidance measures, bridging, and other minimization design strategies. Compensation has been developed in coordination with regulatory agencies and will include mitigation bank credits, stream credits, and restoration and preservation of wetlands. (see **Sections 3.4.2.1**. **3.4.3.1**, and **3.4.4.1**).
Water Quality	In accordance with the Clean Water Act (CWA) Section 303(d) and 40 CFR §130.7(b), and the State Water Control Law (§62.1-44.2 et seq), the Virginia Department of Environmental Quality (VDEQ) has identified approximately 1,141 river miles of impaired waters in the study area. Of these impaired waters, the LOD of the FHWA/VDOT Preferred Alternative crosses a total of 3 sub-watersheds, one of which is in the Chowan/Albemarle Basin, and two of which are in the James River Basin. The potential for degradation of water quality resulting from increased pollutant runoff associated with the FHWA/VDOT Preferred Alternative would be minimized by the implementation of temporary and permanent stormwater management measures identified in VDOT's most recent Road and Bridge Specifications which includes coverage of the State Water Control Law.(see **Sections 3.4.2.1**. **3.4.3.1**, and **3.4.4.1**).

Resource Category	Resource Summary
Floodplains	Floodplain mapping produced by the Federal Emergency Management Agency (FEMA) indicate the presence of 100-year floodplains in the LOD of the FHWA/VDOT Preferred Alternative. Detailed avoidance and minimization measures have been developed to focus on avoiding and minimizing floodplain encroachment, ensuring that the FHWA/VDOT Preferred Alternative meets the goals of EO 11998 and the FHWA policy as set forth in 23 CFR §650 (see **Sections 3.4.2.1**. **3.4.3.1**, and **3.4.4.1**).
Wildlife and Habitat	Clearing of land that would be required for the construction of the FHWA/VDOT Preferred Alternative would impact wildlife and include the displacement of habitat. With the incorporation of best management practices (BMPs), potential impacts to wildlife and habitat would be avoided to the greatest extent practicable (see **Sections 3.4.2.2**, **3.4.3.2.2**, and **3.4.4.2**).
Threatened and Endangered Species	Federally listed and state recognized threatened and endangered species have been identified within the project study area. The FHWA/VDOT Preferred Alternative could possibly impact potential or suitable habitat for some threatened and endangered species, resulting in habitat fragmentation, direct loss of habitat, and potential takes from construction activities. Coordination with the Virginia Department of Game and Inland Fisheries (DGIF), Virginia Department of Conservation and Recreation (DCR) and the U.S. Fish and Wildlife Service (USFWS) is ongoing (see **Sections 3.4.2.2**, **3.4.3.2.2**, and **3.4.4.2**).
Hazardous Materials	A search of federal and state agency databases identified no open petroleum release sites, three closed petroleum release sites, and 2 petroleum facilities within the LOD of the FHWA/VDOT Preferred Alternative (see **Section 3.5**).
Air Quality	In accordance with VDOT and FHWA guidance, as well as requirements established by the Environmental Protection Agency (EPA), carbon monoxide (CO), particulate matter (PM), and mobile source air toxics (MSATs) have been analyzed, in addition to potential construction emissions. As a result of these analyses, it is not expected that the FHWA/VDOT Preferred Alternative would cause or contribute to any violations of National Ambient Air Quality Standards (NAAQS) (see **Section 3.6**).
Noise	The noise analysis indicates that there are noise sensitive receptors that will be impacted by the FHWA/VDOT Preferred Alternative, predominantly residential, but also including recreational/parks/cemeteries, interior, and commercial. Specific noise abatement measures will be finalized during the development of project design (see **Section 3.7**).
Historic Properties and Archaeological Sites	Historic and archaeological resources surveyed and evaluated in the study area identified seven architectural resources within the area of potential effect (APE) and three archaeological resources within the APE/LOD that are either listed in or eligible for the NRHP in accordance with the National Historic Preservation Act (NHPA). None of the architectural resources are within the LOD. Consultation with the Virginia Department of Historic Resources (VDHR) and other parties has been carried out to assess effects and take into account any adverse effects (see **Section 3.8**).
Visual Quality	Aesthetic and visual resources are perceived natural and cultural landscape features that contribute to the overall quality and the public enjoyment of the environment. Visual quality within the Route 460 study area and potential impacts resulting from the FHWA/VDOT Preferred Alternative were determined through the selection of representative viewpoints, determination of visual quality with and without the FHWA/VDOT Preferred Alternative, and consideration of public perception. Overall, visual impacts are expected to be negligible to moderate (see **Section 3.9**).
Energy	Transportation energy consumption accounts for a large portion of total energy consumption in Virginia and the U.S. In order to determine the potential energy requirements of the Route 460 project, a qualitative assessment of the FHWA/VDOT Preferred Alternative's energy impacts was developed to determine its direct and indirect energy use (see **Section 3.10**).

As described in **Chapter 2.0**, the alternatives evaluated in this Final SEIS include the No Build Alternative and the FHWA/VDOT Preferred Alternative. This assessment of environmental resources focuses primarily on the Limits of Disturbance (LOD) of the FHWA/VDOT Preferred Alternative, which was generated based upon preliminary design. Direct effects associated with the implementation of the 16-mile build section of the FHWA/VDOT Preferred Alternative are not anticipated to occur outside of the LOD. However, these assumptions are not based on detailed design and additional impacts to environmental resources may be identified, or further avoided and minimized, as the project development advances or these existing impacts may be reduced. Potential effects resulting from any projects included within the No Build portion of the FHWA/VDOT Preferred Alternative will be identified and addressed by the respective project sponsors. **Table 3.1-2** summarizes potential project related impacts associated with the FHWA/VDOT Preferred Alternative.

Table 3.1-2: Summary of Potential Environmental Impacts within the Limit of Disturbance

Category	Element/Resource Assessed	Potential Impacts
Operational Characteristics	Length (Miles)	16
	Proposed New Interchanges/Intersections (No.)	3
	Railroad Crossings (No.)	0
	Tolling Considered (Y/N)	N
Relocations	Residential Relocations (No.)	21
	Business Relocations (No.)	6
	Farm Relocations (No.)	1
	Non-Profit Relocations (No.)	1
Socioeconomics	Minority Populations (% Population)	46%
	Low Income Populations (% Population)	0%
	Relocations within Minority Census Blocks (No.)	7
	Relocations of Community Facilities (No.)	1
Land Use	Conversion of Land (Acres)	507
	Prime Farmlands Converted (Acres)	265
	Farmland of Statewide Importance (Acres)	56
	Agricultural & Forestal Districts (Acres)	0
	Public and Private Recreational Resources (No.)	1
Natural Resources	Forested Habitat/Wildlife Corridors (Acres/No.)	162.7/3
	Regional Biodiversity (Acres of Conservation Lands)	5.32
	Threatened and Endangered Species or Potential Habitat (No.)**	6
	Floodplains (Acres)	11
	State Wild and Scenic Rivers (Linear Feet)	500
	Streams (No. of Crossings)	53
	Stream Impacts (linear feet)	6,874
	Stream Impacts – Pipe Replacement (linear feet)	789
	Jurisdictional Ditch	9,339
	Permanent Impacts to Vegetated Wetlands (cut/fill, bridge conversion, right-of-way clearing, and secondary) (Acres)	39.77
	Open Water (Acres)	3.93
	Temporary Impacts to Vegetated Wetlands / Open Water (Acres)	1.31 / 0.12
Hazardous Materials	Open Petroleum Release Sites of Concern (No.)	0
Air Quality	Violations of National Ambient Air Quality Standards (No.)	0
Noise	Noise Receptors Affected (No.)	292
Historic Properties	Listed or Eligible Architectural Resources (No. of Properties)	0
	Listed / Potentially Eligible Archaeological Resources (No. of Sites)	0 / 3

Category	Element/Resource Assessed	Potential Impacts
Recreational Resources	Properties Affected	1
	Section 4(f) Properties Affected	0
Visual Quality	High Visual Quality Effects (No.)	0
Cost	Project Cost (Million $) **	$448

*There is habitat present which appears to meet the species' requirements and the study area is within the known range of the species for the following species: northern long-eared bat, barking tree frog, Mabee's salamander, little brown bat, tri-colored bat, and bald eagle.
**Includes construction contingency at an assumed 20% of raw construction cost.

3.2 SOCIOECONOMICS

In order to ensure that highway projects better address public needs and fit more harmoniously into communities and the human landscape, it is important that the unique needs of different population groups are understood and addressed. This section describes the demographic, economic, and travel patterns that are characteristic of the social environment of the study area. Potential impacts resulting from the implementation of the proposed FHWA/VDOT Preferred Alternative are also analyzed and described. Additional details on the methodologies and findings for socioeconomics as they pertain to Route 460 are included in the ***Socioeconomics and Land Use Technical Report*** (VDOT, 2014n).

3.2.1 Regulatory Context and Methodology

3.2.1.1 Social Environment

The social environment for the Route 460 study area includes a baseline of present and/or planned conditions. The study area is bound by Routes 10/32 to the east, Route 10 to the north, and Interstate 295 to the west. The southern boundary is a line three miles south of, and running parallel to, Route 460.

Population, race, ethnicity, income levels, and housing condition data for the study area were determined using geographic information systems (GIS) software, manual review, and data provided by the U.S. Census Bureau (Census). The Census collects and reports data for jurisdictions, as well as for several geographical units that are subsets of the jurisdictional total (i.e., census tract, block group, and block). To provide for regional comparisons, census data are collected and presented at the following levels: state, city/county, place, and study area. Place level data are used when addressing the four incorporated towns within the study area, including Ivor, Waverly, Windsor, and Wakefield. The two remaining towns of Zuni and Disputanta, as well as the King's Fork community in Suffolk, are not incorporated towns governed by their own municipal government and, therefore, are not considered "places" for the purposes of this analysis. For this assessment, 2010 Census data were used wherever possible, and American Community Survey (ACS) 5-Year Estimates were used and noted when 2010 Census data were not available.

General information regarding communities and public facilities was gathered from field review and correspondence with local representatives, primarily conducted during early 2014. Additional information was gathered from local comprehensive plans and reports and secondary mapping sources (e.g., GIS data provided by localities, Google Map, Google Earth, and aerial photography).

3.2.1.2 Environmental Justice

This Environmental Justice (EJ) assessment was conducted in accordance with Title VI of the Civil Rights Act of 1964, which requires that no person in the U.S. shall, on the ground of race, color, or national origin be excluded from participation in, be denied benefits of, or be subjected to discrimination under any program or activity receiving federal financial assistance. In addition, Executive Order (EO) 12898, Federal Actions to Address Environmental Justice in Minority and Low-Income Populations signed by President Clinton on February 11, 1994, requires that "each federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations (59 Fed Reg. 7629)."

The following includes a summary of guidance and orders that the lead federal agencies for the SEIS are subject to, beyond Title VI and EO 12898, which were used to guide the EJ analysis for this SEIS:

- **Environmental Justice Guidance under the National Environmental Policy Act (NEPA) (Council on Environmental Quality [CEQ] 1997) -** Establishes guidance to assist federal agencies in effectively integrating the issue of EJ into their project development procedures.
- **Updated Final Order on Environmental Justice, 5610.2(a) (US Department of Transportation [USDOT] May 2012) -** Provides detailed procedures for identifying EJ populations and for determining disproportionately high and adverse effects to the targeted populations. It sets forth steps to prevent disproportionately high and adverse effects to minority or low-income populations through Title VI analyses and EJ analyses conducted as part of federal transportation planning and NEPA provisions. It also describes the specific measures to be taken to address instances of disproportionately high and adverse effects.
- **FHWA Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, Order 6640.23A (FHWA June 2012a) -** Establishes policies and procedures for the FHWA to use in complying with and incorporating EO 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, into any plans, projects, and activities receiving support from the FHWA.
- **FHWA Memorandum, Guidance on Environmental Justice and NEPA (December 2011a) -** Supplement to FHWA Technical Advisory 6640.8A, this guidance advises FHWA offices on the process to address EJ during NEPA review, including documentation requirements.

3.2.1.2.1 Minority Populations

According to FHWA Order 6640.23A, *FHWA Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, and for the purposes of this analysis, minority populations are comprised of members of the following population groups:

- Black or African American: a person having origins in any of the black racial groups of Africa;
- Hispanic or Latino: a person of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin, regardless of race;
- Asian American: a person having origins in any of the original peoples of the Far East, Southeast Asia, or the Indian subcontinent;

- American Indian or Alaskan Native: a person having origins in any of the original people of North America or South America (including Central America), and who maintains cultural identification through tribal affiliation or community recognition; or
- Native Hawaiian or Other Pacific Islander: a person having origins in any of the original peoples of Hawaii, Guam, Samoa, or other Pacific Islands.

Furthermore, FHWA 6640.23A provides the following definition of a minority population:

- Minority Population: 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 will be similarly affected by a proposed FHWA program, policy, or activity.

In accordance with the terms of the CEQ guidance, *Environmental Justice Guidance under the National Environmental Policy Act* (1997), an area is identified as containing a minority population where either (a) the minority population of the affected area exceeds 50 percent of total population; or, (b) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographical analysis. The CEQ guidance does not define the specific percentage that should be used for determining if the minority or low-income population is "meaningfully greater" than the average in the surrounding jurisdiction. For the purposes of this SEIS, the minority population for each census block was found to be "meaningfully greater" than the surrounding census blocks if it was greater than the value of the jurisdiction with the lowest percentage of minority population, plus an additional 10 percent of that value (i.e., 110 percent). Using the jurisdiction with the lowest percentage of minority population yields the highest number of census blocks considered minority populations versus using the jurisdictional average of the study area or the statewide average.

To perform an EJ analysis, Census data were collected on the racial and ethnic composition for each of the local jurisdictions and the 3,643 census blocks within and adjoining the project study area. Delineated by the Census, census blocks are generally small statistical areas bounded by visible features, such as streets, roads, streams, and railroad tracks, or by nonvisible boundaries such as selected property lines and city or county limits. Specifically, U.S. Census Bureau 2010 Summary File 1 (SF1) 100 Percent Data, Race Alone or in Combination and Hispanic or Latino, was used for the purposes of identifying minority populations within the study area (this is the latest 100 percent decennial Census survey data available). Individual properties were not contacted regarding potential relocations; therefore, it was not feasible to determine the specific ethnicities. The racial characteristics of these residents were estimated based on information obtained from the 2010 Census, which was later confirmed to be an accurate representation of the population by local planners from each jurisdiction.

3.2.1.2.2 Low-Income Populations

In accordance with the terms of FHWA 6640.23A and USDOT Order 5610.2(a), low-income persons include any persons whose median household income is at or below the Department of Health and Human Services (HHS) poverty guidelines (FHWA, 2012). Furthermore, FHWA Order 6640.23A defines low-income populations as follows:

- 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 will be similarly affected by a proposed FHWA program, policy, or activity.

Household median income census data, used for comparison with the national poverty guidelines, are available only at the block group level in ACS 5-year estimate format. As such, 2010-2014 ACS 5-Year Estimates, *Median Income in the Past 12 Months (in 2014 Inflation-Adjusted Dollars)*, were used to generate median household income data for each of the localities within the study area. As set forth in EO 12898, an area is identified as containing a low-income population when the median household income for the area is below the HHS poverty threshold, which was $23,850 for a family of four in 2014. Since the average household size of the counties and city range between 2.19 and 2.92, a family of four was used as the threshold to be conservative.

3.2.1.3 Economic Environment

The economic environment for the Route 460 study area includes a baseline of present and/or planned conditions. Economic data from secondary sources are presented at the city and county levels and information for Virginia is provided as a measure for comparison. Employment trends were provided by the U.S. Bureau of Economic Analysis (BEA) and reflect total full and part time employment from 1980 to 2010. Journey to work data, provided by the Census, indicates the level and location of commuter travel patterns. Journey to work data is available only in the ACS 5-Year Estimate format. As such, 2009-2013 ACS 5-Year Estimates, *County to County Commuting Flows for the United States and Puerto Rico*, was used to indicate the level and direction of commuter travel patterns for localities within the study area (this is the latest journey to work data available).

3.2.1.4 Right-of-Way and Relocations

Relocations were determined based on aerial photography, Google Earth, Google Street View, and GIS analysis. A relocation was determined to occur when a parcel's primary structure or structures (i.e., house, business, farm, or non-profit organization) were within the right-of-way of the Design Corridor or where access to a parcel would be removed and would not be restored. The procedures used to produce relocation data meet the guidelines of the VDOT Manual of Instructions, Right-of-Way Division, Volumes I and II (VDOT, 2011). A comprehensive explanation of the methodology and a detailed breakdown of relocation impacts for the FHWA/VDOT Preferred Alternative are provided within the ***Supplemental Right-of-Way and Relocations Technical Report*** (VDOT, 2016g).

Individual households, businesses, farms, and non-profit organizations were not contacted regarding potential relocations; therefore, it was not feasible to determine the specific relocation needs of each potential relocation. Relocations have been summarized according to structure type and use. Classifications include:

- Residential;
- Business;
- Farm; and,
- Other (non-profit, church, utility, civic, school, government, etc.).

Right-of-way acquisitions include total and partial property takes and are defined for this study as follows:

- *Total Take*: A total take occurs when the primary improvement (a housing structure, business, non-profit, or farm) of a property is within the right-of-way. The owner is compensated for the fair market value of the entire parcel and provided relocation assistance.
- *Partial Take*: A partial take occurs when a portion of a parcel is acquired and that portion does not include a primary improvement. The owner is compensated for the fair market value of the portion of their parcel and minor improvements that would be acquired.

Additionally, wherever a partial take would create uneconomic remnants of the remaining parcel, the owner would be compensated for the fair market value of their entire parcel and may be provided relocation assistance.

3.2.1.5 Community Impact Assessment

For the purposes of this analysis, community boundaries were defined using incorporated town limits, physical barriers, land use patterns, resident perceptions, and discussions with local agency staff members. Recreational areas and community facilities that service each community were identified through a review of data provided by local agencies, discussions with local agency staff members, GIS analysis, and field verification. **Figure 3.2-1** identifies the community boundaries as they are defined for this analysis.

Evaluation methods to identify potential changes to social interaction and stability include site analysis, mapping overlays, and field review, as well as first-hand information provided during public involvement and information gathering meetings. Using project-specific GIS, the relocations of residential, commercial, farm, and non-profit facilities were displayed relative to the communities as a whole. This format allowed for an assessment of the potential magnitude of change in community cohesion while providing a summary of the potential benefits and adverse impacts to residents within the study area. As guided by FHWA's *Community Impacts Assessment: A Quick Reference for Transportation*, the following factors were used to determine direct community impacts that may affect community cohesion:

- Relocations: A GIS-based analysis was completed to identify where the FHWA/VDOT Preferred Alternative would displace residents, businesses, farms, and community facilities within each community/neighborhood. The effects of their potential removal from the community were also addressed. A detailed breakdown of relocation impacts is provided within the ***Supplemental Right-of-Way and Relocations Technical Report*** (VDOT, 2016g).
- Visual Quality: A visual impact assessment was conducted to establish the existing visual environment of the area and assess the potential impacts to the area's visual resources. The visual context of each resource was determined and served to establish whether the resource was considered visually unique, distinctive, common, or intrusive.
- Noise Impacts: The number of residences, churches, or schools with potential noise impacts within a community or neighborhood was identified for the FHWA/VDOT Preferred Alternative. The potential noise impacts of the FHWA/VDOT Preferred Alternative were assessed in accordance with FHWA and VDOT guidelines. To determine the degree of impact of highway traffic noise on human activity, the Noise Abatement Criteria (NAC) established by FHWA regulations were used. Per FHWA, noise impact occurs when the predicted noise levels in the project area "approach or exceed" the NAC during the loudest hour of the day under the future design year build condition. Noise impact also occurs when predicted noise levels substantially exceed existing noise levels by an increase of 10 decibels or more. Noise impacts of the FHWA/VDOT Preferred Alternative are

divided into four land use categories based on the primary activity that occurs on the property; these include Category B (residential), Category C (recreational lands, parks, and cemeteries), Category D (interior), and Category E (commercial). Category D, Interior, consists of schools, church buildings, and facilities with similar uses where interior noise impacts are anticipated.

- Travel Patterns and Accessibility: In general, accessibility and mobility measure the relative ease with which desired destinations can be reached. GIS analysis was used to evaluate the spatial relationship of access for basic services for residents within the study area based on access changes. These impacts are discussed as a function of placement of interchanges/intersection ramps. Types of mobility assessed include vehicular (private and commercial), school buses, pedestrian, and bicycle.

3.2.2 Affected Environment

This section describes existing population and demographic trends that have been identified within and immediately adjacent to the Route 460 study area. The descriptions that follow provide specific detail on population trends, ethnicity and income characteristics, communities, and public facilities that may be affected by the improvements to Route 460.

3.2.2.1 Population

Table 3.2-1 provides population data from the 2010 Census for the study area. There are over 52,000 residents within the study area. Nearly 60 percent of the study area residents live within Isle of Wight and Prince George Counties, the jurisdictions with the highest number of residents in the study area. The City of Suffolk has the largest population of the jurisdictions within the study area; however, only a relatively small portion of Suffolk is located within the study area limits. Thus, Suffolk residents account for nearly 19 percent of the study area population. The smallest percentage of study area residents live within the counties of Surry (7 percent) and Southampton (3 percent).

Table 3.2-1: Population for the Study Area and Jurisdictions Represented by the Study Area

Jurisdiction or Sub-Jurisdiction	Study Area Population	Percent of Study Area Population	Jurisdiction Total Population	Percent of Study Area Population within Jurisdiction
Prince George County	16,658	32%	35,725	47%
Sussex County	6,125	12%	12,087	51%
Wakefield[1]	927[1]	2%	927[1]	100%
Waverly[1]	2,149[1]	4%	2,149[1]	100%
Surry County	3,651	7%	7,058	52%
Southampton County	1,785	3%	18,570	10%
Ivor[2]	339[2]	1%	339[2]	100%
Isle of Wight	14,469	28%	35,270	41%
Windsor[3]	2,626[3]	5%	2,626[3]	100%
City of Suffolk	9,931	19%	84,585	12%
Study Area/Jurisdictional Total	52,619	100%	193,295	24%

Source: U.S. Census Bureau, Census 2010.

[1]Included in Sussex County population; [2]Included in Southampton County population; [3]Included in Isle of Wight County population.

Table 3.2-2 presents the breakdown of age groups in the study area. Persons between the ages of 45 and 64 comprise the largest percentage of the study area population. With almost 17,000 residents, they represent about 32 percent of the study area population. The proportion of persons between the ages of 45 and 64 is higher than that of Virginia, which is 27 percent. Persons under the age of 18 are the second

largest group, representing 22 percent of the study area. Age distribution in each jurisdiction within the study area is similar to the overall distribution for the study area.

Table 3.2-2: Population Age of the Study Area

Jurisdiction	Under 18	18-24	25-34	35-44	45-64	65 and Over	Total
Study Area	11,774	4,107	5,537	6,919	16,753	7,529	52,619
Percent of Total Study Area Population	22%	8%	11%	13%	32%	14%	100%
Virginia	1,853,677	802,099	1,090,419	1,108,928	2,168,964	976,937	8,001,024
Percent of Total Virginia Population	23%	10%	14%	14%	27%	12 %	100%

Source: U.S. Census Bureau, Census 2010

3.2.2.2 Racial and Ethnic Characteristics

Table 3.2-3 provides a summary of racial and minority characteristics for the jurisdictions within the Route 460 study area. White is the largest racial group for Prince George, Surry, Southampton, and Isle of Wight Counties, as well as for the City of Suffolk. Black/African American is the largest racial group in Sussex. Hispanic or Latino persons comprise three percent of the study area population, and Asians, one percent.

Table 3.2-3: Study Area Racial and Ethnic Characteristics

Charac-teristics	Total Population in Study Area	White[1]	Black or African American[1]	American Indian and Alaska Native[1]	Asian [1]	Hawaiian, Other Pacific Islander[1]	Other Race[1]	Two or more races[1]	Hispanic or Latino[2]
Prince George County	16,658	11,238 (67.5%)	4,446 (26.7%	92 (0.6%)	245 (1.5%)	24 (0.1%)	195 (1.2%)	418 (2.5%)	708 (4.3%)
Sussex County	6,125	2,229 (36.4%)	3,680 (60.1%)	5 (0.1%)	33 (0.5%)	0 (0%)	130 (2.1%)	48 (0.8%)	168 (2.7%)
Surry County	3,651	1,910 (52.3%)	1,657 (45.4%)	8 (0.2%)	8 (0.2%)	0 (0%)	15 (0.4%)	53 (1.5%)	42 (1.2%)
Southampton County	1,785	1,249 (70.0%)	480 (26.9%)	4 (0.2%)	12 (0.7%)	0 (0%)	7 (0.4%)	33 (1.8%)	20 (1.1%)
Isle Wight County	14,469	9,622 (66.5%)	4,428 (30.6%)	51 (0.4%)	76 (0.5%)	2 (0.0%)	79 (0.5%)	211 (1.5%)	214 (1.5%)
City of Suffolk	9,931	6,773 (68.2%)	2,729 (27.5%)	28 (0.3%)	121 (1.2%)	2 (0.0%)	73 (0.7%)	205 (2.1%)	273 (2.7%)
Study Area Total	52,619	33,021 (62.8%)	17,420 (33.1%)	188 (0.4%)	495 (0.9%)	28 (0.1%)	499 (0.9%)	968 (1.8%)	1,425 (2.7%)

Source: U.S. Census Bureau, Census 2010

[1] Regardless of Hispanic/Latino designation

[2] The U.S. Census Bureau defines Hispanic or Latino as a person of Mexican, Puerto Rican, Cuban, South or Central American, or other Spanish culture or origin, regardless of race. Because Hispanic or Latino may be any race, data may overlap for other race categories.

The 2010 Census defines "minorities" as all but the non-Hispanic white population. In Virginia, minorities comprise approximately 31 percent of the total population. Within the study area, minorities account for approximately 37 percent of the population. Although this number is higher than the statewide percentage, it is lower than the minority percentage of the jurisdiction total population for the study area communities,

at 48 percent. Among minorities, Black/African Americans are the most prevalent group, comprising approximately 33 percent of the study area population.

Figure 3.2-2 illustrates the distribution of minorities at the census block level as they are found throughout the study area. Along Route 460 in the study area, the largest percentage of minority residents is located generally north and south of the existing Route 460, north and south of Waverly, north of Ivor, north and west of Wakefield, along the northern perimeter of the study area, and along Routes 40, 31, and 258, which run vertically through the study area. As noted in **Table 3.2-4,** the Towns of Waverly and Wakefield have the highest concentration of minorities (containing 70 percent and 53 percent, respectively). Almost all of the minorities in these towns are Black/African American (1,392 of the 1,498 persons within Waverly; 470 of 494 in Wakefield).

Table 3.2-4: Minority Populations within the Study Area Portion of Jurisdictions

Jurisdiction or Sub-Jurisdiction	Total Population	White Non-Hispanic	Minority[1]	Percent Minority
Prince George County	16,658	11,238	5,420	33%
Sussex County	6,125	2,229	3,896	64%
Wakefield[2]	927	433	494	53%
Waverly[2]	2,149	651	1,498	70%
Surry County	3,651	1,910	1,741	48%
Southampton County	1,785	1,249	536	30%
Ivor[3]	339	280	59	17%
Isle of Wight	14,469	9,622	4,847	34%
Windsor[4]	2,626	1,943	683	26%
City of Suffolk	9,931	6,773	3,158	32%
Study Area Total	52,619	33,021	19,598	37%
Virginia	8,001,024	5,486,852	2,514,172	31%

Source: U.S. Census Bureau, Census 2010
[1] Total minority is the sum of all persons other than white-non-Hispanic. Hispanics may be of any race. [2] Included in Sussex County population. [3] Included in Southampton County population. [4] Included in Isle of Wight County population.

3.2.2.3 Income Characteristics

Table 3.2-5 presents median household income and poverty level rates within the study area and study area jurisdictions (Census, 2014c). Census data were extracted for Virginia as a whole to serve as a measure for comparison.

Table 3.2-5: Poverty Characteristics for the Study Area

Jurisdiction	Median Household Income	Persons for Whom Poverty Level is Determined[1]	People Below Poverty Level	Percent of People Below Poverty Level
Virginia	$64,792	7,939,332	914,237	12%
Jurisdictions Total	$55,332	183,146	21,505	12%
Study Area Total	$61,024[2]	37,323	4,121	11%

Source: U.S. Census Bureau, ACS 5-Year Estimates, Median Income in the Past 12 Months: 2010-2014 (in 2014 inflation adjusted dollars)
[1]Poverty status is determined for all people except institutionalized people, people in military group quarters, people in college dormitories, and unrelated individuals under 15 years old.; [2]Averaged across block groups within study area.

The study area's poverty ratio is slightly lower than Virginia's. The median household income within the study area is $61,024, which is $3,768 lower than that of Virginia, at $64,792. When compared to Virginia, the jurisdictions within the study area have the same percentage of people below the poverty level (12 percent), while the study area as a whole has a slightly lower level at 11 percent. The jurisdictions within the study area that exceed the statewide low-income population percentage of 12 percent are the County of Southampton (15 percent) and Sussex (22 percent).

3.2.2.4 Environmental Justice

3.2.2.4.1 Minority Populations

Of the jurisdictions that lie within the overall study area, the locality with the lowest percentage of minority population is Isle of Wight County, with a minority population of 28.2 percent as indicated in **Table 3.2-6.** The minority population value of Isle of Wight County (28.2), plus an additional 10 percent of that value (2.8), establishes a "meaningfully greater" threshold of 31.0 percent.

Of the total census blocks within the study area, 685 contain a minority population equal to or greater than the 31.0 percent threshold. As such, these 685 census blocks are considered minority populations for the purposes of this analysis.

Table 3.2-6: Study Area Jurisdictional Demographics

Locality	Population	White	Total Minority	Percent Minority
Prince George	35,725	21,845	13,880	38.9%
Sussex	12,087	4,747	7,340	60.7%
Surry	7,058	3,618	3,440	48.7%
Southampton	18,570	11,215	7,355	39.6%
Isle of Wight	35,270	25,318	9,952	28.2%
City of Suffolk	84,585	44,197	40,388	47.7%
Virginia	8,001,024	5,486,852	2,514,172	31.4%

Source: U.S. Census Bureau, Census 2010.

3.2.2.4.2 Low-Income Populations

The 2014 HHS poverty guidelines for most states, including Virginia, were published in the Federal Register on January 24, 2014, and are identified in **Table 3.2-7**. While the 2016 HHS poverty threshold data is available, the 2014 dataset is the appropriate dataset for a comparison with the Census's Median Household Income data in 2014 Inflation-Adjusted Dollars. **Table 3.2-8** identifies the median household income for each census block group within and adjoining the study area. Census data were also extracted for each jurisdiction and Virginia as a whole to serve as a measure of comparison. Initial census data findings were confirmed to be an accurate representation of general income characteristics by local planners from each jurisdiction.

Table 3.2-7: 2014 Poverty Guidelines for the 48 Contiguous States and the District of Columbia

Persons in family/household	Poverty Guideline
1	$11,170
2	$15,130
3	$19,090
4	$23,050

Persons in family/household	Poverty Guideline
5	$27,010
6	$30,970
7	$34,930
8	$38,890

Source: U.S. Department of Health and Human Services 2014 Poverty Guidelines

Table 3.2-8: Median Household Income by Census Block Group

Locality		Median Household Income
Virginia		$64,7920
Prince George		$61,071
Census Tract 8504	Block Group 2	$81,402
	Block Group 3	$108,375
	Block Group 4	$53,536
Census Tract 8505.01	Block Group 1	$85,948
	Block Group 3	$65,724
Census Tract 8505.02	Block Group 1	$61,711
	Block Group 2	$49,055
Sussex		$36,972
Census Tract 8702.01	Block Group 1	$55,658
Census Tract 8703	Block Group 1	$17,500
	Block Group 2	$27,917
	Block Group 3	$39,500
Census Tract 8704	Block Group 1	$31,250
	Block Group 2	$36,484
Surry		$51,527
Census Tract 8602	Block Group 2	$65,221
	Block Group 4	$38,983
Southampton		$49,690
Census Tract 2001	Block Group 1	$59,063
Isle of Wight		$65,910
Census Tract 2803	Block Group 1	$56,420
	Block Group 2	$43,274
	Block Group 3	$62,250
Suffolk		$66,822
Census Tract 754.01	Block Group 1	$72,604
	Block Group 2	$36,603
Census Tract 754.02	Block Group 1	$69,639
Census Tract 754.03	Block Group 1	$70,801
	Block Group 2	$109,191
Census Tract 754.04	Block Group 1	$78,235
Census Tract 754.05	Block Group 2	$65,750
	Block Group 3	$105,543

Source: U.S. Census Bureau, ACS 5-Year Estimates, Median Income in the Past 12 Months: 2010-2014

As indicated above, one of the census block groups within or adjoining the study area has a median household income below the HHS poverty threshold at $23,850 for a family of four in 2014. Census Tract 8703, Block Group 1 in Sussex County has a median income of $17,500.

3.2.2.5 Housing

Table 3.2-9 presents selected housing data for the Route 460 study area and Virginia. Virginia has a housing ownership rate of 61 percent and a renter occupied rate of 30 percent. The remaining nine percent of the population includes institutionalized persons, residents on military group quarters, and residents of dormitories/group quarters. The study area jurisdictions, in comparison, have a higher home ownership rate than Virginia with almost 75 percent of the housing units being owner-occupied. Surry, Prince George, and Isle of Wight Counties lead the study area with 86 percent, 80 percent, and 76 percent, respectively. The only study area jurisdiction with a rate below Virginia's is Sussex County with 55 percent ownership.

Table 3.2-9: Study Area Housing Data – Occupancy

Jurisdiction or Sub-Jurisdiction	Total Housing Units	Owner Occupied	Percent of Owner Occupied	Renter Occupied	Percent of Renter Occupied
Prince George County	6,569	5,225	80%	1,008	15%
Sussex County	2,248	1,242	55%	315	14%
Wakefield	455	255	56%	133	29%
Waverly	936	524	56%	300	32%
Surry County	1,659	1,426	86%	246	15%
Southampton County	794	555	70%	161	20%
Ivor	156	103	66%	33	21%
Isle of Wight County	5,959	4,554	76%	1,067	18%
Windsor	1,059	784	74%	231	22%
City of Suffolk	4,018	2,829	70%	941	23%
Jurisdictions Total	21,247	15,831	75%	3,738	18%
Virginia	3,364,939	2,055,186	61%	1,000,872	30%

Source: U.S. Census Bureau, Census 2010

3.2.2.6 Communities

Communities consist of people living in a close geographic boundary to one another, which may culminate in a shared sense of identity, common membership in a group or organization, psychological unity among citizens, social stability, or the common use of facilities or services in an area (Florida Department of Transportation, 2000). Seven principal communities are located along Route 460 in the study area. From the western end of the study area, these communities include Disputanta, Waverly, Wakefield, Ivor, Zuni, Windsor, and a relatively small portion of the City of Suffolk (Kings Fork area). Many of these communities developed initially through the construction of the Norfolk and Petersburg Railroad, which was completed in 1858. Further enhanced development occurred with the construction of Route 460 parallel to the railroad in the 1930s.

Today the communities along Route 460 consist of a combination of residences and businesses typically found within communities, providing such services as gas stations, restaurants, local tourist attractions, grocery stores, and healthcare. Non-profit and local government facilities, including churches, schools, libraries, and community centers, also exist within and serve the communities along Route 460.

3.2.2.7 Public Facilities and Public/Private Institutions

The study area contains a large number of religious facilities and public schools, as well as two vocational schools (Crater Criminal Justice Academy and the Pruden Center) and a post-secondary school (the Hobb-Suffolk campus of Paul D. Camp Community College). There are three correctional facilities in the study area: the Petersburg Jail Farm, the Crater Juvenile Detention Home in Prince George County, and the Sussex State Prison in Sussex. Three library systems serve the study area, providing a total of seven libraries: the Chuckatuck Library of the Suffolk Public Library System; the Blackwater Regional Library of Wakefield, the Blackwater Regional Library of Waverly, and the Blackwater Regional Library of Windsor, of the Blackwater Regional Library System; and the Burrowsville Community Center and Library, the Disputanta Community Center and Public Library, and the Prince George County Library of the Appomattox Regional Library System.

Several jurisdictions contain municipal government buildings and circuit courts within the study area. Additionally, the Virginia State Police (Waverly), the Virginia Department of Forestry (Waverly), the Virginia Department of Agricultural and Consumer Services (Ivor), the Virginia Association of Soil and Water Conservation District (Suffolk), and the National Weather Service Forecast Office (Wakefield) have offices located in the study area.

3.2.2.8 Economic Setting

Employment within the study area is largely dependent on the timbering and agricultural businesses. Between 2006 and 2011, Virginia's forest products industry was particularly hard hit, losing over 19,000 jobs. The severe recession between 2007 and 2009, along with the housing market downturn, resulted in the rapid contraction in demand for wood products used in housing construction, furniture, and related products. The pulp and paper industry also has been affected by the general state of the economy and also faces reduced demand for its products because of the growth in electronic media. The result of these forces is a smaller forest products industry that is much leaner and more efficient (Weldon Cooper, 2013). The farming industry has faced similar pressure from international competition and from domestic competition from larger farms. These downturns have resulted in reduced impacts to the natural environment and a loss of jobs, investment, and population in the region. In addition, long- and short-haul distribution has been an expanding industry within the study area due to the proximity of Route 460 to the Virginia Port Authority.

As mentioned above in **Section 3.2.2.6**, a variety of businesses are located along Route 460 and within each of the seven communities in the study area. These businesses provide services to local residents and through-traffic, employment opportunities for local residents, and tax revenue for their respective jurisdictions.

Between 33 and 47 percent of residents within study area jurisdictions work within the same county as they reside (Census, 2013). As noted in **Table 3.2-10** Sussex County has the lowest out-commuting ratio and Surry County has the highest.

Table 3.2-10: Journey to Work for Study Area Jurisdictions

Residence County	Percent who Work within Residence County	Out-Commute Destination and Percent
Prince George County	45%	1. City of Petersburg (12%) 2. Chesterfield County (11%) 3. City of Hopewell (10%)
Sussex County	47%	1. Prince George County (9%) 2. City of Petersburg (8%) 3. Dinwiddie County (5%)
Surry County	32%	1. Isle of Wight County (13%) 2. Sussex County (9%) 3. James City County and City of Newport News (6%)
Southampton County	33%	1. City of Franklin (23%) 2. Isle of Wight County (8%) 3. City of Suffolk (7%)
Isle of Wight County	33%	1. City of Newport News (20%) 2. City of Suffolk (12%) 3. City of Norfolk (7%)
City of Suffolk	36%	1. City of Norfolk (15%) 2. City of Chesapeake (13%) 3. City of Portsmouth (11%)

Source: U.S. Census Bureau, 2009-2013 ACS 5-Year Estimates, County to County Commuting Flows for the U.S. and Puerto Rico.

3.2.2.9 Travel Patterns and Mobility

Travel patterns within the study area consist of both through trips and local trips between and among the communities along Route 460. The private vehicle is the dominant form of travel as bicycle/pedestrian accommodations are limited to sidewalks within portions of Waverly and Windsor and there is no public transit. Within the study area, 94 percent of total commuters rely on a car, truck, or van, either alone or in carpool, as a means of transportation to work (Census, 2014b). Suffolk commuters account for 46 percent of personal vehicle commuters, the highest of the six jurisdictions, as identified in **Table 3.2-11**.

Table 3.2-11: Travel Patterns within the Study Area

County	Number of Personal Vehicle Commuters by County (Car/Truck/Van Alone or Carpool)	% of Study Area Personal Vehicle Commuters by County
Suffolk	37,677	46%
Southampton	7,769	10%
Isle of Wight	16,475	20%
Prince George	13,706	17%
Surry	2,969	4%
Sussex	2,621	3%
Study Area Total	81,217	100%

Source: U.S. Census Bureau, 2010-2014 ACS 5-Year Estimates, Selected Economic Characteristics.

Along existing Route 460 and other roadways throughout the study area, such as Route 40 and Route 258, motorists are able to access residences and businesses on either side of the road. Further removed from the existing Route 460 corridor, farm equipment and vehicles utilize rural roads and private drives to reach adjacent agricultural property.

3.2.3 Environmental Consequences

This section addresses direct social and economic impacts including relocations, community impacts, impacts to environmental justice populations, and economic impacts. Indirect and cumulative social and economic impacts are addressed in detail in **Chapter 4.0**.

3.2.3.1 No Build Alternative

Although small amounts of new right-of-way may be required for implementation of programmed improvements associated with the No Build Alternative, no major impacts to socioeconomic resources are anticipated; however, evaluation of the potential effects to socioeconomic resources may be required if any programmed improvement involve major new construction with federal funding. Potential effects resulting from any projects included within the No Build portion of the FHWA/VDOT Preferred Alternative will be identified and addressed by the respective project sponsors.

Under the No Build Alternative, travel patterns and access along the Route 460 corridor, and throughout the study area, are expected to remain similar to existing conditions; however, an increase in travel time and delays that could be expected. Additionally, approximately 142 residences and five sites associated with recreational areas/parks/cemeteries would experience noise impacts under the No Build Alternative along Route 460, due to increasing traffic volumes over time (see **Section 3.7: Noise** for further information regarding the noise analysis).

3.2.3.2 FHWA/VDOT Preferred Alternative

The FHWA/VDOT Preferred Alternative would consist of implementing the No Build Alternative between I-295 and one mile west of Zuni, upgrading the existing Route 460 between one mile west of Zuni and two miles west of Windsor, and constructing a new four-lane divided highway from west of Windsor to a new Route 460/Route 58 interchange in Suffolk.

*3.2.3.2.1 **Relocations***

Table 3.2-12 presents the number of households, businesses, farms, and other organizations that would be displaced under the FHWA/VDOT Preferred Alternative. These relocations are based on the Limit of Disturbance (LOD) as it is currently placed within the Inventory Corridor. The FHWA/VDOT Preferred Alternative would displace 21 households, six businesses, one farm, and one post office.

Table 3.2-12: Relocations by the FHWA/VDOT Preferred Alternative

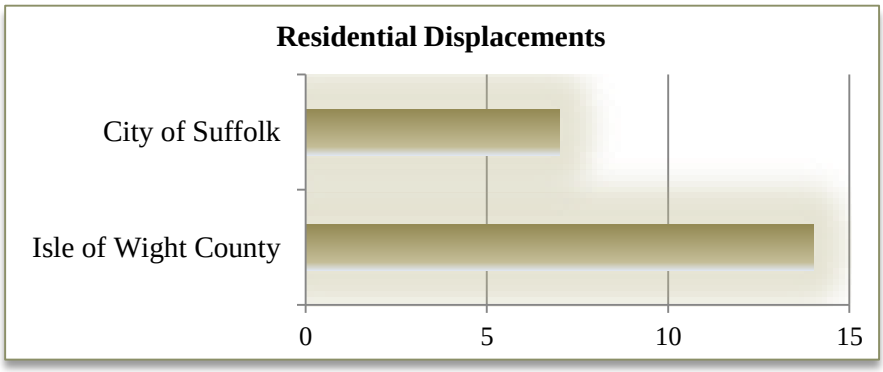
Number of Households Displaced	Number of Businesses Displaced	Number of Farms Displaced	Number of Other[1] Facilities Displaced	Total
21	6	1	1	29

[1] "Other" includes church, utility, civic, school, government, and other non-profit facilities.

Source: Rinker Design Associates, P.C.

Figure 3.2-3 depicts the potential residential relocations for the FHWA/VDOT Preferred Alternative by jurisdiction. The residential relocations would occur in Isle of Wight County and the City of Suffolk. VDOT is required to provide decent, safe, and sanitary replacement housing to all displaced households and guarantees that no displaced persons would be required to move until a comparable replacement dwelling is made available within their financial means. If comparable housing is not available, existing housing does not meet special needs, or the cost exceeds the benefit limit, VDOT is authorized to pursue a broad range of measures to make housing available.

Figure 3.2-3 Distribution of Residential Relocations by Jurisdiction for the FHWA/VDOT Preferred Alternative



3.2.3.2.2 Impacts to Communities

Direct social impacts can affect levels of social interaction and stability in communities and neighborhoods. Community impact assessments (CIAs) are processes used to evaluate the effects of a transportation action on the social fabric of community members and their quality of life (FHWA, 1996b). CIAs provide a way to incorporate community considerations into the planning and development of major transportation projects. Only when impacts to communities that may occur from transportation projects are assessed can disruption or division of stable and cohesive neighborhoods, damage to community character, or impediment of pedestrian mobility be avoided or minimized.

Three principal communities are located within the Inventory Corridor of the FHWA/VDOT Preferred Alternative: Zuni, Windsor, and a relatively small portion of the City of Suffolk (King's Fork area). Anticipated relocations, noise impacts, and visual impacts to each community resulting from the FHWA/VDOT Preferred Alternative are included in **Table 3.2-13**. Changes to visual quality and aesthetics, noise impacts, relocations, and changes in access patterns are discussed in the sections that follow.

Table 3.2-13: Relocations by the FHWA/VDOT Preferred Alternative

Community	Relocations				Noise	Visual
	Residential	Business	Farm	Non-Profit		
Zuni, Isle of Wight County	5	3	0	1	21	Moderate
Windsor, Isle of Wight County	0	0	0	0	15	Negligible
King's Fork, City of Suffolk	3	1	0	0	100	Moderate
Areas Outside of the Designated Communities*	13	2	1	0	N/A	N/A

* **Section 3.2.3.2.1** has a full discussion of the relocations along the entire alignment.

If the FHWA/VDOT Preferred Alternative is implemented, impacts related to visual quality and aesthetics, relocations, and access are not anticipated to occur in the communities west of Zuni. Anticipated community impacts in Zuni, Windsor, and King's Fork are summarized in the descriptions below:

Zuni, Isle of Wight County

- Visual Quality and Aesthetics: The FHWA/VDOT Preferred Alternative is anticipated to result in negligible changes in visual quality to Zuni. The roadway widening and the addition of sidewalks

and intersection medians will enlarge, but also modernize the corridor through downtown Zuni.

- Noise: Noise impacts are predicted to occur at 16 residences. The sound levels would increase between four and six dBA over existing conditions (generally a 5 dBA increase is a noticeable change). Due to the extent of driveways, noise barriers were not evaluated.
- Relocations: Five residential relocations, two business relocations, and a non-profit are anticipated in the Zuni community. The business relocations include a gas station and a retail store, each of which provide important services and goods to the community. One other facility, the post office, would be displaced in Zuni. The loss of a local post office may impact the community's sense of place, and ease of doing business; however it is possible that the post office would either be relocated on-site or elsewhere within the community. East of Zuni, two additional residences and one additional business along the Route 460 corridor would also be relocated.
- Access: The FHWA/VDOT Preferred Alternative would introduce an improved intersection at Route 644. Additionally, new sidewalks would be introduced throughout Zuni along both sides of the Route 460 corridor where currently none exist.

Windsor, Isle of Wight County

- Visual Quality and Aesthetics: The FHWA/VDOT Preferred Alternative is anticipated to result in negligible changes in visual quality for Windsor because it will be on a new bypass located north of the community.
- Noise: Noise impacts are predicted to occur at 27 residences. Impacts are associated with the new alignment being located adjacent to receptors that currently have very low noise levels. The increases range from 17 to 26 dBA over existing conditions, especially at the residences closest to the new alignment (generally an increase of 10 dBA would be twice as loud as existing conditions, an increase of 20 dBA would be four times as loud as existing conditions, and an increase of 30 dBA would be eight times as loud as existing conditions). A noise barrier was evaluated for a portion of this area; however it was found to not be reasonable based upon the cost per benefited receptor.
- Relocations: No relocations are anticipated within Windsor because the new Route 460 would bypass Windsor to the north. Outside of Windsor's limits, but within the LOD of the FHWA/VDOT Preferred Alternative, eight residential units and one business would be relocated. These relocations are dispersed along the bypass alignment north of Windsor.
- Access: Access within Windsor would not change; there would be no new interchanges/intersections within Windsor.

King's Fork, City of Suffolk

- Visual Quality and Aesthetics: Moderate changes to visual quality are anticipated, within the viewshed that includes King's Fork Community House and open farmland views.

  Noise: Noise impacts are predicted to occur at 32 residences, five athletic fields associated with Nansemond Suffolk Academy and one recreational area associated with Liberty Baptist Church. Impacts to 14 of the residences and the athletic fields are associated with the new alignment being located adjacent to receptors that currently have very low noise levels, with increases in sound levels ranging from 12 to 31 dBA over existing conditions. Four noise barriers were assessed for this area but only the two barriers that would protect the athletic fields were found to be reasonable. The impacts to the remaining 18 residences and the recreational area are associated with the existing alignment. These receptors already experience sound levels above the criteria; therefore they are considered to be impacted even though the FHWA/VDOT Preferred Alternative is not predicted to

cause an increase in sound levels. A noise barrier was evaluated for this area and was determined to be reasonable.

- Relocations: Within King's Fork, three residential units and one farm-related business (a milling operation) would be displaced. West of the King's Fork community, three additional residences, one additional agriculture-related business, and one farm would be relocated.
- Access: With the exception of the eastern project terminus at the interchange of Route 58 and existing Route 460, no additional access would be provided through the King's Fork community.

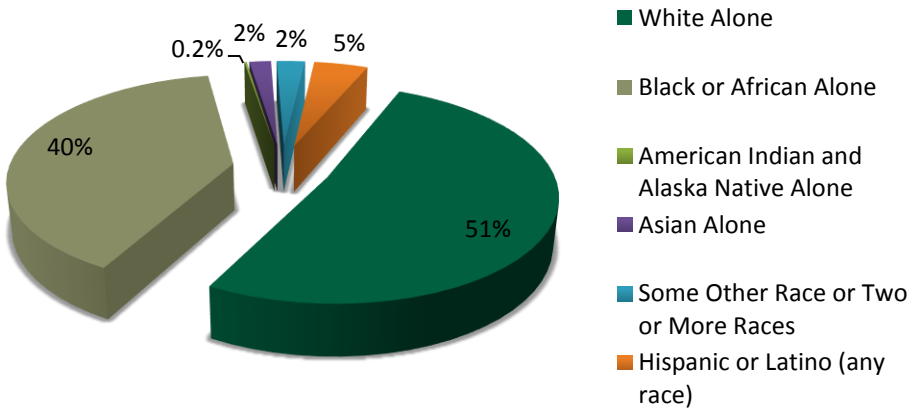
3.2.3.2.3 Environmental Justice

The study area, for the purposes of this discussion, consists of the LOD of the FHWA/VDOT Preferred Alternative. **Table 3.2-14** and **Figure 3.2–4** present the demographic makeup of the census blocks fully or partially within the LOD of the FHWA/VDOT Preferred Alternative.

Table 3.2-14: Demographics of the Census Blocks within the LOD of the FHWA/VDOT Preferred Alternative

Demographic Measure	Preferred Alternative
Total Population	3,111
White Alone	1,601
Black or African Alone	1,230
American Indian and Alaska Native Alone	6
Asian Alone	57
Native Hawaiian and Other Pacific Islander Alone	0
Some Other Race Alone	4
Two or More Races	71
Hispanic or Latino (any race)	142
Percent Minority	49%

Figure 3.2-4: Demographics of the Census Blocks within the LOD of the FHWA/VDOT Preferred Alternative



Of the 79 census blocks within the LOD of the FHWA/VDOT Preferred Alternative, ten census blocks contain minority populations equal to or in exceedance of the 31.0 percent threshold discussed in **Section 3.2.2.4**. These census blocks are located in the corridor between Zuni and Windsor, along the Windsor bypass, and at the Eastern Terminus. The total number of parcels within all of the census blocks is 785;

428 parcels are within the census blocks with minority populations (55 percent), and 357 parcels are within the census blocks with non-minority populations (45 percent). No census blocks with an average median income lower than the poverty guidelines are within the LOD of the FHWA/VDOT Preferred Alternative; therefore, disproportionate impacts to low income populations were not assessed; although mitigation measures for low income households are discussed.

The impact analysis for minority populations parallels the Impacts to Communities assessment discussed in **Section 3.2.3.2.2**. The impacts to census blocks with minority populations above the 31.0 threshold were compared to the impacts to non-minority populations (those below the 31.0 threshold) to determine if they would be burdened with disproportionately high and adverse impacts.

Visual Quality and Aesthetics

The FHWA/VDOT Preferred Alternative is anticipated to result in negligible changes in the visual quality along the existing Route 460 alignment. The roadway widening and intersection medians will enlarge, but also modernize the corridor between Windsor and Zuni. Moderate changes to visual quality are anticipated along the bypass of Windsor due to the addition of the new roadway element. The portion of the Eastern Terminus within the census blocks with minority populations would have negligible changes as they are located above the connection of Route 460 to the Eastern Terminus. The majority of the bypass would affect non-minority parcels; therefore, the impacts to minority populations would not be disproportionate.

Noise

Noise impacts within census blocks with minority populations are predicted to occur at the following four general locations, impacting 106 residences and the recreational area that is part of the Elephant's Fork Elementary School.

- The sound levels in the area along existing Route 460, in the vicinity of Ecella Road, would remain the same or increase up to 3 dBA over existing conditions, causing noise impacts to 13 residences. This area already experiences levels near or above the noise impact threshold due to the proximity to Route 460. Due to driveways, noise barriers were not evaluated for the entire area. Two barriers were evaluated to benefit the receptors along Ecella Road; however they were found to not be reasonable.
- The sound levels in the area along Route 603 (Shiloh Drive) would increase between 12 and 26 dBA due to the construction of the new roadway in an area that previously had low noise levels, causing noise impacts to 16 residences. Two noise barriers were evaluated; however they were determined to not be reasonable due to the low density of the residences.
- The sound levels in the area along existing Route 460, west of the Eastern Terminus would decrease slightly; however since this area already experiences levels above the noise impact threshold, one residence is considered to be impacted. Due to access restraint issues, a noise barrier was not evaluated.
- The sound levels in the area near the Eastern Terminus would remain the same/decrease slightly or increase up to 3 dBA, causing impacts to 76 residences and the recreational area that is part of the Elephant's Fork Elementary School. This area already experiences levels near or above the noise impact threshold due to the proximity to Routes 58 and 460. Three noise barriers were evaluated and were determined to be feasible and reasonable, benefiting all of the impacted receptors.

A total of 236 residences, and three recreational areas would be impacted by the FHWA/VDOT Preferred Alternative. Five noise barriers are recommended, three of which would be located within the census blocks

with minority populations. With the incorporation of noise barriers, census blocks with minority populations would have 36 remaining noise impacts (23 percent of the remaining impacts); while census blocks with non-minority populations would have 124 remaining noise impacts (77 percent of the remaining impacts). Since 55 percent of the parcels are within census blocks containing minority populations equal to or in exceedance of the 31.0 percent threshold, receiving 23 percent of the noise impacts would not be disproportionately high.

Relocations

Relocation information was obtained from the ***Supplemental Right-of-Way and Relocations Technical Report*** (VDOT, 2016g). Contact was not made with local citizens to determine such factors as population per household, minority status, owner/renter status, or income. Rather, relocations within Census blocks with a minority population equal to or greater than the 31.0 percent threshold, discussed in **Section 3.2.2.4**, were considered to impact a minority population. **Table 3.2-15** compares the number of parcels and relocations within minority census blocks within the LOD of the FHWA/VDOT Preferred Alternative to those within non-minority census blocks. The construction of the FHWA/VDOT Preferred Alternative would result in a total of 29 relocations, six of the which (approximately 21 percent of the total) would be in census blocks containing minority populations equal to or in exceedance of the 31.0 percent threshold. The relocations would consist of five residences and one business – two residences and a business along Route 460, west of the new Route 460 and existing Route 460 intersection; two residences along Shiloh Drive, to accommodate the bypass; and one residence east of Route 58, to accommodate the intersection of Route 460 and the Eastern Terminus. A greater percentage of parcels within non-minority census blocks (6 percent) are proposed for relocation than parcels within minority census blocks (one percent). Therefore, the relocations associated with the construction of the FHWA/VDOT Preferred Alternative would not have disproportionately high or adverse effects on minority populations.

Table 3.2-15: Relocations within Census Blocks with Minority Populations

Total Number of Parcels within Minority Population Census Blocks	Number of Relocations within Minority Census Blocks	Percent of Parcels Displaced within Minority Population Census Blocks*	Total Number of Parcels within Non-Minority Population Census Blocks	Number of Relocations within a Non-Minority Census Blocks Population	Percent of Parcels Displaced within Non-Minority Population Census Blocks*
428	6	1%	357	23	6%

*Totals include both minority and non-minority relocations within a minority population census block.

Source: U.S. Census Bureau, Census 2010, Rinker Design Associates, P.C.

Access

The FHWA/VDOT Preferred Alternative would reduce travel times to employment centers and reduce traffic on Route 460 between west of Windsor and Route 58 in Suffolk, benefiting local traffic flow and safety, including emergency services response times. The improved access could create additional employment opportunities if commercial development occurs at some of the interchange/intersection locations or industrial development moves into the economic development zones established by some of the localities, which would benefit those living in the study area including minority populations.

3.2.3.2.4 Economic Consequences

Economic impacts were addressed on several different levels. Impacts include the relocation of existing businesses and jobs, the loss of property tax revenues, travel time savings, access benefits to industrial developments, and potential bypass effects to existing business districts. Additional information regarding

relocations and property tax impacts are provided within the ***Supplemental Right-of-Way and Relocations Technical Report*** (VDOT, 2016g). Socioeconomic effects related to induced growth are discussed in **Chapter 4: Indirect Effects and Cumulative Impacts**.

Relocations

The FHWA/VDOT Preferred Alternative is expected to displace seven business parcels. Many of the anticipated business relocations occur to businesses characteristic of those typically found along highways or in rural communities, providing such services as gas stations, auto repair shops, storage facilities, and small-scale retail. Displaced businesses would result in job loss, loss of sales tax, and loss of revenues. However, impacted businesses will have the option of relocating with financial assistance from VDOT which would make some of these impacts temporary.

Loss of Property Tax Revenues

When land and improvements are acquired by VDOT from private property owners, the local governments no longer receive property tax revenues for that property. Properties that may be acquired include residences, businesses, farms, and non-profit organizations, as well as undeveloped properties.

Construction

Regionally, the potential for temporary jobs would be created for the FHWA/VDOT Preferred Alternative for the duration of construction. Temporary increases in construction employment also would support existing local businesses, such as hotels, gas stations, and restaurants.

3.2.3.2.5 Travel Patterns and Mobility

The implementation of the FHWA/VDOT Preferred Alternative is expected to result in more efficient mobility, as it would provide roadway improvements and reduce travel delays over the length of improvements. The bypass around Windsor and the overpasses would be provided to ensure that motorists traveling the secondary roadways between two miles west of Windsor and Route 58 for their daily travel would not be impeded. The addition of interchanges would introduce new access points to the existing roadways.

Other changes to access include the large tracts of land that may be divided by the introduction of the new roadway. Access to these parcels has been considered in the development of the preliminary design; access is anticipated to be provided for some of these parcels.

3.2.4 Socioeconomic Mitigation

3.2.4.1 Social/Community Mitigation

VDOT sought to minimize the number of potential relocations when developing the LOD of the FHWA/VDOT Preferred Alternative, and will continue to look for opportunities to do so should the project be advanced to final stages of design and right-of-way acquisition. To minimize the loss of households, businesses, farms, and non-profit organizations from each community, VDOT right-of-way staff will coordinate closely with each locality to determine the feasibility of allowing a person/business whose building needs to be relocated, to relocate on their existing property, if they so desire. This will be addressed on a case-by-case basis and would be determined based on local regulations regarding minimum lot size, zoning, and availability of water and sewer. To minimize impacts to active farming operations, VDOT has accommodated access for bisected properties where practicable. Refer to **Section 2.5.2.1** for additional discussion of the adjustment to the inventory corridor to minimize property impacts.

VDOT will investigate the feasibility of implementing context sensitive design features such as landscaping, berms, and noise walls to reduce noise and community impacts. Noise barriers have been considered for sites that are predicted to be impacted by traffic noise (see **Section 3.7**, Noise). VDOT will provide information on noise-compatible land use planning and noise impact zones for undeveloped land in the project corridor to local officials within whose jurisdiction the project is located, so informed land use decisions can be made that minimize future traffic noise impacts on currently undeveloped lands. VDOT acknowledges that different communities may have different mitigation needs or preferences; these requested measures would be taken into account during final design.

3.2.4.2 Environmental Justice Mitigation

VDOT right-of-way staff will coordinate with residents requiring relocation. Relocation resources will be available without discrimination. VDOT's relocation policies provide an added benefit to low-income displacees (although no Census blocks were identified with an average median income lower than the poverty guidelines, individual property owners may qualify as low-income displacees). The relocation program outlines special cases where a displacee is eligible for a price differential payment in addition to the fair market value of the property to help defray the costs necessary to purchase a comparable, decent, safe, and sanitary replacement dwelling. This price differential payment may not exceed $22,500 for homeowners or $5,250 for renters and can also be used toward a down payment, increased mortgage interest costs, and incidental expenses associated with purchasing a home (e.g., title search, recording fees, and closing costs).

If appropriate housing cannot be found, VDOT can provide housing of last resort. Housing of last resort may include relocation in a rehabilitated dwelling, construction of an addition to a relocation dwelling, purchase of land and construction of a new replacement dwelling, a replacement housing payment in excess of the price differential, or a direct loan that would enable the displaced person to construct or contract the construction of a replacement dwelling.

In accordance with FHWA Order 6640.23A, consideration of mitigation for noise impacts (e.g., noise barriers) will be provided without discrimination and if determined to be feasible and reasonable. Public outreach and meaningful access to public information will continue to be provided to minority and/or low-income populations.

3.2.4.3 Economic Mitigation

Economic mitigation for the FHWA/VDOT Preferred Alternative includes the following:

- VDOT's right-of-way acquisition and relocation program will be conducted in accordance with the Uniform Relocation Assistance and Real Property Acquisition Act of 1970, as amended, and with the Surface Transportation and Uniform Relocation and Assistance Act of 1987.
- VDOT will coordinate closely with each community to determine appropriate signage at interchange areas. The signage may designate historic or shopping districts.

3.3 LAND USE

In order to ensure that highway projects better address public needs and fit more harmoniously into communities and the surrounding environment, it is important that the land uses in the study area be understood. This section describes the current and future land uses, parklands, and farmlands, as well as public policies that provide the context in which people in the study area live. Potential impacts resulting from the implementation of the proposed FHWA/VDOT Preferred Alternative are also analyzed and

described. Additional details on the methodologies and findings as they pertain to Route 460 land use are included in the ***Socioeconomics and Land Use Technical Report*** (VDOT, 2014n).

3.3.1 Regulatory Context and Methodology

3.3.1.1 Land Use

Land use information was compiled from: Census, National Oceanic and Atmospheric Administration's (NOAA) Coastal Change Analysis Program (C-CAP), local comprehensive plans, and various internet resources. General descriptions of the development in the study area are based on the compiled land use information and field visits during 2014.

3.3.1.2 Farmlands

The Farmland Protection Policy Act (FPPA) enacted in 1981 (final rules published in 1994) requires a farmland impact evaluation for applicable, federally-funded projects. The FHWA/VDOT Preferred Alternative would impact some areas considered to be rural and as the project is not a categorically excluded project, coordination with the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) is required through the completion of a Farmland Conversion Impact Rating Form (Form NRCS-CPA-106).

The authority for the establishment of agricultural and forestal (A&F) Districts of Statewide Significance is derived from Title 15.2, Chapter 43 of the Code of Virginia, entitled "Agricultural and Forestal Districts Act." The authority for the establishment of A&F Districts of local significance is derived from Title 15.2 Chapter 44 of the Code of Virginia, entitled the "Local Agricultural and Forestal Districts Acts."

The locations of soils determined to be prime, unique, statewide, or locally important were taken from the NRCS Soil Surveys for the Counties of Isle of Wight, Southampton, Surry, Sussex, and Prince George along with the City of Suffolk. The locations of A&F Districts were located through mapping data from the Virginia Department of Forestry.

3.3.1.3 Recreational Resources

Recreation can be considered any activity pursued by an individual for the purposes of physical, mental, cultural, and/or emotional replenishment. For purposes of the study, outdoor recreational resources, where individuals are generally presumed to seek such activity, have been identified as any protected area under the jurisdiction of a municipal, state, federal, or conservation entity; or a publicly or privately-owned area where recreation or preservation is a primary function or resource. The following resources contributed information in locating and identifying types of recreational resources in the Route 460 study area:

- 2013 Virginia Outdoors Plan;
- Virginia Outdoors Plan Mapper;
- The Nature Conservancy;
- Virginia Department of Conservation and Recreation (DCR);
- Aerial photography and internet resources;
- Virginia Department of Game and Inland Fisheries; and,
- Comprehensive plans of each jurisdiction.

The following general types of recreational resources were identified:

- Federal and state parklands;

- Regional and local parks;
- Wildlife Management Areas (where recreational opportunities exist); and
- Public and private recreation facilities.

This analysis was conducted with consideration given to Section 4(f) of the Department of Transportation Act of 1966 (Section 4(f)) and Section 6(f) of the Land and Water Conservation Fund Act of 1965.

3.3.2 Affected Environment

Land use in the study area is mostly rural in nature, comprised primarily of forest, agriculture, recreational areas, and open space, with interspersed suburban and built-up areas as well as the existing towns. Comprehensive plans and policies established by the localities in the study area provide the conceptual structure and direction for overall land use. The descriptions that follow summarize the existing and future land use conditions, the plans and policies guiding land use, and the compatibility of the FHWA/VDOT Preferred Alternative with these plans.

3.3.2.1 Existing Land Use

Bounded by the suburban development of the City of Suffolk to the east and outlying suburban portions of Petersburg, Hopewell, and Richmond located in Prince George County to the west, the study area encompasses approximately 745 square miles of mostly open space, including tracts of vegetated and forested acres and aquatic resources, combined with agriculture. Development and built-up areas are generally confined to the transportation corridors along Route 10 and existing Route 460; however, rural residential units are scattered throughout the study area. Commercial and industrial development is clustered within and near the incorporated towns of Windsor, Smithfield, Ivor, Wakefield, and Waverly. The study area also includes a number of crossroad communities and towns, including Zuni, Disputanta, Elberon, Dendron, Carsley, and Spring Grove, established around neighborhood oriented commercial services and businesses, churches, post offices, fire stations, and other civic buildings.

The land cover composition of the study area is illustrated in **Figure 3.3–1**. **Table 3.3-1** provides a summary of existing land cover acreage for the study area.

Table 3.3-1: Land Cover in the Study Area

Study Area Land Cover	Acreage	
Developed Land	11,671	2%
Agricultural Land	126,296	27%
Grassland	15,188	3%
Forest Land	173,741	36%
Wetland	79,403	17%
Scrub Land	63,430	13%
Water and Other Lands	7,308	2%
Total	477,037	100%

Source: NOAA C-CAP

The zoned land use areas described in the local comprehensive plans are presented in **Figure 3.3–2**. **Table 3.3-2** provides a summary of the local comprehensive plan zoning acreages.

Table 3.3-2: Land Use in the Study Area

Jurisdiction	Land Use Zoning (acres)				
	Agricultural	Commercial/ Industrial	Natural Resources/Conservation	Residential	Other
Prince George County	79,931	3,280	0	3,458	0
Sussex County	48,657	663	0	6,585	5,483
Surry County	121,467	179	0	0	1,844
Southampton County	35,045	408	0	638	637
Isle of Wight County	123,195	4,219	0	881	832
City of Suffolk	24,051	396	2,427	3,264	545
Total	398,840	9,146	5,296	14,826	9,340

Source: Prince George, Sussex, Surry, Southampton, and Isle of Wight Counties and the City of Suffolk.

3.3.2.2 Planned and Future Land Use

Planned and future land use maps were obtained from local government agencies' comprehensive plans. These maps indicate most of the study area would remain rural, agricultural, or open space. The land use plans call for concentrating development near existing communities and service areas including development along most of Route 460. Many jurisdictions also call for the concentration of urban and built-up land uses within small town centers. Incorporated towns along Route 460 are making attempts to intensify development, and planned growth is represented in comprehensive plans. Industrial areas have been created near the towns of Wakefield, Waverly, and Windsor to attract and concentrate future business and development. The City of Suffolk, and the Counties of Sussex, Prince George, and Isle of Wight all have industrial areas planned around the Route 460 corridor.

3.3.2.3 Land Use Plans and Policies

Land use in the project study area is guided by the principles set forth in each locality's comprehensive planning documents. These plans include the following:

- ***Prince George County 2014 Comprehensive Plan Update*, Prince George County** – Approved in December, 2014, Prince George's comprehensive plan seeks to preserve existing agricultural and environmental resources while effectively accommodating development and pressure for growth from nearby Petersburg, Hopewell, and Richmond.
- ***2004-2005 Comprehensive Plan Update*, Sussex County** – Adopted October 2005, this plan seeks to maintain the rural character and natural beauty of Sussex County, concentrating commercial and industrial development along the Route 460 and the Interstate 95/Route 301 corridors.
  ***Surry County Comprehensive Plan Update*, Surry County** – In addition to the Land Development Plan of Surry County, this comprehensive plan controls and directs growth to adhere to the community's vision. The County's supplemental Zoning Ordinance (October 2012) identifies the specific land uses allowed for portions of the jurisdiction.
- ***Vision 2025: The Southampton County Comprehensive Plan*, Southampton County** – Adopted in June 2015, Southampton's comprehensive plan identifies the predominant activity centers within the county and primarily directs growth opportunities to these areas: Ivor, Courtland, and Boykins-Branchville-Newsoms.
- ***Comprehensive Plan*, Isle of Wight County** – Published in October 2008, Isle of Wight's comprehensive plan informs decisions regarding the character of the county, establishing preservation policies for agricultural and rural areas and encouraging growth within three separate Development Service Districts (DSDs) at Smithfield, Windsor, and Camptown (east of Franklin).

- ***City of Suffolk Comprehensive Plan, 2035: A Vision For The Future*** – Adopted in April 2015, this plan states that investment in the Route 460 corridor is critical to the City's economic development and crucial to the City's access to regional markets.

Suburban land use designations are shown along the existing Route 460 corridor in the project study area. Based on their comprehensive plans, the study area jurisdictions collectively stress the need for safe and efficient modes of transportation and managed growth. All jurisdictions, with the exception of Suffolk, call for "safe and efficient movement of people" (Isle of Wight, Southampton, Sussex), or "a safe and efficient transportation system" (Surry, Prince George). Managed growth includes the concentration of more urban land uses (commercial, industrial, residential) near towns and along the Route 460 corridor. New development is encouraged, but only if supported by adequate infrastructure such as water and sewer lines. By concentrating such land uses, farmlands and the rural character of these areas are preserved.

3.3.2.3.1 Economic Investment Incentive Areas

In addition to county comprehensive plans and zoning designations, economic incentives within individual localities are used as a tool to attract and direct development and growth. Such economic incentives include the establishment of county Enterprise Zones that allow industries that locate within them to be eligible for benefits such as special financing and tax breaks. Prince George has an Enterprise Zone located on the western side of Route 460 near the Interstate 295 interchange. Southampton has established Enterprise Zones, but they are not within the study area for the proposed Route 460 project. In November 2011, the Virginia Department of Housing and Community Development approved a re-designation application to allow the expansion of the joint Franklin/Southampton Enterprise Zone to include over 2,400 acres in Isle of Wight, with two industrial Enterprise Zones surrounding Windsor along the Route 460 corridor. Surry has developed industrial parks around the town of Surry. Sussex has commercial and industrial zones along Route 460 and outside the towns of Wakefield and Waverly.

3.3.2.3.2 Farmland and Forestry Preservation Policies

Designated agricultural areas and farmland policies help to preserve the rural character that many of the counties within the project study area seek to maintain. Isle of Wight's current comprehensive plan states a purpose to "preserve the rural character of the County and preserve forest and agriculture in areas outside of established DSDs". Surry's comprehensive plan states the need to preserve existing prime agriculture and timberlands from conflicting demands for use and maintaining the rural quality of life. It promotes the development of strategies to install land use controls that encourage farming and timberland conservation. According to the Sussex County 2004-2005 Comprehensive Plan Update, most of Sussex has been retained in an agricultural land use category to facilitate existing and future farming operations. Permitted uses are restricted to agriculture and other activities that are compatible with the existing land use pattern. Suffolk's comprehensive plan states one of the key planning themes of the City is preserving its agricultural heritage. Prince George stresses the need to maintain a balance between development and preservation objectives throughout the County. Isle of Wight is the only county within the study area that contains A&F Districts, which are recognized by the State of Virginia. **Section 3.3.2.4** that follows and the ***Socioeconomics and Land Use Technical Report*** (VDOT, 2014n) provide further details on Virginia's A&F Districts located in Isle of Wight.

3.3.2.4 Farmlands

The FPPA of 1981 (7 USC § 4201, et seq.) requires that federal actions identify and consider adverse effects on protected farmland. Under the FPPA, the USDA defines "farmland" as:

- Prime farmland – land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses.
- Unique farmland – land other than prime farmland that is used for production of specific high-value food and fiber crops.
- Farmland – other than prime or unique farmland that is of statewide or local importance for the production of food, feed, fiber, forage, or oilseed crops.

This land may be in cultivation, forest, pasture, or other uses except for urban or built-up land or water uses (7 USC § 4201(c)).

The FPPA provides protections to areas underlain by Prime, Unique, and Statewide and Locally Important soils. Only prime farmland and statewide important soils exist in Virginia, and are determined based on soil surveys published by the USDA NRCS. Approximately 26 percent of the study area is agricultural land. This section describes farmlands as categorized by the Agriculture and Food Act of 1981 and the FPPA. **Figure 3.3–3** shows the locations of prime and statewide important farmland soils in the study area.

3.3.2.4.1 Farmland Uses and Production

Data on farmland use and production are only available at the county level (not specific to the study area). According to the 2012 Census of Agriculture, there are over 1,200 farms within the six jurisdictional areas with over 440,000 acres of farmland. Of the available farmland, about half (about 256,000 acres) of it is used as harvested cropland. Among the largest crops are corn (for grain), soybeans, and peanuts. **Table 3.3-3** lists the size of agricultural lands in the jurisdictions that encompass the study area.

Table 3.3-3: Farmland Uses and Production for Jurisdictions within Study Area

Jurisdiction	Number of Farms (2012)	Acreage of Farms (2012)	Harvested Cropland (acres) (2012)	Largest Crops, Livestock (2012)
Prince George County	167	36,659	16,562	Corn for grain, Soybeans, Peanuts, Beef cattle
Sussex County	123	64,245	37,879	Corn for grain, Wheat for grain, Soybeans, Peanuts
Surry County	127	45,122	30,238	Corn for grain, Wheat for grain, Soybeans, Peanuts
Southampton County	335	153,831	87,902	Corn for grain, Wheat for grain, Soybeans, Peanuts
Isle of Wight County	213	75,642	47,868	Corn for grain, Soybeans, Peanuts, Beef cattle
City of Suffolk	308	69,253	36,269	Corn for grain, Wheat for grain, Soybeans, Peanuts

Source: 2012 Census of Agriculture – County Data, Virginia, USDA

Southampton has the greatest amount of acreage devoted to agricultural purposes with over 150,000 acres. It also has the most harvested cropland according to the 2012 Agricultural Census. Prince George County has the lowest figures of the jurisdictions.

3.3.2.4.2 Agricultural and Forestal Districts

Virginia's A&F Districts Act allows for the establishment of Agricultural, Forestal, or A&F Districts. The A&F program is designed to preserve and protect open spaces, forested areas, and agricultural lands in the state of Virginia. Of the six jurisdictions that make up the study area, only Isle of Wight County currently

has established A&F Districts. A&F Districts within Isle of Wight County and the study area are listed in **Table 3.3-4** and displayed on **Figure 3.3–4**.

Table 3.3-4: Agricultural and Forestal Districts

Jurisdiction	A&F District Name	Area (acres)	Area (square miles)
Isle of Wight County	Longview*	8,318	13
	Knoxville*	4,426	7
	Courthouse	13,807	22

Source: Virginia Department of Forestry, Isle of Wight County

*The Knoxville and Longview A&F Districts have parcels located outside the study area.

3.3.2.5 Recreational Resources

As stated previously, for the purposes of the study, outdoor recreational resources are defined as any protected area under the jurisdiction of a municipal, state, federal, or conservation entity; or a publically or privately-owned area where recreation or preservation is a primary function of the resource. Recreational resources and preserves located in the study area are listed in **Table 3.3-5** and displayed in **Figure 3.3–5**.

Table 3.3-5: Study Area Recreational Resources

Map ID	Name of Site	Proprietor	Type of Facility
1	North Elementary School	Prince George County School Board	Recreational Fields
2	Scott Memorial Park	Prince George County Parks and Recreation	Recreational Fields
3	L. L. Beazley Elementary School	Prince George County School Board	Recreational Fields
4	N. B. Clements Jr High School	Prince George County School Board	Recreational Fields
5	Prince George High School	Prince George County School Board	Recreational Fields
6	Crater Criminal Justice Academy	Commonwealth of Virginia	Recreational Fields
7	Prince George Education Center	Prince George County School Board	Recreational Fields
8	JEJ Moore Middle School/Athletic Complex	Prince George County School Board	Recreational Fields
9	South Elementary School	Prince George County School Board	Recreational Fields
10	Prince George Country Club	Private Owner	Recreation
11	David A Harrison Elementary School	Prince George County School Board	Recreational Fields
12	Waverly Hunt Club	Private Owner	Recreation
13	Ruritan Field	Private Owner	Recreational Fields
14	Luther P Jackson Middle School	Surry County School Board	Recreational Fields
15	Surry County High School	Surry County School Board	Recreational Fields
16	Surry County Elementary School	Surry County School Board	Recreational Fields
17	Dendron Swamp State Natural Area Preserve	Virginia Department of Conservation & Recreation	Natural Preserve
18	Municipal Recreation Facility	Town of Wakefield	Recreational Fields
19	Ellen B Chambliis Elementary School	Sussex County School Board	Recreational Fields
20	Tidewater Academy	Private Owner	Recreational Fields
21	Wakefield Community Hunt Club	Private Owner	Recreation
22	Piney Grove TNC Preserve	The Nature Conservancy	Natural Preserve
23	Big Woods Wildlife Management Area	Va. Department of Game and Inland Fisheries	Natural Preserve
24	Heavenly Waters Youth Camp	Private Owner	Recreation
25	Blackwater Sandhills DCR	VA Dept. of Conservation and Recreation	Natural Preserve
26	Blackwater River TNC Preserve	The Nature Conservancy	Natural Preserve
27	H. Massey Joyner Ball Park	Town of Ivor	Recreational Fields

Map ID	Name of Site	Proprietor	Type of Facility
28	White Tail Resort	Private Owner	Recreation
29	Big Bear Family Campground	Private Owner	Recreation
30	Antioch Pines State Natural Area Preserve	VA Dept. of Conservation and Recreation	Natural Preserve
31	Blackwater Ecological State Natural Area Preserve	Old Dominion University	Natural Preserve
32	Zuni Hunt Club	Private Owner	Recreation
33	Westside Elementary School	Isle of Wight County School Board	Recreational Fields
34	Cypress Creek Golf Club	Private Owner	Recreation
35	Lana Affemann Performance Horses	Private Owner	Recreation
36	Smithfield Middle/High Schools	Isle of Wight County	Recreational Fields
37	Isle of Wight County Farm	Isle of Wight County	Fairgrounds
38	Isle of Wight Academy	Private Owner	Recreational Fields
39	Windsor Elementary School	Isle of Wight County School Board	Recreational Fields
40	Heritage Park	Isle of Wight County	Conservation
41	Central County Park	Isle of Wight County	Park Area
42	Windsor Middle School	Isle of Wight County School Board	Recreational Fields
43	Windsor High School	Isle of Wight County School Board	Recreational Fields
44	Robinson Park	Isle of Wight County	Park Area
45	Centennial Park	Isle of Wight County	Park Area
46	Butler Campground	Private Owner	Recreation
47	Oakland Elementary School	City of Suffolk School Board	Recreational Fields
48	Burnt Mills Reservoir	City of Suffolk	Boating
49	Western Branch Reservoir	City of Norfolk	Boating
50	Lake Prince	City of Norfolk	Boating
51	Kings Fork Middle School	City of Suffolk School Board	Recreational Fields
52	Kings Fork High School	City of Suffolk School Board	Recreational Fields
53	Suffolk Youth Athletic Association (Diamond Springs Park)	Private Owner	Recreational Fields
54	Indian Point Farm	Private Owner	Recreation
55	Kings Fork Athletic Field	City of Suffolk	Recreational Fields
56	Nansemond-Suffolk Academy	Private Owner	Recreational Fields
57	Elephants Fork Elementary School	City of Suffolk School Board	Recreational Fields
58	Lake Cohoon	City of Portsmouth	Boating
59	Lake Meade	City of Portsmouth	Boating
60	Liberty Arabians	Private Owner	Recreation
61	Lakeland High School	City of Suffolk School Board	Recreational Fields

Source: Virginia Department of Conservation and Recreation

3.3.3 Environmental Consequences

3.3.3.1 No Build Alternative

Although small amounts of new right-of-way may be required for implementation of programmed improvements associated with the No Build Alternative, no major impacts to land use anticipated; however, evaluation of the potential effects to land use may be required if any programmed improvement involve major new construction with federal funding. Potential effects resulting from any projects included within the No Build portion of the FHWA/VDOT Preferred Alternative will be identified and addressed by the respective project sponsors.

The No Build Alternative would be consistent with comprehensive plans of Sussex and Surry, which do not include any future alternative Route 460 alignments or upgrades. Suffolk's current land use plan depicts the previously proposed Modified Candidate Build Alternative (CBA) 1 alignment from the FEIS, but does not anticipate any future land use plan changes if a No Build Alternative is adopted. The comprehensive plans of Prince George, Southampton, and Isle of Wight Counties depict the 2008 FEIS FHWA/VDOT Preferred Alternative as a proposed Route 460 alignment. Therefore, the No Build Alternative would generally not be consistent with these jurisdictions' transportation goals as identified in their comprehensive plans. Comprehensive plans indicate the need to improve Route 460 due to concerns regarding flooding, safety, and hurricane evacuation. Substantial improvements to the existing Route 460 are not included in the No Build Alternative.

3.3.3.2 FHWA/VDOT Preferred Alternative

3.3.3.2.1 Land Use

The existing land use classifications were derived from the land use coverages provided by the NOAA C-CAP land cover classification schemes, which were derived using remote sensing means. GIS software was used to determine the acreage of each land use impacted by the FHWA/VDOT Preferred Alternative. In the ArcGIS software package, the layer (or shapefile, depending on which version of ArcView or ArcGIS is used) containing the study area land uses was "clipped" to the LOD of the FHWA/VDOT Preferred Alternative. A calculation function was performed to summarize the impacted land use classifications. Areas of potential impacts were also compared to local comprehensive plan zoning areas to determine compatibility and consistency with future land use plans.

Table 3.3-6 displays the land cover associated with the Inventory Corridor and the LOD of the FHWA/VDOT Preferred Alternative. The FHWA/VDOT Preferred Alternative would convert a total of 507 acres of land, 365 acres of which are classified as agriculture and forest and 112 acres of which are classified as developed land.

Table 3.3-6: Impacted Acreage by Land Cover for FHWA/VDOT Preferred Alternative

Area of Study	Land Cover/Use Classification (acres)					
	Agricultural	Developed	Forest	Grassland	Scrub	Total
LOD of the Preferred Alternative	245	112	119	10	21	507
Inventory Corridor	868	306	501	37	85	1797

Source: NOAA, Prince George, Sussex, Surry, Southampton, Isle of Wight Counties and the City of Suffolk.

Consistency with Comprehensive Plans

Consistency with comprehensive plans was assessed first through review of published comprehensive plans, supplemented by meetings with local jurisdictions' planning staff to provide local government input regarding the FHWA/VDOT Preferred Alternative. The FHWA/VDOT Preferred Alternative was compared to the goals and policies of each jurisdiction.

Policies related to the FHWA/VDOT Preferred Alternative pertain to transportation, land use designations, and economic development within the localities. The FHWA/VDOT Preferred Alternative is generally consistent with the goals of each jurisdiction, which state the need to improve traffic conditions and provide access to planned development areas. Regarding specific improvements to the Route 460 corridor, the FHWA/VDOT Preferred Alternative's 16-mile build section from Zuni to Suffolk and 36-mile "No Build section" from Petersburg to Zuni can be assessed separately with regard to consistency with local comprehensive plans. As stated above, the comprehensive plans of Sussex and Surry do not include any future alternative Route 460 alignments or upgrades. The FHWA/VDOT Preferred Alternative section that runs through Sussex and Surry is all No Build; therefore, the FHWA/VDOT Preferred Alternative is consistent with these Counties' plans. The build section of the FHWA/VDOT Preferred Alternative begins in Southampton and runs east through Isle of Wight to the City of Suffolk. The FHWA/VDOT Preferred Alternative is consistent with the local comprehensive plans of these localities, which include improvements to the Route 460 corridor in their most recent plan updates. Prince George County also includes Route 460 improvements in its comprehensive plan; however, the FHWA/VDOT Preferred Alternative includes the No Build Alternative within Prince George County's boundaries; therefore, the FHWA/VDOT Preferred Alternative is not consistent with that plan.

3.3.3.2.2 Farmland Consequences

The following sections describe the FHWA/VDOT Preferred Alternative's impact to farmlands. Impacts were determined for prime farmland soils, farmland uses and production, economic consequences of farmland conversion, and impacts to A&F Districts.

Prime Farmland Consequences

The FPPA requires that federal actions identify and consider adverse effects on protected farmland. According to the FPPA, protected farmland includes prime farmland soils, unique soils, or statewide or locally important soils. In Virginia, only prime farmland soils, prime farmland soils if drained, and soils of statewide importance are defined.

VDOT coordinated with the USDA NRCS to assess the impacts of the Route 460 project to farmlands in the study area. NRCS-CPA-106 forms were completed to determine the Farmlands Conversion Impact Rating for the project. The Farmland Conversion Impact Rating is based on an assessment of the suitability of the land in the corridor for the protection of farmland. The FPPA states that "increasingly higher levels of consideration for protection" be given to farmlands impacted by projects that have a Farmland Conversion Impact Rating exceeding a total score of 160. The FHWA/VDOT Preferred Alternative scored below 160 and thus no further action is recommended to mitigate farmland conversion.

The FHWA/VDOT Preferred Alternative would convert soils mapped as prime farmland soils by the NRCS to roadway surface and right-of-way. Acres of prime farmland soils converted compared with acres of prime farmland soils within the Inventory Corridor are presented in **Table 3.3-7**. Acres of farmland of statewide importance converted compared with acres of farmland of statewide importance within the Inventory Corridor are presented in **Table 3.3-8**.

Table 3.3-7: Acres of Prime Farmland Soils

Area of Study	Jurisdiction Prime Farmland Area (acres)			
	Southampton County	Isle of Wight County	City of Suffolk	Total
LOD of the Preferred Alternative	8	117	140	265
Inventory Corridor	90	412	457	959

Source: NRCS

Table 3.3-8: Acres of Farmland of Statewide Importance

Area of Study	Jurisdiction Farmland of Statewide Importance (acres)			
	Southampton County	Isle of Wight County	City of Suffolk	Total
LOD of the Preferred Alternative	0	7	49	56
Inventory Corridor	6	33	195	234

Source: NRCS

Impacts to Farmland Uses and Production

In addition to the conversion of prime farmland soils described above, the FHWA/VDOT Preferred Alternative would result in relocation of one existing farm located west of the City of Suffolk within the FHWA/VDOT Preferred Alternative's LOD. The loss of farmland production from the relocation of this farm, as well as the taking of partial properties would be approximately $128,000 per year for Isle of Wight and $91,000 for the City of Suffolk.

Agricultural and Forestal District Consequences

Three A&F Districts are located within the study area in Isle of Wight, which is the only locality with such districts. No conversion of A&F Districts would take place with the No Build Alternative. Although the LOD of the FHWA/VDOT Preferred Alternative is located in close proximity to both the Knoxville District and the Courthouse District, as shown in **Figure 3.3–6**, neither the LOD nor the Inventory Corridor are within the districts. Therefore, conversion of land in the A&F District would not need to be performed.

3.3.3.2.3 Recreational Resources Consequences

Outdoor recreational facilities located within the Inventory Corridor are presented in

Table 3.3-9. Four recreational resources have been identified within the Inventory Corridor. One resource, Nansemond Suffolk Academy, is located within the LOD of the FHWA/VDOT Preferred Alternative and would, therefore, be impacted by the FHWA/VDOT Preferred Alternative.

Table 3.3-9: Recreational Resource Located within the Inventory Corridor

Name of Recreational Resource	Location
Central County Park	Isle of Wight
Nansemond-Suffolk Academy	Suffolk
Elephants Fork Elementary School	Suffolk
Lake Meade	Suffolk

Sources: 2012 Virginia Outdoors Plan, the Virginia Department of Conservation and Recreation, Comprehensive Plans.

The proposed alignment would be constructed across Nansemond Suffolk Academy's athletic fields between two baseball diamonds. VDOT has coordinated extensively with Nansemond Suffolk Academy

to shift the alignment to avoid the playing fields to the greatest extent feasible and to minimize the direct impacts to the recreational resource. The remaining three resources are located outside of the LOD of the FHWA/VDOT Preferred Alternative, and would not be impacted by the FHWA/VDOT Preferred Alternative.

3.3.4 Land Use Mitigation

No land use mitigation is proposed.

3.4 NATURAL RESOURCES

This section describes the natural resources that are characteristic of the study area and within the Inventory Corridor. Potential impacts resulting from the implementation of the FHWA/VDOT Preferred Alternative were analyzed and are described. Additional details on the methodologies and findings for natural resources as they pertain to Route 460 are included in the ***Supplemental Natural Resources Technical Report*** (VDOT, 2016f).

3.4.1 Regulatory Context and Methodology

3.4.1.1 Regulatory Context

Construction of a new Route 460 would require coordination with and approval/clearances from a number of different regulatory and resource agencies during the final design and permitting phase of the project, as summarized below and described further in the ***Supplemental Natural Resources Technical Report*** (VDOT, 2016f). U.S. Army Corps of Engineers (USACE) administers regulations for activities affecting waters of the United States (WOUS) and navigable waters pursuant to Section 404 of the Clean Water Act (CWA) of 1977, as amended, and Section 10 of the Rivers and Harbors Act of 1899, respectively. Section 9 of the Rivers and Harbors Act of 1899 (33 U.S.C. 401) pertains to bridges and causeways, but the authority of the Secretary of the Army and USACE with respect to bridges and causeways was transferred to the Secretary of Transportation under the Department of Transportation Act of October 1966, and is administered by the U.S. Coast Guard (USCG).

Section 404 of the CWA prohibits the discharge of dredged or fill material into WOUS if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem. Per Section 404 (b)(1) of the CWA, the U.S. Environmental Protection Agency (EPA) issued guidelines that the USACE must follow when issuing Section 404 permits, known as the Section 404(b)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material (33 U.S. Code Annotated §1344 et seq.; 40 CFR §230). During permit coordination with regulatory agencies, an alternatives analysis is generally required to identify less damaging alternatives that might be available. **Chapter 2.0** (**Sections 2.4 and 2.5**) and the ***Supplemental Alternatives Technical Report*** (VDOT, 2016f) contain detailed documentation of the alternative analysis that led to the identification of the FHWA/VDOT Preferred Alternative. The analysis included input from the USACE and EPA throughout the process. This information is also included in the permit application for the Route 460 project, submitted in November 2015.

The CWA delegates authority to EPA and USACE to define the term "waters of the United States", which has been defined as follows:

> **(1)** All waters which are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide;

(2) All interstate waters including interstate wetlands;

(3) All other waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, the use, degradation or destruction of which could affect interstate or foreign commerce including any such waters:

(i) Which are or could be used by interstate or foreign travelers for recreational or other purposes; or

(ii) From which fish or shellfish are or could be taken and sold in interstate or foreign commerce; or

(iii) Which are used or could be used for industrial purpose by industries in interstate commerce;

(4) All impoundments of waters otherwise defined as waters of the United States under the definition;

(5) Tributaries of waters identified in paragraphs (a) (1) through (4) of this section;

(6) The territorial seas;

(7) Wetlands adjacent to waters (other than waters that are themselves wetlands) identified in paragraphs (a) (1) through (6) of this section.

(8) Waters of the United States do not include prior converted cropland. Notwithstanding the determination of an area's status as prior converted cropland by any other Federal agency, for the purposes of the Clean Water Act, the final authority regarding Clean Water Act jurisdiction remains with EPA.

Under USACE regulations (33 CFR §329) as applied to the study area, navigable waters are determined by the USACE District Engineer and are made for all waters that are "presently used or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce." The USACE general definition of navigable waters of the U.S. is "those waters subject to the ebb and flow of the tide shoreward to the mean high water mark and/or are presently used, or have been used in the past, or may be susceptible for use, to transport interstate or foreign commerce. A determination of navigability, once made, applies laterally over the entire surface of the waterbody, and is not extinguished by later actions or events which impede or destroy navigable capacity." This definition includes all tidal waterbodies including streams, rivers, and wetlands.

In addition to the regulations administered by USACE regulatory oversight, several state agencies have jurisdiction over surface waters. Virginia Department of Environmental Quality (VDEQ) administers the Virginia Water Protection Permit program (9 VAC 25-210), Section 401 of the CWA, and the State Water Control Law for activities affecting jurisdictional wetlands, streams, and other water bodies. In July 2000, VDEQ authority was modified by the Virginia General Assembly to develop a non-tidal wetlands program and to provide regulations to protect fish and wildlife resources. Section 401 of the CWA requires any applicant for a federal license or permit for any activity that may result in a discharge into waters to obtain a certification that discharge will not adversely affect water quality from the state in which the discharge will occur. Section 401 requires certification by Virginia that prospective permits comply with the state's applicable effluent limitations and water quality standards. While waters that are considered "isolated" do not fall under federal CWA permitting, they are regulated by VDEQ.

The Virginia Marine Resources Commission (VMRC) is authorized to permit activities in, on, or over state-owned subaqueous lands in Virginia (Code of Virginia Chapter 2, Title 62.1). Through this regulatory framework, activities requiring permits include building, dumping, or otherwise trespassing upon or over, encroaching upon, taking, or using any material from the beds of the bays, oceans, and jurisdictional rivers, streams, or creeks. In addition, VMRC is responsible for managing and regulating the use of Virginia's tidal wetlands and coastal primary sand dunes in conjunction with Virginia's local wetlands boards, where

established. VMRC also protects and regulates those areas designated as non-vegetated and vegetated tidal wetlands and state-owned subaqueous bottom land.

Virginia's state waters, including wetlands, are also regulated under the Virginia Wetlands Act and through Subtitle III of Title 28.2 of the Code of Virginia. Through this framework, each county's local wetlands board regulates activities in tidal wetlands within their counties. Though tidal wetlands are present in a small portion of the northeast corner of the study area, no tidal wetlands occur within the Inventory Corridor. Since tidal wetlands do not occur within the Inventory Corridor, the local wetlands boards do not have jurisdiction.

The Chesapeake Bay Preservation Act (Bay Act), administered by the VDEQ, regulates development in the Chesapeake Bay watershed. The Chesapeake Bay Preservation Areas consist of Resource Protection Areas (RPAs) and Resource Management Areas (RMAs). RPAs consist of environmentally sensitive lands along shorelines or perennial streams that serve as "filters" by removing pollutants from runoff before they enter the Chesapeake Bay and its tributaries. RMAs are contiguous to the entire inland boundary of the RPA and if improperly used or developed, have the potential for causing water quality degradation or for diminishing the functional value of the RPA. Regulations limit development activities from encroaching into the RPAs due to the important functions these areas perform in water quality protection. Title 9 of the VAC (9VAC10-20-150B) allows public roads to be located within RPAs subject to certain conditions. Construction, installation, operation, and maintenance of public roads and their appurtenant structures are exempt if:

- The roadway is constructed in accordance with an erosion and sediment control plan consistent with regulations promulgated pursuant to the Erosion and Sediment Control Law (§ 10.1-560 et seq. of the Code of Virginia).
- The roadway is constructed in compliance with the Stormwater Management Act (§10.1-603.1 et seq. of the Code of Virginia) and a stormwater management plan is approved by VDEQ.
- The road is designed and constructed to prevent or minimize otherwise minimal encroachment in the RPA and minimize water quality impacts.

3.4.1.2 Methodology

3.4.1.2.1 Water Resources and Aquatic Ecology

Surface Water Resources

Surface water resources were identified using available published data sources, online sources, and aerial photo-interpretation. Baseline water quality information and impaired waters information were obtained from the 2012 305(b)/303(d) Integrated Report (VDEQ, 2014a), as well as other online resources and published sources (VDEQ, 2014b). Information on surface drinking water supplies was obtained from the Cities of Norfolk (City of Norfolk, 2014), Portsmouth (City of Portsmouth, 2012), Suffolk (City of Suffolk, 2012), and Hopewell (City of Hopewell, 2014) which operate the study area's major water supply reservoirs.

Groundwater Resources

The Safe Water Drinking Act (SWDA) requires the EPA to set standards for public water supply systems, including groundwater resources. EPA's Wellhead Protection Program is a community-based approach for the protection of groundwater that supplies drinking water to public water wells and wellfields. Public

drinking water systems, as defined by EPA, may be publicly or privately owned and serve at least 25 people or 15 service connections for at least 60 days per year. The surface and subsurface areas surrounding a water well or wellfield supplying a public water system though which contaminants are reasonably likely to move toward and reach such water well or wellfields are designated as wellhead protection areas. The Virginia Wellhead Protection Plan (VDEQ, 2005) specifies a 1,000-foot wellhead protection radius and the Virginia Waterworks Regulations (VR 355-18-000) specifies a 100-foot wellhead setback zone for public groundwater supply wells. Virginia Department of Health (VDH) records were searched to identify groundwater supply wells within the study area.

The SWDA also gives EPA the authority to designate aquifers which are the sole or principal drinking water source for an area, and which, if contaminated, would create a significant hazard to public health, as a sole source aquifer. EPA records were searched to identify any sole source aquifers within the study area.

Floodways and 100 Year Floodplains

EO 11988 (Floodplain Management), as amended (Floodplain Management), EO 13690 (Establishing a Federal Flood Risk Management Standard and a Process for Further Soliciting and Considering Stakeholder Input), and the regulations of the National Flood Insurance Program administered by Federal Emergency Management Agency (FEMA) require avoidance of impacts associated with the occupancy and modification of floodplains. As defined in EO 11988, a floodplain is "the lowland and relatively flat area adjoining inland and coastal waters including flood prone areas of offshore islands, including at a minimum, that area subject to a one percent or greater chance of flooding in any given year," an area identified for planning purposes as the 100-year floodplain. The floodway is the area that experiences the deepest water and the highest velocities. Development in floodplains reduces the ability of these areas to detain floodwaters, thereby reducing flood storage capacity and placing development in the floodplain and downstream properties at risk. Federal standards limit increases in base flood levels to less than 1.0 foot above pre-development levels, provided that hazardous velocities are not produced.

Locations of designated floodplains and floodways were determined using Flood Boundary and Floodway Maps published by FEMA. For areas where digitized FEMA Q3 data were unavailable, floodplain encroachments were identified by transposing FEMA-published flood boundaries onto 1:24,000 topographic maps showing the FHWA/VDOT Preferred Alternative.

Wetlands

During the development of the 2014 Draft SEIS, wetlands within the Inventory Corridor for each alternative evaluated were identified using photointerpretation, review of ancillary data sources, and limited field review of selected areas. Since the publication of the 2014 Draft SEIS, a comprehensive wetland delineation was conducted to locate the limits of jurisdictional WOUS within the Inventory Corridor for the FHWA/VDOT Preferred Alternative. WOUS (including wetlands) were delineated pursuant to the USACE Wetland Delineation Manual, Technical Report Y-87-1 (1987 Manual), the USACE November 2010 Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region Version 2.0 (USACE, 2010), and subsequent regulatory guidance. Wetland delineation field work and USACE confirmation site visits were conducted from April through July 2015.

VDOT, in collaboration with USACE, EPA, and VDEQ, engaged in a functional assessment of each wetland impacted along 16 miles of improvements. The purpose of this functional assessment was to provide an understanding of the functions and to document the functions of wetlands that may be impacted by the proposed project. This functional assessment also helped to guide the proposed Compensatory

Mitigation Plan in order that compensatory mitigation adequately replaces similar lost or impaired wetland functions. For more information regarding the functional assessment methodology see **Section 3.4.3.2.1**.

Navigable Waters of the U.S.

The USACE administers regulations for activities affecting navigable waters pursuant to Section 10 of the Rivers and Harbors Act of 1899. Under the general definition provided in 33 CFR §329.4, "Navigable waters of the United States are those waters that are subject to the ebb and flow of the tide and/or are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce. A determination of navigability, once made, applies laterally over the entire surface of the waterbody, and is not extinguished by later actions or events which impede or destroy navigable capacity." These waters are typically larger rivers, lakes, or canals with ports, loading docks, boat ramps, etc.

Waterways, Waterbodies, and Associated Deepwater Habitat

Surface waters within the vicinity of the Inventory Corridor were classified as WOUS using the USACE/EPA regulatory guidance. Other waters, including ditches, were delineated based on the application of the hydrology parameter and the regulatory definition of ordinary high water (33 CFR §328) and in accordance with new jurisdictional determination guidance wrought by the June 5, 2007 Rapanos court decision and subsequent regulatory guidance.

Deepwater habitats are permanently flooded lands lying below the deepwater boundary of wetlands (Cowardin, et.al. 1979). The boundary between wetland and deepwater habitat is generally considered to be at a depth of two meters (6.6 feet) below low water.

Palustrine waters with unconsolidated bottom are waterbodies less than 20 acres in size and less than two meters in depth at low water (Cowardin, et.al. 1979). These waters are permanently to periodically flooded and have a substrate of sand, gravel, mud, or cobble. These waters are located in areas of low energy and have the potential for being unstable due to a lack of large surfaces for plant growth.

Wild and Scenic Rivers

The Wild and Scenic Rivers Act of 1968 was enacted to preserve remarkable scenic, recreational, geological, wildlife, historical, cultural, or other similar values along rivers or segments of rivers. The National Wild and Scenic Rivers System is intended to preserve the free flowing condition of the listed rivers, to protect their water quality, and to promote conservation. Eligible river segments usually are only accessible by trail and are free of impoundments. Presence or absence of designated Scenic Rivers in the project area were determined through review of the National Wild and Scenic Rivers system operated by the NPS.

The Virginia Scenic Rivers Act of 1970 protects rivers and segments of rivers in Virginia that possess scenic, recreational, and/or historic values. Information on state Scenic Rivers was obtained from the DCR Blackwater Scenic River Report (DCR, 2009a), the 2013 Virginia Outdoors Plan (DCR, 2013), and the DCR Recreation Planning – Scenic Rivers Program webpage (DCR, 2014b).

Coastal Zone Management Resources

The Coastal Zone Management Act (CZMA) of 1972 and federal consistency regulations (15 CFR §930, Subpart D, §930.50 et seq.) stipulate that activities in Virginia's Coastal Management Area (CMA) that have a federal component (e.g., those requiring federal permits, licenses, or approval) and can affect a Virginia coastal use or resource must be consistent with the enforceable policies of the Virginia Coastal Zone Management Program (CZMP). VDEQ administers the Virginia CZMP through a network of state

agencies and local governments, which share responsibility for administering the enforceable policies as follows: *Fisheries Management* (VMRC and DGIF), *Subaqueous Lands Management* (VMRC), *Wetlands Management* (VMRC and VDEQ), *Dunes Management* (VMRC), *Non-point Source Pollution Control* (VDEQ), *Point Source Pollution Control* (VDEQ, State Water Control Board), *Shoreline Sanitation* (VDH), *Air Pollution Control* (VDEQ, Air Pollution Control Board), and *Coastal Lands Management* (VDEQ). Information on the Virginia CMA and the CZMP enforceable policies was obtained from VDEQ's Coastal Zone Management website (VDEQ, 2014e).

Aquatic Biology

Information on the aquatic biological resources in the study area was compiled from readily available reference sources for fisheries and wildlife information in Virginia. The Virginia Department of Game and Inland Fisheries' (DGIF) Fish and Wildlife Information Service (VAFWIS) was utilized for obtaining fish and wildlife species and habitat information (DGIF, 2014a). This online service provides a listing of historic and recently confirmed observations of species within a certain geographic area. The VDEQ Ecological Data Application System (EDAS) datasets were utilized to obtain benthic invertebrate family occurrence data for the study area (VDEQ, 2014d). Both of these datasets draw from past monitoring and collection events.

3.4.1.2.2 Terrestrial Resources

Natural Communities, Wildlife Habitat, and Biodiversity

NOAA's 2010 C-CAP land cover dataset was utilized initially to review and identify general land uses, forest types, and other large-scale vegetation communities within the study area (NOAA, 2010b). The C-CAP land cover is based on data analyzed by NOAA, with land coverage classification adapted from the Cowardin wetland classification system (Cowardin, et al. 1979) and the Land Use and Land Cover Classification System for Use with Remote Sensor Data (Anderson, et al. 1976), also known as the "Anderson Land Use Classification".

Natural vegetation communities of the study area were classified according to *The Natural Communities of Virginia: Classification of Ecological Groups and Community Types* (Fleming et al, 2012 and 2013). Windshield surveys of the study area combined with site reconnaissance of the undeveloped lands were conducted in 2012 and 2013 to aide in identifying plant communities and associated wildlife habitat.

Natural vegetation communities within the Inventory Corridor were identified and mapped in the field during the spring and summer of 2015. Onsite surveys were conducted to determine the natural community types based on *The Natural Communities of Virginia: Classification of Ecological Groups and Community Types* (Fleming and Patterson, 2013). Natural community boundaries were estimated in the field and hand sketched on field maps using 2013 Virginia Geographic Information Network (VGIN) true color and color infrared aerial imagery as the base mapping, and then were later digitized in GIS to produce final shapefiles for analysis.

DCR's GIS database of natural heritage sites was reviewed for identification of unique communities. The data were contained within the 2015 Comprehensive Environmental Data and Reporting (CEDAR) System GIS database, updated April 2015 (VDOT, 2015).

Threatened and Endangered Species

U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) regulate and protect federally listed threatened and endangered (T&E) species under the Endangered Species Act (ESA)

of 1973. The purpose of the ESA is to protect and recover imperiled species and the ecosystems upon which they depend. USFWS has primary responsibility for terrestrial and freshwater organisms, while the responsibilities of NMFS are mainly marine wildlife such as whales and anadromous fish such as Atlantic sturgeon. Under the ESA, species may be listed as either "Endangered" or "Threatened". "Endangered" means a species is in danger of extinction throughout all or a significant portion of its range. "Threatened" means a species is likely to become endangered within the foreseeable future.

The ESA protects T&E species and their habitats by prohibiting the "take" of listed animals and the interstate or international trade in listed plants and animals, including their parts and products, except under federal permit. Under the ESA, the term "take" means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or to attempt to engage in any such conduct.

The Virginia Endangered Species Act of 1972 (amended in 1977) prohibits the taking, transportation, and sale of state-listed T&E species, except as permitted. Two state agencies, DGIF and the Virginia Department of Agriculture and Consumer Services (VDACS) have legal authority for state T&E species and are responsible for their conservation. DGIF has legal authority for Virginia's designated T&E animal species, excluding insects. DGIF's list of designated species is comprehensive, meaning that in addition to those species specifically designated by the state (i.e., state-listed), it also includes all species listed at the federal level. As a result, species listed by the federal process automatically become de facto state-listed.

VDACS has legal authority for state T&E insects and plants. Unlike animals, when a plant or insect is listed at the federal level, it is not added to Virginia's list until it is officially listed by the Board of Agriculture and Consumer Services. Additional protection for T&E plants and insects is granted in part through the Endangered Plant and Insect Species Act of 1979 (Chapter 10 §3.2-1000 through 1011 of the Code of Virginia). This Act mandated that VDACS conserve, protect, and manage T&E species of plants and insects.

A third state agency, DCR Division of Natural Heritage (DNH), produces an inventory of Virginia's natural resources and maintains a databank of ecologically significant sites. A memorandum of agreement between VDACS and DCR DNH facilitates data transfer between agencies and allows for DCR DNH to nominate species for listing by VDACS (Townsend, 2014).

VDOT has conducted threatened and endangered species coordination with resource agencies through field visits, pre-application meetings, and phone discussions. In addition to coordinating with resource agencies, VDOT queried threatened and endangered species databases to determine if any federal- or state-listed species have been documented within the study area. The databases include the DGIF VAFWIS and Wildlife Environmental Review Map Service (WERMS), the USFWS Information, Planning, and Conservation (IPaC) database, and the DCR-DNH online searchable database. Because of the variability in relevance of the various species "hits" returned from query results, an initial screening process was used to pare down the list of species returned from the database queries to a smaller list of species relevant to the overall study area. This initial screening process was informed using a combination of site-specific knowledge, species life history requirements, resource agency coordination, and best professional judgement.

Field habitat assessments were conducted for six species within the Inventory Corridor: northern long-eared bat, red-cockaded woodpecker, bald eagle (although no longer federally or state listed, bald eagles currently are protected under the Bald and Golden Eagle Protection Act), Dismal Swamp southeastern shrew (listed

at the time habitat assessments were conducted), Mabee's salamander, and barking tree frog. Habitat assessments were conducted April through July, 2015. Based on the results of the habitat assessment and DGIF recommendations, VDOT conducted presence/absence surveys in the Inventory Corridor for the barking tree frog and Mabee's salamander during the respective species sampling seasons in 2015.

Invasive Species

Invasive species are nonnative plant, animal, or microbial species that cause, or are likely to cause, economic or ecological harm or harm to human health (EO 13112). "Nonnative" (or "alien", "exotic", or "nonindigenous") means they have been introduced by human action, intentionally or accidentally, into a region outside their natural geographic range. Introductions can occur through a variety of pathways, including intentional transport of a species for commercial purposes, accidental introduction such as invasive plant species seeds in fill material, or intentional releases such as illegal stocking of fish or for biological control of a pest (EPA, 2012a). Invasive species found in the study area were identified through published sources and online resources. These resources included DGIF (DGIF, 2012), DCR (DCR, 2014c), Virginia Invasive Species Working Group (VISWG) (VISWG 2012 & 2014), and the Center for Invasive Species and Ecosystem Health's (CISE) Early Detection and Distribution Mapping System (EDSS) (CISE, 2014).

Mineral Resources and Unique Geological Features

Mineral resources and unique geological features were identified through published sources and online resources such as the Virginia Department of Mines, Minerals, and Energy (DMME) website.

3.4.2 Affected Environment

3.4.2.1 Water Resources and Aquatic Ecology

3.4.2.1.1 Surface Water Resources

Two major river basins are located in the study area, the James and the Albemarle-Chowan (see **Figure 3.4–1**). The James River Basin occupies the central portion of Virginia and covers 10,265 square miles or approximately 24 percent of Virginia's total land area. The eastern and northwestern portions of the study area are contained within the James River Basin. Approximately 243.6 square miles of the James River Basin lie within the study area.

The Albermarle-Chowan Basin is located in the southeastern portion of Virginia and covers 4,220 square miles or approximately 10 percent of Virginia's total area. The central and southwestern portions of the study area are contained within the Albermarle-Chowan Basin. Approximately 502.5 square miles of the Albermarle-Chowan Basin lie within the study area.

The study area contains a large number of named and unnamed perennial and intermittent streams. Of these, the Blackwater River is the most prominent and longest water course. The major surface water impoundments of Lake Burnt Mills, Lake Prince, Western Branch Reservoir, Lake Cahoon, and Lake Meade are located in the easternmost portion of the study area. In addition, the study area contains numerous small ponds, most of which are man-made.

Baseline Water Quality

To characterize existing water quality in the study area, baseline water quality data of surface water resources were compiled and assessed for highway-related contaminants using data from the final VDEQ 305(b)/303(d) report (VDEQ, 2014a). The most common contaminants in highway runoff are heavy metals,

inorganic salts, aromatic hydrocarbons, and suspended solids that accumulate on the road surface as a result of regular highway operation and maintenance activities. These materials are often washed off the highway by stormwater runoff during events of rainfall or snowmelt (FHWA, 2012c).

Baseline water quality was documented from 15 state-maintained stream monitoring stations within the study area (see **Figure 3.4-2**). These 15 stations were selected based on both their location and their period of record regarding relevant water quality parameters. The water quality monitoring data provided by VDEQ are presented in **Table 3.4-1** and **Table 3.4-2.**

Table 3.4-1: Recent Water Quality Data – Physical and Chemical Parameters Associated with Stormwater Runoff (TP, TS, SS, BOD, TOC)

Stream	Station	Year	Median Concentration of Pollutant (mg/L)				
			TP	TS	SS	BOD5	TOC
Blackwater River	5ABKR003.68	2003	0.05	--	6.70	--	--
		2004	0.07	--	5.00	--	--
		2009	--	--	--	--	--
Blackwater River	5ABLW058.22	2003	0.03	89.5	6.8	--	--
		2007	0.06	124.5	7.0	--	--
		2010	0.05	129.0	5.0	--	--
Blackwater River	5ABLW040.22	2003	0.06	79.8	4.30	--	--
		2007	0.06	130.5	3.0	--	--
		2010	0.06	127.5	5.0	--	--
Warwick Swamp	5AWKS001.00	2003	0.03	80.0	5.0	--	--
		2005	0.03	--	--	--	14.7
Otterdam Swamp	5AOTR001.26	2003					
		2006	0.10	--	5.5	--	--
		2011	0.05	--	--	--	--
Spring Branch	5ASRN001.99	2003	0.10	--	11.5	1.86	--
		2005	0.05	--	7.50	2.0	18.2
		2010	0.05	--	7.50	2.5	--
Spring Branch	5ASRN000.65	2003	0.25	--	8.30	2.86	--
		2006	0.28	--	13.50	7.0	12.8
		2010	0.55	--	18.00	5.5	--
Coppahaunk Swamp	5ACPH006.00	2002	0.06	--	9.0	3.9	--
		2007	0.05	--	6.00	7.0	--
Coppahaunk Swamp	5ACPH002.59	2003	0.06	--	8.33	--	--
		2005	0.03	--	3.5	--	--
Black Swamp	5ABLS001.58	2000	0.11	117.8	4.4	2.0	--
		2006	0.03	--	3.0	7.0	--
		2011	0.21	--	6.0	3.0	22.1
Western Branch Reservoir	2-NWB002.93	2001	0.02	72.4	4.86	2.14	--
		2007	0.04	--	--	--	--
		2009	0.03	--	--	--	--
Western Branch Reservoir	2-NWB006.56	2001	0.03	83.7	3.86	2.86	9.21
		2007	0.03	--	--	--	--
Lake Meade	2-LMD002.07	2003	0.05	88.6	4.29	2.71	--
		2007	0.04	--	--	--	--

Water quality parameter abbreviations are as follows: TP = total phosphorous; TS = total solids; SS = total suspended solids; BOD5 = biological oxygen demand; TOC = total organic carbon

Source: VDEQ, 2012b

Table 3.4-2: Recent Water Quality Data – Physical and Chemical Parameters Associated with Stormwater Runoff (NH^3, CDM, CRS, CUS, PBS, NIS, ZNS, FEM)

Stream	Station	Year	Median Concentration of Pollutant							
			(mg/L)	(mg/kg)						
			NH^3	CDM	CRS	CUS	PBS	NIS	ZNS	FEM
Blackwater River	5ABKR003.68	2003	0.04	--	--	--	--	--	--	--
		2004	0.04	--	--	--	--	--	--	--
Warwick Swamp	5AWKS001.00	2003	0.05	--	--	--	--	--	--	--
		2005	0.04	--	0.20	0.25	0.13	0.26	1.40	170.0
Otterdam Swamp	5AOTR001.26	2003								
		2006	0.05	--	--	--	--	--	--	--
Spring Branch	5ASRN001.99	2003	0.05	--	--	--	--	--	--	--
		2005	0.12	--	--	--	--	--	--	--
		2010	0.07	--	--	--	--	--	--	--
Spring Branch	5ASRN000.65	2003	0.09	--	--	--	--	--	--	--
		2006	0.07	--	--	--	--	--	--	--
		2010	0.09	--	--	--	--	--	--	--
Coppahaunk Swamp	5ACPH006.00	2002	0.08	--	--	--	--	--	--	--
		2007	--	5.0	5.0	5.0	5.0	5.0	17.5	--
Coppahaunk Swamp	5ACPH002.59	2003	0.04	--	--	--	--	--	--	--
		2005	0.04	--	--	--	--	--	--	--
Black Swamp	5ABLS001.58	2000	0.04	--	--	--	--	--	--	--
		2006	0.07	--	--	--	--	--	--	--
Western Branch Reservoir	2-NWB002.93	2001	0.04	1.0	27.8	42.9	18.9	12.0	48.4	25800
		2007	0.04	--	--	--	--	--	--	--
		2009	0.04	--	--	--	--	--	--	--
Western Branch Reservoir	2-NWB006.56	2001	0.04	1.0	48.4	387.5	46.2	26.0	127.0	64600
		2007	0.04	--	--	--	--	--	--	--
Lake Meade	2-LMD002.07	2001	0.04	1.0	8.6	13.0	15.4	5.0	35.8	7760
		2007	0.04	--	--	--	--	--	--	--

Water quality parameter abbreviations are as follows:
NH^3 = ammonia; CDM = cadmium in mud; CRS = chromium in sediment; CUS = copper in sediment; PBS = lead in sediment; NIS = nickel in sediment; ZNS = zinc in sediment; FEM = iron in sediment
Source: VDEQ 2014a

However, these data provide limited insight into the contribution of highway-related contaminants to overall baseline water quality in the study area because the data collected at these stations do not include analysis for inorganic salts or aromatic hydrocarbons, two of the most common contaminants associated with highway runoff. These data do include some heavy metals and total suspended solids data, but highway runoff is only one contributing source for some of those contaminants. These data include all sources of pollution contributing to stream degradation, not just those specifically associated with highways.

Impaired Waters

When surface waters fail to meet water quality standards sufficient to support designated use categories, they are classified as "impaired waters" under Section 303(d) of the CWA. Freshwater rivers and surface waters in Virginia are evaluated every two years on their ability to support five designated use categories: Recreation, Aquatic Life, Fish Consumption, Public Water Supply, and Wildlife. **Figure 3.4–2** shows the locations of state-listed impaired waters in the James River and Albemarle-Chowan watersheds.

Causes of impairment are largely due to bacteria, including E. coli, mercury in fish tissue, benthics, and dissolved oxygen. The major suspected sources of the impairments are nonpoint sources, wildlife,

agriculture, livestock grazing or feeding operations, atmospheric deposition, natural conditions, municipal point source discharges, unspecified domestic waste, and unknown sources. A breakdown of the suspected sources of impairment for each basin is provided in **Table 3.4-3**. According to the 305(b)/303(d) Integrated Report (VDEQ, 2014a), the largest causes of impairments within the James River Basin are bacteria (74 percent), benthics (18 percent), and dissolved oxygen (12 percent). The largest causes of impairment within the Albemarle-Chowan Basin are mercury in fish tissue (55 percent), dissolved oxygen (47 percent), and bacteria (36 percent).

Table 3.4-3: Suspected Sources of Impairment Ranked by Percentage of Impaired Water Size

James River		Albemarle-Chowan	
Suspected Source	**%**	**Suspected Source**	**%**
Nonpoint Sources	51	Unknown Sources	70
Wildlife other than Waterfowl	37	Natural Conditions	43
Unknown Sources	30	Atmospheric Deposition (Toxics)	29
Agriculture	21	Nonpoint Sources	17
Livestock Grazing or Feeding Operations	18	Wildlife other than Waterfowl	10
Unspecified Domestic Waste	18	Municipal Point Source Discharges	10

Source: VDEQ, 2014a

These issues are discussed in greater detail in the ***Natural Resources Technical Report*** (VDOT, 2014i) and the ***Supplemental Natural Resources Technical Report*** (VDOT, 2016f).

Surface Drinking Water Supplies

The study area contains portions of surface water drainage areas determined by the VDH to be important to the protection of public drinking water supplies. These drainage areas and the localities to which they are important are listed in **Table 3.4-4** and are shown on **Figure 3.4–3**.

Table 3.4-4: Drainage Areas Determined by VDH to be Important to Public Drinking Water Supplies

Drainage Area Name	Associated Locality
Appomattox River	City of Hopewell
Blackwater River	City of Norfolk (high flow augmentation)
Lake Prince	City of Norfolk
Western Branch	City of Norfolk
Millpond	City of Suffolk
Lake Kilby	City of Portsmouth
Lake Meade	City of Portsmouth

Source: VDOT 2013

The City of Norfolk owns and operates two surface drinking water supplies and intakes within the easternmost portion of the study area - the Lake Prince and Western Branch Reservoir public water supplies (City of Norfolk, 2014). Just south of the study area, the City of Norfolk owns an intake off the Blackwater River for high flow augmentation. The City of Portsmouth owns and maintains two surface drinking water supplies immediately east of (downstream of) the study area - the Lake Kilby and the Lake Meade public water supplies (City of Portsmouth, 2013). The City of Portsmouth also owns and operates an intake and water treatment plant just above the Lake Kilby dam. In addition, within the eastern portion

of the study area and immediately east of the study area, the City of Suffolk owns and operates two Millpond public water supply intakes, which withdraw waters from an impoundment on Chuckatuck Creek (City of Suffolk, 2012). The City of Hopewell owns and operates one surface drinking water supply just west of the study area on the Appomattox River (City of Hopewell, 2014).

3.4.2.1.2 Groundwater Resources

The project study area falls within the Eastern Virginia Groundwater Management Area, regulated under the Virginia Ground Water Management Act of 1992 (Code of Virginia, Title 62.1, Chapter 25), as well as 9VAC25-600-10 et seq. and 9VAC25-610-10 et seq. (VDEQ, 2014c). The purpose of this Act is to "recognize and declare that the right to reasonable control of all ground water resources within this Commonwealth belongs to the public and that in order to conserve, protect and beneficially utilize the ground water of this Commonwealth and to ensure the public welfare, safety and health, provision for management and control of ground water resources is essential" (Code of Virginia §62.1-254). Groundwater wells provide a sizeable portion of the potable water supplied by public drinking water systems within the study area. The primary groundwater resources within the study area are derived from deep wells screened within Cretaceous-age sands, which underlie much of the study area. Wells screened within shallower Tertiary-age and Pleistocene-age sediments are also capable of providing somewhat lower yielding groundwater supplies. VDH maintains records of 23 municipal public groundwater supply wells and 79 community/institutional public groundwater supply wells within the study area (see **Figure 3.4–4**). No aquifers within the study area have been designated by the EPA as sole source aquifers.

3.4.2.1.3 Floodways and 100 Year Floodplains

Areas within the study area are vulnerable to tidal flooding from major storms, commonly referred to as hurricanes and nor'easters. Both storms produce winds that push large volumes of water against the shore and may produce flooding within the floodplains within the study area. Hurricanes, with their high winds and heavy rainfall, are the most severe storms to which the study area is subjected. While hurricanes may affect the area from May through November, nearly 80 percent occur during the months of August, September, and October with approximately 40 percent occurring during September. The study area has experienced major storms since the early settlement of the area. Historical accounts of such storms date back several hundred years (FEMA 2013 and 2014).

The study area also contains numerous tidally influenced waters that are subject to tidal flooding in their lower reaches, but fluvial flooding on the upper reaches. Flooding on the upper reaches of these streams and on tributaries of the Blackwater River and other streams may be caused by heavy rains occurring any time of the year. Flood heights on these streams can rise from normal to extreme flood peaks in a relatively short period of time. During all major floods, high-velocity flood flows and hazardous conditions would exist in the main stream channel (FEMA, 2013 and 2014). Hurricanes, nor'easters, and other heavy rains have historically affected the easternmost portion of the study area more than the western portion. Tropical storms are responsible for some of the larger floods.

FEMA identifies the floodways along rivers and streams, where the channel of the stream and any adjacent floodplain areas must be kept free of encroachments to prevent substantial increases in flood height. FEMA mapping has identified regulated floodways along the following: Blackwater River, Blackwater Swamp, Bailey Creek, Chappell Creek, Manchester Run, Powell Creek, Walls Run, and Wards Creek. Because the concept of a floodway does not apply to areas of tidal flooding, FEMA has designated no floodways for the James or Pagan Rivers or their estuaries.

The Blackwater River, including the Blackwater Swamp that forms its headwaters, is the longest and largest stream traversing the Route 460 study area. Floodplain elevations (for the 100-year storm event) along the Blackwater River range from 32.8 feet (National Geodetic Vertical Datum (NGVD)) where the river flows out of the study area in Isle of Wight County (FEMA, 2014) to approximately 112 feet (NGVD) where Blackwater Swamp flows into the Route 460 study area in Prince George County (FEMA, 2013b). **Figure 3.4–5** depicts the FEMA regulated floodways and 100-year floodplains within the study area.

There are no existing flood control structures that would provide protection during major floods within the study area.

3.4.2.1.4 Wetlands

Wetlands in the study area are principally classified as Palustrine systems under Cowardin Classification. These are non-tidal wetlands and have been broadly classified within the study area into three major categories: Palustrine Emergent (PEM), Palustrine Scrub-Shrub (PSS), and Palustrine Forested (PFO) wetlands (see **Figure 3.4-6**). Descriptions of these wetland categories are provided below and supporting data along with species composition are provided in the ***Supplemental Natural Resources Technical Report*** (VDOT, 2016f).

Palustrine Emergent Wetlands

Non-tidal PEM wetlands are dominated by herbaceous (non-woody) vegetation (Cowardin, et.al. 1979). All study area watersheds contain a substantial amount and multiple types of PEM wetlands. Some are naturally occurring PEM wetlands, while others are artificially maintained in an emergent state due to a variety of reasons. The naturally occurring PEM wetlands typically result from inundation for too long of a duration during the growing season to allow ready succession by woody species. Typical species include softstem bulrush (*Juncus effusus*), switchgrass (*Panicum virgatum*), deertongue (*Dichanthelium clandestinum*), sweet flag (*Acorus calamus*), blunt spikerbush (*Eleocharis obtusa*), smartweed (*Polygonum punctatum*), rice cutgrass (*Leersia oryzoides*), and common cattail (*Typha latifolia*).

Artificially maintained PEM wetlands identified within the study area include wetlands along utility easements and roadway rights-of-way, along with farmed wetlands (primarily pastures). Utility easements and roadway rights-of-way are usually maintained in an emergent state by mowing or herbicide application, while the pastures are maintained in this state by livestock grazing and trampling. In wetter portions of maintained utility easements and roadway rights-of-way, the emergent vegetation species are similar to the naturally occurring PEM wetlands. The pasture emergent wetlands typically exhibit low species diversity due to the constant disturbance and grazing from livestock. Commonly occurring species in these wetlands include species that are less preferred as forage by the livestock, and that are readily adaptable to disturbance, such as common soft rush (*Juncus effusus*), wartremoving herb (*Murdannia keisak*), hairy buttercup (*Ranunculus sardous*), and curly dock (*Rumex crispus*).

Palustrine Scrub-Shrub Wetlands

The PSS wetlands identified within the study area consist primarily of mid-successional wetland communities transitioning towards forested communities, semi-permanently flooded vegetated fringe communities around permanent water bodies, and semi-permanently or temporarily flooded riparian communities along low-gradient Coastal Plain small-stream swamp systems. A large portion of the PSS wetlands consist of recently harvested forested communities that are in early to mid-successional stages of regeneration. The location of these recently harvested communities in the landscape generally dictates the

composition of the species occurring in each particular area. The PSS wetlands occurring as semi-permanently flooded are typically found around many of the manmade ponds along the corridor.

The PSS wetlands occurring in semi-permanently or temporarily flooded riparian communities are found along low-gradient Coastal Plain small-stream swamp systems. These communities generally have not resulted from human activity and timber harvesting, but rather have resulted from beaver-induced backflooding, followed by the subsequent death of non-flood tolerant tree species and harvesting of other flood tolerant tree species by beavers. These areas typically have a mix of open water, emergent wetlands areas, shrub hummocks, and scattered stands of tree species tolerant of deeper and longer durations of flooding. The true shrubs in these communities include species tolerant of permanently or semi-permanently flooded conditions, such as swamp azalea (*Rhododendron viscosum*) and possumhaw viburnum (*Viburnum nudum*), but some other less flood tolerant species are often found growing on hummocks formed from old decaying tree stumps, such as wax myrtle (*Morella cerifera*) and highbush blueberry (*Vaccinium fuscatum*).

Palustrine Forested Wetlands

The PFO wetlands identified along the corridor include flatwoods and riparian wetlands located along narrow headwater ephemeral streams, intermittent streams, large stream floodplains, and small-stream swamp systems. All of these wetlands are ultimately connected hydrologically to the larger Coastal Plain small-stream swamp systems.

The forested wetlands associated with the large flatwoods typically occur at some of the highest elevations in the landscape. These large flats are primarily precipitation and groundwater-driven systems, where the groundwater rises to the surface in the winter and spring, then draws back down in the summer and fall. When the groundwater from these systems is discharged at the surface, the water discharges down ephemeral drainageways or flows out of the side slopes as seeps that discharge downslope to nearby swamp systems. The hydrologic regimes of these systems appear to be closely linked to underlying geology and soil composition and structure. The flatwoods located on the Rains Fine Sandy Loam soil series in the study area also tend to be considerably wetter than the flatwoods located on the Slagle, Craven, Eunola, and Eulonia soil series, but not quite as wet as the Myatt Loam flatwoods. Historically, Rains soil flatwoods were often dominated by pond pine (*Pinus serotina*), but this species is now rarely encountered and has been largely replaced by planted loblolly pine (*Pinus taeda*). Some pond pine is encountered in Rains soil flatwoods in Suffolk. The commonly encountered trees in Rains flatwoods are the same species encountered in the seasonally saturated portions of the Myatt Loam flatwoods. The shrub layer is generally similar as well, but in some locations was observed to support species more often associated with pocosins.

The forested riparian wetlands located along ephemeral and intermittent headwater streams are most often encountered as narrow belts of forest passing through agricultural fields, but occasionally they occur in areas where the entire tract is forested. Hydrology is quite variable in these wetlands from year to year and season to season and is largely driven by surface runoff. Groundwater also contributes to hydrology, but typically further downstream.

Under the broad grouping of forested riparian wetlands associated with larger stream floodplains and small-stream swamp systems, three major subgroups were observed. The first of these subgroups occurs along the floodplains of some of the larger streams in Prince George County and the western half of Sussex County (that are not swamp systems). Green ash (*Fraxinus pennsylvanica*) and red maple (*Acer rubrum*) dominates the tree canopy, with a variety of other species scattered along the floodplain, including willow

oak (*Quercus phellos*), water oak (*Quercus nigra*), sweet gum (*Liquidambar styraciflua*), black gum (*Nyssa sylvatica*), box elder (*Acer negundo*), and tulip poplar (*Liriodendron tulipifera*). The understory in these areas is dominated by ironwood (*Carpinus caroliniana)*, American holly (*Ilex opaca*), several highbush blueberry (*Vaccinium*) species, and sweet pepperbush (*Clethra alnifolia*).

The second subgroup occurs along the floodplains of larger Coastal Plain small-stream swamp systems in Prince George County, Sussex County, and the western portion of Southampton County. The dominant tree canopy species are red maple and water tupelo (*Nyssa biflora*), with a few areas supporting bald cypress (*Taxodium distichum*). These swamp systems are typically underlain by silts and clayey soils, with a near-neutral pH. These swamp systems are sometimes referred to as "brownwater" swamps, because the water is often turbid from the frequent re-suspension of fine silty sediments.

Along the floodplains of the larger Coastal Plain small-stream swamp systems in the eastern portion of Southampton County, Isle of Wight County, and the City of Suffolk, bald cypress replaces water tupelo as the dominant tree canopy species, although tupelo still can be found. These swamp systems are typically underlain by sandy organic soils with low pH. These swamp systems are sometimes referred to as "blackwater" swamps because of their clear tea-colored water resulting from leaching of the organic material. These swamps are classified as "high value wetlands" as defined in Virginia's wetland regulations when 10 percent or more (singly or in combination) in a vegetative stratum of Atlantic white cedar (*Chamaecyparis thyoides*), bald cypress , water tupelo (*Nyssa aquatic*), or overcup oak (*Quercus lyrata*) are present.

Wetlands within the study area, independent of Cowardin classification and vegetative cover type, can alternatively be grouped into three subclasses based on their geomorphic setting, water sources, and hydrodynamics: bottomland hardwood forests, bald cypress/tupelo swamps, and wet flatwoods. Following is a brief description of each wetland subclass, followed by a description of the general functions that each type of wetland performs.

Bottomland Hardwood Forest

Bottomland hardwood forests within the study area can generally be described as hardwood dominated forests located in floodplains and river terraces. These communities may be classified under the Cowardin wetland classification system as palustrine forested with non-tidal wetland regimes that vary from semi-permanently flooded to intermittently exposed, permanently flooded, saturated, intermittently flooded, or temporarily flooded (Cowardin et al., 1979). Further classification describes these systems in a geomorphic context as low-gradient alluvial wetlands (Brinson, 1993). *The Natural Communities of Virginia: Classification of Ecological Community Groups* (Fleming et al., 2013) categorizes such wetlands as Coastal Plain/Piedmont bottomland/floodplain forests represented by wetlands not dominated by bald cypress or tupelo (Nyssa spp.).

Wetland hydrodynamics are dominated by unidirectional flow where flow velocities correspond with low-gradient landforms. Singular or multiple inflow points can be present while outlets are generally unobstructed, and typically convey surface hydrology to downstream resources. Lateral migration is present in periods when groundwater discharge or precipitation events exceed soil permeability. Chemically reduced soil matrices that are formed as a result of a fluctuating water table generally display strong redoximorphic features including concentrations, depletions, and other features indicating chemical reduction and oxidation of iron and manganese compounds.

Vegetation within the canopy of bottomland hardwood forests is generally composed of species including red maple, black gum, water oak, laurel oak (*Quercus laurifolia*), sweet gum, green ash, American holly, willow oak, and sweet bay (*Magnolia virginiana*). The scrub shrub stratum is composed of shrubs and shrub sized tree species including black willow (*Salix nigra*), possumhaw viburnum, coastal sweet pepper bush, and highbush blueberry. The herbaceous stratum is composed of broadleaf cattail (*Typha latifolia*), lizard's tail (*Saururus cernuus*), Virginia iris (*Iris virginica*), spotted lady's thumb (*Persicaria maculosa*), spotted touch-me-not (*Impatiens capensis*), netted chain fern (*Woodwardia areolata*), cinnamon fern (*Osmunda cinnamomea*), giant cane (*Arundinaria tecta*), soft rush , and various sedge species (*Carex* spp.). The vine stratum is characterized by greenbrier (*Smilax rotundifolia*), laurel greenbrier (*Smilax laurifolia*), poison ivy (*Toxicodendron radicans*), and Japanese honeysuckle (*Lonicera japonica*).

Bald Cypress/Tupelo Swamps

Bald cypress/tupelo swamps within the study area are associated with inundated forested areas typically located along watercourses. These communities may be classified under the Cowardin wetland classification system as palustrine forested with non-tidal wetland regimes that vary from semi-permanently flooded to intermittently exposed, or permanently flooded (Cowardin et al., 1979). Further classification describes these systems in a geomorphic context as low-gradient alluvial wetlands (Brinson, 1993). *The Natural Communities of Virginia: Classification of Ecological Community Groups* (Fleming et al., 2013) categorizes such wetlands as bald cypress/tupelo swamps represented by wetlands dominated by bald cypress and tupelos. Wetland hydrodynamics are similar to bottomland hardwood forests within the study area.

Vegetation within the canopy of bald cypress/tupelo swamps is generally composed of bald cypress, water tupelo and swamp tupelo. Occasionally, green ash, red maple, overcup oak , and American elm (*Ulmus americana*) are found in the canopy, but are more commonly understory trees. Carolina ash (*Fraxinus caroliniana*) is often dominant in the shrub layer. The herbaceous stratum is sparse to seasonally lush, and commonly includes lizard's tail, false nettle (*Boehmeria cylindrica*), greater marsh St. John's-wort (*Hypericum walteri*), small beggar-ticks (*Bidens discoidea*), weak stellate sedge (*Carex seorsa*), giant sedge (*Carex gigantea*), taper-leaf water horehound (*Lycopus rubellus*), and catchfly cutgrass (*Leersia lenticularis*).

Wet Flatwoods

Wet flatwoods communities within the study area were historically mixed hardwood communities that, through human disturbance, have been mostly converted to silvicultural and agricultural use. The wet flatwoods communities within the study area consist mostly of crop fields, pastures, loblolly pine plantations, and early to mid-successional pine-hardwood communities. These communities may be classified under the Cowardin wetland classification system as palustrine forested with non-tidal wetland regimes that vary from saturated to intermittently flooded, or temporarily flooded (Cowardin et al., 1979). Further classification describes these systems in a geomorphic context as low-gradient non-alluvial wetlands (Brinson, 1993). The *Natural Communities of Virginia: Classification of Ecological Community Groups* (Fleming et al., 2013) categorizes such wetlands as Non-Riverine Flatwoods and Swamps.

Wetland hydrodynamics are generally fed by precipitation with water loss through evapotranspiration, with some retention of floodwaters within depressions; groundwater is also a seasonal component of the hydrodynamics in these systems. Wet flatwoods generally lack inlets, while outlets, when present, are generally intermittent or restricted. Lateral migration is present in periods when groundwater discharge/precipitation events exceed soil permeability, although this duration is decreased in higher slope

gradients. Chemically reduced soil matrices with strong redoximorphic features provide evidence that there is seasonal vertical fluctuation of the water table.

Vegetation within wet flatwoods varies depending upon whether the communities are under active or historic silviculture, how recently it has been logged, dominance of pine, and to what degree the understory has been manipulated. Late-successional stands of wet flatwoods include swamp chestnut oak (*Quercus michauxii*), cherrybark oak (*Quercus pagoda*), willow oak, laurel oak, water oak, pin oak (*Quercus palustris*), and white oak (*Quercus alba*). Common understory species include ironwood, giant cane, American holly, coastal sweet pepper bush, sweetbay magnolia, coastal dog-hobble (*Leucothoe axillaris*), and highbush blueberry. Herb layers usually contain netted chain fern and a variety of sedges. Late successional stands of wet flatwoods are greatly reduced in extent due to agricultural clearing and silviculture. Early to mid-successional wet flatwoods, which are prevalent throughout the study area, include sweet gum, red maple, pond pine, and loblolly pine in the canopy. Understory species typically consist of sweetbay magnolia, black gum, red bay (*Persea palustris*), coastal dog-hobble, and giant cane.

Wetland Functions

Wetland functions are self-sustaining properties of a wetland ecosystem that exist in the absence of society without regard to subjective human values (USACE, 1999). Wetlands within the study area serve a variety of functions that benefit the wetland and the wetland's watershed. These include, but are not limited to, habitat for fish, wildlife, and plants; improving water quality and hydrology; flood protection; protecting shorelines and stream banks from erosion; economic benefit; and recreation, education, and research (EPA, 2016).

3.4.2.1.5 Navigable Waters of the U.S. (Section 10 Waters)

The Blackwater River is the only navigable water of the U.S. within the study area subject to regulation under Section 10 of the Rivers and Harbors Act of 1899 (as determined by the Norfolk District USACE).

3.4.2.1.6 Waterways, Waterbodies, and Associated Deepwater Habitat

The study area contains a large number of named and unnamed perennial and intermittent streams (see **Figure 3.4–7**). Of these, the Blackwater River is the most prominent and longest stream course. The major surface water impoundments of Western Branch Reservoir, Lake Prince, Lake Cahoon, and Lake Meade are located in the easternmost portion of the study area. In addition, the study area contains numerous small ponds, most of which are man-made.

The study area falls within four sub-basins, the Hampton Roads, the Blackwater, the Nottoway, and the Lower James. The Hampton Roads and Lower James sub-basins drain to the James River and ultimately the Chesapeake Bay; whereas, the Blackwater and Nottoway sub-basins drain to the Chowan River and, ultimately, the Albemarle Sound in North Carolina. All streams located within the study area drain to the Chesapeake Bay or Albemarle Sound.

Deepwater habitat that can be found within the overall study area is comprised of estuarine, lacustrine, riverine, and palustrine unconsolidated bottom habitats. Resource areas containing the largest proportion of deepwater habitat occur along the lower reaches of the Blackwater River and the several reservoirs located in the study area. Lacustrine habitats are comprised of abandoned millponds and other impoundments scattered throughout the study area, along with the public water supply reservoirs located in eastern Isle of Wight County and the City of Suffolk. Several ponds located along some of the larger perennial streams and larger farm ponds located throughout the study area provide additional smaller areas

of deepwater palustrine habitat. These larger ponded areas, reservoirs, and the Blackwater River provide aquatic habitat as well as recreational opportunities.

All the study area watersheds have a significant amount of palustrine waters with unconsolidated bottom (PUB). These waters are permanently to periodically flooded and have a substrate of sand, gravel, mud, or cobble. Jurisdictional ditches, for the purposes of classification, were added to the PUB category. The PUBs along the corridor consist primarily of manmade ponds (which are palustrine open water (POW)) and conveyance ditches. These ponds have been created by the damming of stream drainages, excavation in wet flats, excavation in sandy deposits for the purposes of obtaining borrow material, and excavation to provide irrigation water for agricultural use. The water quality in these ponds can be quite variable depending on the source of runoff supplying the pond's hydrology, which can include chemicals from agricultural practices, or if the hydrology of the pond is groundwater driven. Ditches have been created to drain low lying areas, and have the ability to transfer pollutants downstream in the watershed.

3.4.2.1.7 Wild and Scenic Rivers

There are no National Wild and Scenic Rivers located in or immediately downstream of the Route 460 study area.

According to the Virginia Outdoors Plan (DCR, 2013), there is one state Scenic River that occurs within the study area – a portion of the Blackwater River – which was designated a state Scenic River in 2010 (see **Figure 3.4–8**). The Scenic River status for this section of the Blackwater River extends 56 miles, beginning at Proctor's Bridge at U.S. Route 621, approximately five miles north of the community of Ivor, and terminating at the Virginia-North Carolina border where it joins the Nottoway River to form the Chowan River (DCR 2009a). Approximately 15 miles of the Scenic River segment of the Blackwater River runs through the study area. The State Scenic River status was recommended for the Blackwater River due to the aesthetic and recreational qualities, its environs, the unique flora and fauna, and the historic setting of this river section.

The Blackwater River is a free-flowing, undefined, meandering river predominately forested with swamps, earthen bluffs, and occasional development. The corridor is primarily undeveloped, with the largest developed area being Zuni, located at the intersection of the Blackwater River and Route 460. Most other development along the river has occurred along roads at intersections of bridges where other small communities have developed (DCR, 2009a). The river fully supports various aquatic life, wildlife, and recreation uses.

3.4.2.1.8 Coastal Zone Management Resources

The CMA is comprised of 29 counties, 15 cities, and 42 incorporated towns. It includes 5,000 miles of shoreline, the Potomac, Rappahannock, York, and James Rivers, and all of the waters therein. In addition, it encompasses parts of the Chesapeake Bay and Albemarle-Pamlico Sound watersheds and the entire watershed of Virginia's Atlantic Coast out to the three nautical mile Territorial Sea Boundary. Three counties and one city in the study area are in the CMA: the Counties of Isle of Wight, Prince George, and Surry, and the City of Suffolk.

All portions of the study area are in Maintenance/Attainment for all criteria pollutants. Impacts to coastal lands would result from point and non-point pollution resulting from land disturbing activities in Chesapeake Bay Preservation Areas. Although portions of Prince George, Surry, and Isle of Wight

Counties and the City of Suffolk are in Virginia's Coastal Zone, the majority of the study area is outside the jurisdiction of the CZMP.

3.4.2.1.9 Aquatic Biology

A wide diversity of aquatic habitat is present within the study area which provides valuable resources (food, shelter, etc.) for many aquatic and water-dependent species. Riparian corridors along the Blackwater River and larger tributaries contribute to regional biodiversity. The biodiversity of certain stream segments has been adversely affected by nonpoint pollution (increased sedimentation, nutrient loading, and fecal coliform) over a long history of silvicultural and agricultural practices (particularly those associated with livestock management). The biodiversity of streams in urbanized areas has been affected by channel modifications and by point and nonpoint pollution. Biodiversity-ranked (BRANK) aquatic communities known as Stream Conservation Units (SCUs) designated by Virginia DCR DNH are discussed in more detail in the Regional Biodiversity section of this Chapter below.

Fish Species and Associated Habitat

The study area contains a variety of aquatic habitat including coastal plain streams, stream swamp systems, ponds, and rivers. These varied aquatic habitats contain a wide diversity of fish species. Based on a review of DGIF's Fish and Wildlife Information Service (DGIF, 2014a), 99 species are known or have the potential to occur in the study area (see the ***Supplemental Natural Resources Technical Report*** (2016f)). Members of the sunfish (*Lepomis* spp.), darter (*Percina* spp. and *Etheostoma* spp.), dace *(Rhinichthys* spp. and *Clinostomus* spp.), minnow (*Pimephales* spp. and *Hybognathus* spp.), and shiner (*Notropis* spp., *Notemigonus* spp., *Cyprinella* spp., and *Luxilus* spp.) families have been recorded. Game species such as largemouth bass (*Micropterus salmoides*), smallmouth bass (*Micropterus dolomieu*), and bluegill (*Lepomis macrochirus*) have been documented (DGIF 2014a). Other recreationally important fish species found in the study area include channel catfish (*Ictalurus punctatus*), bowfin (*Amia calva*), yellow perch (*Perca flavescens*), and chain pickerel (*Esox niger*). All fisheries in the study area are warmwater fisheries. There are no Natural Trout Waters or Stockable Trout Waters located within the study area (DGIF, 2014a).

Numerous intermittent streams are located in the study area and typically do not support permanent populations of fish; however, they provide seasonal breeding grounds for some fish species and temporary refuge for juveniles. Additionally, intermittent streams are important to fish resources primarily as seasonal sources of water and nutrients delivered downstream to more suitable fish habitats. Intermittent stream channels contribute nutrients to downstream reaches from primary production and leaf litter. Productivity of perennial streams depends on delivery of materials from intermittent stream channels (Reid and Ziemer, 1994).

Native and non-native fish species have been introduced to the study area through stocking of farm ponds by private landowners. Farm ponds are generally stocked with gamefish by landowners for private recreation. Commonly stocked fish include largemouth bass, bluegill, redbreast sunfish (*Lepomis auritus*), pumpkinseed (*Lepomis gibbosus*), black crappie (*Pomoxis nigromaculatus*), red-ear sunfish (*Lepomis microlophus*), and channel catfish (DGIF, 2014a). Many of the stocked fish species have escaped the original stocking location into adjacent streams, expanding the range of these species.

Essential Fish Habitat (EFH) is defined by the Magnuson-Stevens Fishery Conservation and Management Act, amended in 1996, as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (16 U.S.C. 1802 (10)). EFH regulations apply largely to marine fisheries, but are also applicable to freshwater spawning waters for anadromous species. The study area is located generally in

the divide between the James River/Chesapeake Bay and the Blackwater-Chowan River/Albemarle Sound drainages. Both drainages have several species of anadromous fish; however, no designated anadromous fish waters are located within the study area. The closest designated anadromous fish water is located on the Blackwater River with the upstream boundary located approximately one mile above Rt. 603 in Isle of Wight County. No EFH is located within the study area.

Benthic Communities

Benthic macroinvertebrates are common inhabitants of streams and ponds within the study area. These organisms usually inhabit bottom substrates for at least part of their life cycle. Macroinvertebrates commonly found include arthropods, annelids, crustaceans, and mollusks. Arthropods observed in study area water bodies include mayflies (Order *Ephemeroptera*), stoneflies (Order *Plecoptera*), caddisflies (Order *Trichoptera*), true bugs (Order *Hemiptera*), dragonflies (Order *Odonata-Anisoptera*), damselflies (Order *Odonata-Zygoptera*), true flies (Order *Diptera*), and butterflies/moths (Order *Lepidoptera*). Annelids include leeches (Order *Hirudinea*) and oligochaete worms (Orders *Haplotaxida* and *Opisthopora*). Crustaceans and mollusks include freshwater clams (Order *Veneroida*), aquatic snails (Order *Gastropoda*), freshwater mussels (Order *Unionoida*), and crayfish and shrimp (Order *Decapoda*). According to the VDEQ EDAS database (VDEQ, 2014d), over 150 families of benthic macroinvertebrates have been observed in Virginia's Coastal Plain streams and ponds over the last four years. The most abundant families include *Chironomidae*, *Hydropsychidae*, *Elmidae*, *Heptageniidae*, and *Ephemerellidae*. Because different groups of macroinvertebrates have different tolerances to the chemical and physical characteristics of water bodies, the species compositions within different water bodies may differ depending on the bottom substrate and quality of the water.

Waterfowl and Other Water-Dependent Migratory Birds

Waterfowl occur in a wide variety of habitats including agricultural fields, forests, and wetlands; however, waterfowl generally depend on the aquatic habitats within the study area for food and nesting habitat. Riparian areas along both perennial and intermittent channels and ponds are particularly rich in insects and fruit, providing important food sources for water-dependent species. Many species prefer patches of riparian vegetation as a part of their territory, even if they do not depend fully upon them. Additionally, the streams and ponds provide habitats for aquatic plants, aquatic invertebrates, fish, and amphibians, which in turn provide food resources for waterfowl. River segments with open tree canopy, farm ponds, and the wetlands surrounding these areas provide suitable habitat for a variety of waterfowl. More stable wetland communities contain mature living trees and standing dead trees suitable for cavity nesting species. Agricultural fields lack plant diversity and have a relatively high level of disturbance compared to wetland habitats, which limits their desirability by wildlife. However, depending on the time of year and type of crop, water-dependent species could use agricultural lands on a limited basis for refuge and foraging.

Waterfowl and wading species that occur in the study area include double-crested cormorant (*Phalacrocorax auritus*), great blue heron (*Ardea herodias*), green heron (*Butorides virescens*), great egret (*Ardea alba egretta*), tricolored heron (*Egretta tricolor*), Canada goose (*Branta canadensis*), mallard (*Anas platyrhynchos*), American black duck (*Anas rubripes*), hooded merganser (*Lophodytes cucullatus*), and wood duck (*Aix sponsa*) (DGIF, 2014a). Although the majority of these species occur primarily as winter residents or spring and fall migrants, great blue heron, green heron, Canada geese, mallards, and wood ducks nest within the study area.

Waterways, water bodies, and wetlands within the study area provide suitable habitat for a number of migratory bird species that are dependent on aquatic habitat for at least a portion of their life cycle. VFWIS

identifies 100 water-dependent migratory bird species listed for protection under the Migratory Bird Treaty Act that have the potential for occurrence within the study area (DGIF, 2014a) (see the ***Supplemental Natural Resources Technical Report*** (VDOT, 2016f)). Out of the 100 water-dependent species, there were six species listed as a "Species of Management Concern" for the northeast region (USFWS, 1995). The "reason for concern" for two of these species (least bittern and northern harrier) is reported to be "dependence on vulnerable or restricted habitats". For the remaining four species, the USFWS-designated "reason for concern" is not directly linked to habitat loss. While VAFWIS indicates that 100 water-dependent species potentially exist within the study area, only 18 of these species have been recorded within the study area. American bittern and northern harrier are the only water-dependent migratory bird species observed within the study area that are listed as "Species of Management Concern".

Other Wildlife Species Associated with Aquatic Habitats

Aquatic habitats (including open waters and wetlands) provide food sources and denning for water-dependent animals. Aquatic habitats, including their associated riparian zones, may also be used as travel corridors within and between watersheds. Open water habitats may provide escape from terrestrial predators. Several water-dependent mammals, including river otter (*Lutra canadanesis*), beavers (*Castor canadensis*), marsh rice rats (*Oryzomys palustris*), and muskrats (*Ondatra zibethicus*) have been observed in streams and wetlands within the study area. The northern water snake (*Nerodia sipedon sipedon*) and northern copperhead (*Agkistrodon contortrix mokasen*) are also commonly found in wetlands within the study area, as are several species of aquatic turtles, including the eastern mud turtle (*Kinosternon subrubrum subrubrum*), eastern musk turtle (*Sternotherus odoratus*), northern red-bellied cooter (*Pseudemys rubriventris*), snapping turtle (*Chelydra serpentine*), eastern painted turtle (*Chrysemys picta*), and spotted turtle (*Clemmys guttata)* (DGIF, 2014a).

Amphibians are also very common in aquatic habitats of the study area. Most amphibians require open water to breed, and some need open water throughout the year to support their life cycles. Intermittent streams may be particularly important for young amphibians because these streams on average support fewer predators than perennial streams. Numerous ephemeral ponds scattered throughout the mineral flatwoods within the study area also provide breeding habitat for amphibians, including listed threatened and endangered species such as the barking tree frog (*Hyla gratiosa*), the Mabee's salamander (*Ambystoma mabeei*), and the eastern tiger salamander (*Ambystoma tigrinum*). Several species of frogs have been recorded or observed within the study area. These species include the eastern cricket frog (*Acris crepitans*), Brimley's chorus frog (*Pseudacris brimleyi*), Cope's gray tree frog (*Hyla chrysoscelis*), northern spring peeper (*Pseudacris crucifer*), southern chorus frog (*Pseudacris nigrita*), American bullfrog (*Lithobates catesbeianus*), southern leopard frog (*Lithobates sphenocephalus utricularius*), and the green frog (*Lithobates clamitans*). Common toads are the American toad (*Anaxyrus americanus*), southern toad (*Anaxyrus terrestris*), and Fowler's toad (*Anaxyrus fowleri*). Salamander and newt species that have been recorded and observed include the red-spotted newt (*Notophthalmus viridescens*), northern red-backed salamander (*Plethodon cinereus*), marbled salamander (*Ambystoma opacum*), and spotted salamander (*Ambystoma maculatum*) (DGIF, 2014a).

3.4.2.2 Terrestrial Resources

3.4.2.2.1 Natural Communities, Wildlife Habitat, and Biodiversity

Portions of the study area have experienced noticeable alterations over the past several hundred years, primarily due to human activity. Agricultural and forestry practices throughout the study area as well as urbanization along the railroad and Route 460 and other major thoroughfares has removed, altered, and

encroached on the various terrestrial and palustrine wildlife habitats found in the study area; however, some remain relatively unaltered. The major terrestrial systems identified within the study area include hardwood and pine forests (which include palustrine systems), agricultural lands (cropland and pasture), and brush/old field communities. The forested portions of these systems are made up of a variety of natural communities that provide greater opportunity for biodiversity than the agricultural lands and brush/old field communities. Areas with greater human-induced disturbance include current and former agricultural fields, as well as recent clearcuts that have yet to regenerate to forested systems.

Natural Communities

The study area contains three main terrestrial forest types: (1) deciduous forest, (2) evergreen forest, and (3) mixed evergreen/deciduous forest (NOAA, 2010a). Terrestrial forest types comprise approximately 51 percent of the study area (or 242,414 acres out of the 477,058-acre study area). Of this forested total, approximately 25 percent (or 59,983 acres) is comprised of deciduous forest, approximately 36 percent (or 88,475 acres) is comprised of evergreen forest, and approximately 39 percent (or 93,956 acres) is comprised of mixed evergreen/deciduous forest. The majority of the forest lands in the study area are fragmented by agricultural lands and road corridors and, to a lesser extent, by residential and commercial development (see **Figure 3.4–9)**.

For purposes of this study, these forest types can be correlated to natural community types, as defined under *Natural Communities of Virginia: Classification of Ecological Groups and Community Types* (Fleming et al, 2013). These forest communities are described in greater detail below and their correlation to Virginia Natural Communities is presented in **Table 3.4-5**. Although not formally recognized under the *Natural Communities of Virginia*, pine plantations within the study area can be thought of as an early-successional planted-pine variant of the Non-Riverine Flatwoods and Swamps.

Deciduous Forests

Upland deciduous forests in the study area are primarily made up of low elevation mesic forests, including Mesic Mixed Hardwood Forests and Piedmont/Coastal Plain Oak-Beech/Heath Forests. These occasionally occur on north-facing slopes or bluffs, but are more often found on interstream (the area between streams) moist flatwoods. Repeated logging has reduced their extent in the Coastal Plain. Mesic Mixed Hardwood Forests typically occupy moist uplands, ravines, lower slopes, and well-drained “flatwoods” on acidic, relatively nutrient-poor soils. The Piedmont/Coastal Plain Oak-Beech/Heath Forests within the study area are spread widely and occupy relatively small patches in the overall landscape. They are very similar to Mesic Mixed Hardwood Forests but tend to occupy drier, steeper slopes. The wildlife utilizing these habitats includes many habitat generalists, but relatively few habitat specialists. The deciduous hardwood forests provide important sources of both hard and soft mast that are eaten by many bird and mammal species. Additionally, the oaks and beech trees often develop heart rot, allowing cavities to form that many species use as denning or nesting sites. As much as 42 percent of the bird and mammal species using these forests are cavity nesting or denning species (Benyus, 1989). Many common mammals, birds, reptiles, and amphibians utilize these habitats, as listed in the ***Natural Resources Technical Report*** (VDOT, 2014i).

Table 3.4-5: Ecosystem Classification Cross-Reference

C-CAP[1] Land Cover Classification (% of Forested Study Area)	Total Acreage of Habitat Within Study Area	Terrestrial Habitats	Natural Communities of Virginia
Deciduous Forest (25%)	59,983	Southern Atlantic Coastal Plain Mesic Hardwood Forest	Mesic Mixed Hardwood Forests
		Southern Piedmont Mesic Forest/ Northern Atlantic Coastal Plain Hardwood Forest	Piedmont/Coastal Plain Oak-Beech/Heath Forests
		Atlantic Coastal Plain Blackwater Stream Floodplain Forest	Bald Cypress-Tupelo Swamps
		Southern Piedmont Large Floodplain Forest	Coastal Plain/Piedmont Bottomland Forests
Evergreen Forest (36%)	88,475	Southern Piedmont Dry Oak-Pine Forest	Loblolly Pine Savannas
		Pine Plantation /Horticultural Pines	Non-Riverine Flatwoods and Swamps, Planted-Pine Variant
Mixed Forest (39%)	93,956	Atlantic Coastal Plain Upland Longleaf Pine Woodland	Pine/Scrub Oak Sandhills
		Atlantic Coastal Plain Peatland, Pocosin, and Canebrake	Pond Pine Woodlands and Pocosins

[1] Adapted from National Oceanic and Atmospheric Administration's (NOAA) Coastal Change Analysis Program (C-CAP)
Source: Ferree & Anderson 2013, NOAA 2010, and Fleming et al, 2013.

The primary wetland natural communities that are dominated by deciduous forest include Bald Cypress-Tupelo Swamps and Coastal Plain/Piedmont Bottomland Forests. Floodplain Ponds and Pools, Semipermanent Impoundments, and Coastal Plain Depression Wetlands occur in study area deciduous forest wetlands, but are present in a lesser amount.

Bald Cypress-Tupelo Swamps are seasonally to semi-permanently inundated. Because this habitat is typically flooded for long periods of time, the wildlife that most commonly utilize this habitat type includes aquatic species and tree canopy species. Mammals encountered in this community include water loving species such as the river otter and beaver, and tree dwelling species such as raccoon (*Procyon lotor*) and Virginia opossum (*Didelphis virginiana*). Bird species commonly encountered include great blue heron, wood duck, double-crested cormorant, barred owl (*Strix varia*), red-shouldered hawk (*Buteo lineatus*), pileated woodpecker (*Hylatomus pileatus*), red-bellied woodpecker (*Melanerpes carolinus*), hooded merganser, belted kingfisher (*Ceryle alcyon*), northern parula (*Parula americana*), prothonotary warbler (*Protonotaria citrea*), common grackle (*Quiscalus quiscula*), and American woodcock (*Scolopax minor*). Reptiles and amphibians occurring in this habitat type include mud snake (*Farancia abacura*), rainbow snake (*Farancia erytrogramma*), northern copperhead, northern water snake, red-belly water snake (*Nerodia erythrogaster*), and a number of turtle and frog species.

Coastal Plain/Piedmont Bottomland Forests are a community with much variation across the landscape. They include temporarily to seasonally flooded floodplains and terraces with a wide array of species. These forests serve as important wildlife corridors in the study area. Wildlife utilizing this habitat type includes many of the species found in the Cypress-Tupelo community, but also include more terrestrial species that use the habitat to move from area to area. Mammals utilizing these riparian corridors include many of the aforementioned species, as well as coyote (*Canis latrans*), bobcat (*Felis rufus*), mink (*Mustela vison*),

striped skunk (*Mephitis mephitis*), southeastern shrew (*Sorex longirostris*), and southern short-tailed shrew (*Blarina carolinensis*). Bird species using these forests include red-shouldered hawk, sharp-shinned hawk (*Accipiter striatus*), barred owl, eastern screech owl (*Otus asio*), American crow (*Corvus brachyrhynchos*), northern waterthrush (*Seiurus novaeboracensis*), Carolina wren (*Thryothorus ludovicianus*), gray catbird (*Dumetella carolinensis*), eastern phoebe (*Sayornis phoebe*), mourning dove (*Zenaida macroura*), numerous woodpecker species, and numerous warbler, vireo, thrush, and sparrow species. Reptiles and amphibians using these forests include eastern box turtle, northern copperhead, garter snake (*Thamnophis sirtalis*), black rat snake (*Pantherophis obsoletus)*, eastern hognose snake (*Heterodon platirhinos*), canebrake rattlesnake (*Crotalus horridus atricaudatus*), black racer (*Coluber constrictor Priapus*), pickerel frog (*Rana palustris*), southern leopard frog, and Cope's gray tree frog.

Evergreen Forest

Loblolly Pine Savannas are the only evergreen forest natural community within the study area. These occur in the Piney Grove and Zuni Pine Barrens portions of the study area and are currently confined to areas that are subject to frequent fire due to their management prescriptions. The wildlife associated with these fire-maintained pine savannas is not as diverse as other habitats within the study area, but it does include some rare species that favor the more open understory beneath a mature pine canopy, such as the red-cockaded woodpecker. Additionally, several game birds and mammals use these habitats. A number of common reptiles but fewer amphibians inhabit these pine savannas.

For the purposes of this study, pine plantations are categorized as Non-Riverine Flatwoods and Swamps (Planted Pine Variant), as this is likely the natural community in which they would be classified if unaltered. These communities are somewhat early-successional forests that have been planted and managed as part of a concerted forestry management plan. These forests are common throughout the study area and make up the vast majority of the land cover classified as "evergreen forest". The wildlife associated with these communities is relatively diverse, but is primarily composed of habitat generalists, and common species associated with all previously described communities can be found in these planted pine variants of the Non-Riverine Flatwoods and Swamps.

Mixed Forest

Mixed forests occur throughout the study area in both uplands and wetlands, with the predominant upland community being Pine/Scrub Oak Sandhills. Pine/Scrub Oak Sandhills are ridges of sandy soils underlain by clay subsoil that support a mix of scrub oaks and loblolly pine. The loblolly pine may have been preceded by longleaf pine in the overstory, but logging and lack of a natural fire regime have allowed loblolly to take over. Mixed forest wetland natural communities that occur in the study area include Pond Pine Woodlands and Pocosins. Pond Pine Woodlands and Pocosins are fire-adapted peatlands that are relatively rare due to fragmentation and absence of the frequent burning they require. The wildlife associated with the Pine/Scrub Oak Sandhills is very similar to the wildlife found in the Loblolly Pine Savannas, and the wildlife associated with the Pond Pine Woodlands and Pocosins is similar to the wildlife found in the planted pine variant of the Non-Riverine Flatwoods and Swamps. Very few habitat specialist species occur in either of these communities.

Floodplain Ponds and Pools, Semi-permanent Impoundments, and Coastal Plain Depression Wetlands

Floodplain Ponds and Pools, Semi-permanent Impoundments, and Coastal Plain Depression Wetlands are wetland natural communities that occur infrequently and cover relatively small areas. They are generally too small to be mapped and thus are not included in **Table 3.4-5**. Floodplain Ponds and Pools are typically abandoned oxbows and meander cut-off sloughs with nearly permanent flooding. They can contain

scattered trees adapted to flooded conditions, with aquatic emergent plants being their predominant vegetation. Semi-permanent impoundments typically occur along shorelines of beaver and man-made ponds and are subject to water level fluctuations seasonally. Community composition can vary widely, with common species being predominantly herbaceous and emergent. Wildlife associated with these habitats includes species previously discussed in the aquatic community descriptions. The Floodplain Ponds and Pools and Semi-permanent Impoundments typically possess fish fauna, and therefore represent less important amphibian breeding areas than the Coastal Plain Depression Wetlands. The Coastal Plain Depression Wetlands are ephemeral ponds with no connection to other surface waters that are found within the Non-Riverine Flatwoods and Swamps community. These habitats are generally fish-free and are used heavily as breeding sites for many of the study area's amphibian species, including some of the listed threatened and endangered species.

Ecology and Habitat of Agricultural Lands

Approximately 126,296 acres of agricultural lands are located in the study area (see **Figure 3.4–10**). Agricultural land uses include cropland (both row crops and non-row crops), confined feeding lots (primarily for pigs), and pastureland (for cattle and horses). Among the food crops grown within the study area are soybeans, corn, and peanuts. Cotton is the predominant non-food crop. Hay crops, grown as fodder for livestock, are interspersed throughout. Several nurseries are located in the study area. The majority of the non-cultivated agricultural land appears to be utilized by cattle and horses for grazing (i.e., pastures) and is dominated by various opportunistic grass (*Poaceae*) species and other common herbaceous species.

Wildlife habitat associated with agricultural lands is comparatively limited due to the lack of plant diversity and the relatively high frequency of disturbance (i.e., plowing, planting, fertilizing, grazing, and routine maintenance). Despite these factors, agricultural lands are used by wildlife on a limited basis, with the species composition often depending on the type of crop being cultivated, the time of year, and the methods of harvesting. Agricultural areas, including corn and soybean fields, pastures, and nurseries, are important forage areas for many wildlife species. Foraging by wildlife includes actual consumption of the plant crop, but also nondestructive foraging. Foraging by insectivorous birds and mammals and consumption of weed seeds by wildlife are beneficial to agriculture. Wildlife often consumes waste grain left behind by mechanical harvesting machines or fruit that has fallen on the ground. In other cases, however, loss and damage to crops by wildlife have been clearly documented. Corn is consumed by over 100 species of wildlife, including 17 species of waterfowl and gamebirds, 59 species of songbirds, 10 species of fur and game mammals, six species of small mammals, and by deer and black bear (Graham, 2002).

In addition to foraging wildlife, agricultural fields attract predators. Foxes, coyotes, and raccoons frequently use agricultural fields for hunting small mammals and birds that are attracted to the agricultural fields. In addition, birds of prey such as red tailed hawks (*Buteo jamaicensis*), red shouldered hawks, great horned owls (*Bubo virginianus*), and barn owls (*Tyto alba*) frequently hunt and roost near agricultural fields hunting small mammals and other prey species (Graham, 2002).

The boundary between active agricultural fields and adjacent habitats often creates "edge" habitat or edges. Edges are areas where two habitat types meet, such as an agricultural field and a forest. Edges are unique because they combine some of the characteristics of two or more habitats. Despite being relatively small (only a few feet wide in most cases), edge habitat between agricultural fields and adjacent forest lands provides habitat and foraging for a diverse assemblage of species. The edge habitat offers forage and cover for white-tailed deer (*Odocoileus virginianus*) and a variety of smaller mammals, including eastern

cottontail (*Sylvilagus floridanus*), mice, moles, voles, and shrews. Additionally, edges provide nesting and foraging for many different bird species such as sparrows (*Emberizidae)*, finches (*Carpodacus*), and eastern bobwhite quail (*Colinus virginianus*).

Ecology and Habitat of Brush and Old Fields

Approximately 63,361 acres of brush and old fields are located within the study area (see **Figure 3.4–11**). Typically these areas have been timbered, grazed, or utilized as cropland in the recent past. Most of these areas have lain fallow for a number of years and have been left to re-vegetate through natural succession.

Abandoned pastures and agricultural fields can provide excellent wildlife habitat. These areas contain an interspersion of plant communities, which is beneficial to many species. Many songbirds use clumps or islands of wild plum and blackberry for nesting; quail use them for escape cover; deer browse on the twigs; and a host of species eat the fruits.

Regional Biodiversity

The habitat diversity within the study area varies greatly. It includes a patchwork of riparian corridors, farm fields, abandoned fields, pastureland, and various forest types. This variety in habitats contributes to a relatively rich assemblage of plants and animals in the study area. Biodiversity tends to be greater in areas with larger landscape diversity and edge habitat and tends to decrease as the natural habitat decreases. There are several areas within the study area that are protected because they contain rare and unique communities and/or provide habitat for rare species, but the general abundance of such sites is fairly typical for Virginia's Rolling Coastal Plain and Mid-Atlantic Flatwoods ecoregions.

In the late 1980's, the Virginia Natural Area Preserves System was established to protect the significant natural areas in Virginia. Properties that are in the Virginia Natural Area Preserves System will have legally binding restrictions on future activities on those properties. There are seven Conservation Lands within the study area – Piney Grove Preserve, Big Woods, Blackwater River Preserve, Dendron Swamp, Blackwater Ecological Preserve, Antioch Pines, and Blackwater Sandhills (DCR, 2014a). Four of these are also designated as Natural Area Preserves and are described below.

The Dendron Swamp Natural Area Preserve is located in Sussex County along the Blackwater River and is a bald cypress/tupelo swamp. There are trees within Dendron Swamp that are around 600 years old and have diameters that reach up to 79 inches. The Charles C. Steirly National Natural Landmark is also located on the natural area preserve and provides protection to a Great Blue Heron nesting site.

The Blackwater Ecological Preserve and the Antioch Pines Natural Area Preserve are located immediately adjacent to each other in Isle of Wight County. The Blackwater River forms the western boundary of the Blackwater Ecological Preserve. Antioch Pines lies immediately to the north and is bounded on three sides by Antioch Swamp. These preserves are managed through prescribed fire and have prescribed burns conducted on them five to 10 times a year. This is done to maintain the habitat for 23 rare species of plants and animals that would lose their natural habitat if the prescribed fires were not conducted. Examples of these species include pixie moss (*Pyxidanthera barbulata*), white-fringed orchid (*Platanthera blephariglottis*), pale grass-pink (*Calopogon pallidus*), rose pogonia (*Pogonia ophioglossoides*), purple pitcher plant (*Sarracenia purpurea*), and sandbog deathcamas (*Zigadenus glaberrimus*).

The Blackwater Sandhills Natural Area Preserve contains numerous significant natural areas and is located along the Blackwater River in Isle of Wight County. The area contains both uplands and bottomlands that

once supported saturated swamps and longleaf pine sandhills. The sandhills are part of a project to restore longleaf pine sandhill vegetation and to protect bottomland hardwoods (DCR, 2014a).

In addition to the Natural Area Preserves System, DCR DNH maintains a database of BRANK communities that occur throughout the state. The BRANK system is used to determine the significance of these communities. The significance of a community is based on its natural features or elements (e.g., species, community type, etc.) and the ability of DCR DNH to protect the site. The following biodiversity ranks are used to determine a site's significance:

B1 Outstanding Significance: only site known for an element; excellent occurrence of a G1 species (Globally, Extremely Rare).

B2 Very High Significance: excellent example of a rare community type; good occurrence of a G1 species; or excellent occurrence of a G2 or G3 species (Globally, Very Rare or Rare to Uncommon).

B3 High Significance: excellent example of any community type; good occurrence of a G3 species.

B4 Moderate Significance: good example of a community type; excellent or good occurrence of state-rare species.

B5 General Biodiversity Significance: good or marginal occurrence of a community type or state-rare species.

Table 3.4-6 lists rare or unique terrestrial communities that are reported to occur within the study area.

Table 3.4-6: Rare or Unique Communities in the Project Study Area

Community Name	Description	Acreage	County/City	BRANK	Legal Status
Cat Ponds	Conservation Site	923	Isle of Wight	B1	SL
Foursquare Ponds	Conservation Site	326	Isle of Wight	B2	NL
Zuni Pine Barrens	Conservation Site	2155	Isle of Wight	B2	NL
Manry Wakefield	Conservation Site	4513	Sussex	B2	FL
Kilby Northwest Powerline	Conservation Site	157	City Of Suffolk	B2	NL
Disputanta	Conservation Site	653	Prince George	B2	NL
Muddy Cross Ponds	Conservation Site	120	Isle of Wight	B2	NL
Moonlight Sinkhole Ponds	Conservation Site	378	Isle of Wight	B2	NL
Wards Creek Above Rt 10 SCU	Stream Conservation Unit	10	Prince George	B2	NL
Terrapin Swamp SCU	Stream Conservation Unit	10	Southampton and Surry	B2	NL
Hickaneck Swamp	Conservation Site	1307	Southampton and Isle of Wight	B3	SL
Bailey Branch Rt 10 SCU	Stream Conservation Unit	8	Surry	B3	NL
Antioch Swamp SCU	Stream Conservation Unit	3158	Southampton and Isle of Wight	B3	SL
Golden Hill Branch Powerline	Conservation Site	143	Surry	B4	NL
Ivor East Powerline	Conservation Site	72	Southampton	B4	NL
Blackwater Walls Bridge	Conservation Site	105	Surry	B4	NL
Devils Millpond	Conservation Site	195	Isle of Wight	B4	NL
Berrymans Corner	Conservation Site	604	Surry	B4	NL
Clontz Place	Conservation Site	221	Isle of Wight	B4	SL

Community Name	Description	Acreage	County/City	BRANK	Legal Status
Green Swamp SCU	Stream Conservation Unit	6	Surry	B4	NL
Pouches Creek SCU	Stream Conservation Unit	11	Isle of Wight	B4	NL
Walls Run at Rt 635 SCU	Stream Conservation Unit	7	Prince George	B4	NL
Shrub Pocosin Powerline	Conservation Site	569	Surry	B5	SL
Warwick Swamp Powerline	Conservation Site	84	Sussex	B5	NL
15261 Nobles Road	Conservation Site	66	Prince George	B5	SL
Dendron Swamp	Conservation Site	1160	Surry and Sussex	B5	SL
Wakefield South Powerline	Conservation Site	163	Sussex	B5	NL
Route 601 Powerline Habitat Zone	Conservation Site	11	Sussex	B5	NL
Route 635 Roadside Powerline Habitat Zone	Conservation Site	101	Prince George	B5	NL
Upper Warwick Swamp Powerline	Conservation Site	168	Prince George	B5	NL
Rt 617 East of Mill Swamp	Conservation Site	89	Surry	B5	SL
Rt 618 SW of Mercy Seat Church	Conservation Site	111	Surry	B5	SL
Route 616 Bend	Conservation Site	234	Southampton	B5	SL
Lazy Oak Corner	Conservation Site	234	Surry	B5	SL
Route 604 – Hwy 31 Fields	Conservation Site	234	Surry	B5	SL
Golden Hill Branch	Conservation Site	81	Surry	B5	SL
Mill Swamp	Conservation Site	77	Surry	B5	SL
Blackwater Swamp - Rt 156 Bridge SCU	Stream Conservation Unit	14	Prince George	B5	NL

Source: VDOT, 2013.

Biodiversity-ranked communities that are reported to occur within the study area are shown in **Figure 3.4–12**. Although there are 38 sites currently identified in the study area, this represents only a very small percentage of the land area within the study area, and the distribution and abundance of these sites are not dissimilar to other areas within the state.

Wildlife Corridors

Due to a long history of agricultural and silvicultural activities, most uplands within the region are so highly fragmented that they afford little contribution with respect to wildlife corridors. Riparian corridors, on the other hand, have been less altered over history and presently serve as components of several prominent wildlife corridors within the study area. Prominent wildlife corridors within the study area generally greater than a half mile in width consist of:

- an east-west riparian corridor along the middle to upper Blackwater River (extending roughly from the community of Dendron westward into central Prince George County north of the community of Disputanta);
- an east-west riparian corridor formed by Otterman Swamp and the headwaters of Cypress Swamp (extending roughly from the Town of Surry westward to the Blackwater River in central Prince George County);
- a north-south riparian corridor formed by the headwaters of Wards Creek, Otterman Swamp tributaries, a portion of Warwick Swamp, Black Swamp, and the headwaters of Assamoosick Swamp (extending roughly from north-central Prince George County southward into northwestern Surry County); and
- a north-south riparian corridor along Cypress Swamp (in central Surry County).

Other prominent wildlife corridors generally having a width less than a half mile are located within the study area. These narrower wildlife corridors consist of:

- a north-south riparian corridor formed by Green Swamp, Mill Swamp, and Rattlesnake Swamp (extending roughly from the Town of Surry southward to the Blackwater River in northern Southampton County);
- a north-south riparian corridor along the lower Blackwater River (extending roughly from the community of Dendron southward past the Town of Zuni);
- a north-south riparian corridor along Burnt Mills Swamp to Antioch Swamp (extending roughly from Route 258 north of Windsor, across Route 460 to Antioch Pines south of Zuni); and,
- an east-west riparian corridor along Ennis Mill Swamp into the headwaters of Lake Prince (generally located west of the Town of Windsor).

In all cases, these wildlife corridors are associated with contiguous or (where interrupted by existing roads or utility lines) near-contiguous forest communities. See **Figure 3.2–12** for prominent wildlife corridors informally identified as part of this study and their relationship to state-ranked biodiversity resources.

Forest Interior Dwelling Species Habitat

Depending on the width and vegetative composition of the forested portions of these corridors, they may also represent important sites for forest interior dwelling species (FIDS). These species typically require large, relatively unfragmented tracts of hardwood or mixed hardwood forest located within heavily forested landscapes or regions to successfully breed and maintain viable populations. They prefer hardwood/mixed hardwood tracts in excess of 100 acres, or they require large contiguous linear tracts of hardwood or mixed hardwood forest that are a minimum of 600 feet wide, as many of these species prefer nest sites to be located greater than 300 feet from the forest edge. This diverse group includes Neotropical migrants such as tanagers, warblers, and vireos that breed in North America and winter in the Caribbean and Central and South America, as well as residents and short-distance migrants such as woodpeckers, some hawks, and owls (Jones, et. al., 2001).

Although most FIDS are still fairly common, populations of some forest interior bird species have been declining during the last 30-40 years. The main factor contributing to the decline of FIDS is forest fragmentation and loss of mature forests. Forest fragmentation reduces the size of forest patches, reducing the total area of contiguous habitat available to birds and increasing the isolation of habitat, reducing the quality of that which remains (Jones, et al., 2001).

3.4.2.2.2 Threatened and Endangered Species

Queries performed through the DCR – DNH database are based upon the 12 digit Hydrologic Unit Codes (HUCs) which intersect the study area. Other databases use the study area boundary to determine which federal- or state-listed species are located within the area. **Table 3.4-7** describes which species were identified as known occurrences and which were identified because they potentially have habitat (including breeding or roosting) with the study area, or may be used during breeding season. **Figure 3.4-13** shows the locations of the known occurrences.

Table 3.4-7: Threatened and Endangered Species within Study Area

Common Name	Scientific Name	Legal Status	DCR DNH List	Known Occurrence (DGIF)	WERMS[1]	IPAC[2]
Red-cockaded Woodpecker	*Picoides borealis*	FESE	Yes	Yes	Yes	Yes
Roanoke Logperch	*Percina rex*	FESE	No	Potential	No	Yes
Atlantic Sturgeon	*Acipenser oxyrinchus*	FESE	Yes	No	No	No
Northern long-eared bat	*Myotis septentrionalis*	FT	No	No	No	Yes
Sensitive joint vetch	*Aeschynome virginica*	FE	Yes	NA	NA	Yes
Bald Eagle	*Haliaeetus leucocephalus*	MBTA/ BGEPA	NA	Yes	YES	Yes
Rafinesque's Eastern Big-Eared Bat	*Corynorhinus rafinesquii macrotis*	SE	Yes	Yes	YES	NA
Black Rail	*Laterallus jamaicensis*	SE	No	Potential	No	NA
Eastern Tiger Salamander	*Ambystoma tigrinum*	SE	Yes	Yes	Yes	NA
Eastern Chicken Turtle	*Deirochelys reticularia*	SE	Yes	Yes	Yes	NA
Canebrake Rattlesnake	*Crotalus horridus*	SE	Yes	Potential	No	NA
Blackbanded Sunfish	*Enneacanthus chaetodon*	SE	Yes	Yes	Yes	NA
Little Brown Bat	*Myotis lucifungus*	SE	Yes	No	No	NA
Tri-colored Bat	*Perimyotis subflavus*	SE	Yes	No	No	NA
New Jersey Rush	*Juncus caesariensis*	ST	Yes	NA	NA	NA
Henslow's Sparrow	*Ammodramus henslowii*	ST	No	Potential	No	NA
Barking Tree Frog	*Hyla gratiosa*	ST	Yes	Yes	Yes	NA
Mabee's Salamander	*Ambystoma mabeei*	ST	Yes	Yes	Yes	NA
Peregrine Falcon	*Falco peregrinus*	ST	Yes	No	No	NA

Note: FE = federal endangered; FT = federal threatened; SE = state endangered; ST = state threatened; The bald eagle has been delisted at both the state and federal levels; however, it is still afforded legal protection under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA). The Dismal Swamp southeastern shrew was delisted in 2016. 1) Wildlife Environmental Review Map Service (WERMS) 2) the USFWS Information, Planning, and Conservation (IPaC) database.

Federally Listed Species

This section describes species that are known or likely to occur or have been documented in cities and counties encompassed within the study area.

Red-Cockaded Woodpecker (Picoides borealis)

The red-cockaded woodpecker was listed as a federal endangered species in 1973. The species is native to the southeast U.S. and is non-migratory. The species was classified as endangered because of its perceived rarity, declines in local populations, and a presumed reduction in available nesting habitat. The species nests in old growth pines, which are declining in numbers due to current commercial timbering methods.

Fire, which at one time maintained the open pine stands that this woodpecker prefers, is now suppressed. Other threats include forest fragmentation, catastrophic events, and demographic and genetic processes affecting populations confined to isolated areas (USFWS, 2003).

This species is limited to stands where mature pine (greater than 80 years old) occurs or predominates, and it shows a preference for open woods. It selects mature to over-mature live pines often infected with red heart disease (*Fomes pini*) for nest cavity excavation. They prefer longleaf pines. They live in social groups called clans of up to ten individuals, but never more than one breeding pair per colony. They forage for insects mainly within pines. In Virginia, the red-cockaded woodpecker nests between late April and early June. The female lays two to five eggs in the breeding male's nest cavity. The eggs are incubated for approximately 10 days and the young fledge at 26 to 29 days (USFWS, 2003).

The red-cockaded woodpecker is a very rare, permanent resident south of the Chesapeake Bay and the James and Appomattox Rivers. Historically this species has been recorded in Southampton and Sussex Counties and the City of Suffolk, with nesting verified only in Sussex County (DGIF, 2014a). In Virginia, this species is currently found only within the Piney Grove Preserve in Sussex County. This population represents the species' northernmost extent and in 2012 had 10 breeding pairs. The results of a 2012 winter population count on the preserve yielded 53 individuals (CCB, 2013). The Piney Grove Preserve is located within the study area.

Roanoke Logperch (Percina rex)

The Roanoke logperch is a freshwater fish species that was listed as a federal endangered species in 1989. The Roanoke logperch is endemic to the Roanoke River and Chowan River drainage basins, where it is encountered in relatively small numbers. Populations located to date are separated from one another by long segments of rivers or by large impoundments (DGIF, 2014a).

Roanoke logperch is a biological indicator of moderate to good upland stream habitat conditions. This species occupies warm, moderate to large size streams and rivers with a succession of riffle-run-pool habitat, with moderately to unsilted substrates varying from gravel, rubble, to boulder, and usually clear water. They are intolerant of moderately to heavily silted areas except in winter periods of inactivity. Roanoke logperch are insectivores and will methodically flip over stones in search of aquatic insect larvae. The major threat to this species is habitat loss. Siltation of streams negatively affects Roanoke logperch and the species has not fared well because high quality upland streams have been reduced due to agricultural, industrial, and residential development (DGIF, 2014a).

Atlantic Sturgeon (Acipenser oxyrinchus)

The Atlantic sturgeon is an anadromous species that migrates from the ocean into coastal estuaries and rivers to spawn. In the Chesapeake Bay, Atlantic sturgeon historically spawned in all of its major tributaries. Presently, spawning populations have been drastically reduced due to overfishing, pollution, dam construction, and habitat degradation (Bilkovic, et al., 2009). The James and York Rivers in Virginia are the two rivers comprising the Chesapeake Bay Distinct Population Segment where Atlantic sturgeon reproduction has been confirmed (Balazik, et al., 2012). The collapse of Atlantic sturgeon stocks led Virginia to impose a total moratorium on sturgeon catches in 1974. The Atlantic States Marine Fisheries Commission followed suit in 1998 with a total moratorium on all Atlantic sturgeon catches throughout its jurisdiction. The Atlantic sturgeon was identified as a federal species of concern in 1988 and the Chesapeake Distinct Population Segment was federally listed as endangered in 2012.

Atlantic sturgeons may live to 60 years of age and are fairly old before reproductive maturity is reached (USFWS, 2011). Reproductive maturity and cycles vary among populations, but on average males mature at eight years and females at 14 years; after the first spawning males reproduce every one to two years and females every three or more years. Atlantic sturgeons are opportunistic benthic feeders, feeding primarily on worms, crustaceans, aquatic insects, snails, and sand lances. Juveniles may spend several years in fresh water of some large rivers, or on others they may move downstream to brackish waters when the temperature drops in the fall (DGIF, 2014a). Additionally, this species is migratory and widely distributed from the Gulf of Mexico to southeastern Canada (Natureserve, 2014).

Northern Long-eared Bat (Myotis septentrionalis)

The northern long-eared bat (NLEB) was listed by the USFWS as threatened in April 2015. The NLEBis found in the U.S. from Maine to North Carolina on the Atlantic Coast, westward to eastern Oklahoma and north through the Dakotas, extending southward to parts of southern states from Georgia to Louisiana, even reaching into eastern Montana and Wyoming. Virginia is within the native range of the NLEB.

Suitable winter habitat (hibernacula) for the NLEB includes underground caves and cave-like structures (e.g., abandoned or active mines, railroad tunnels). These hibernacula typically have large passages with significant cracks and crevices for roosting; relatively constant, cool temperatures (0-9 degrees Celsius) with high humidity and minimal air currents. NLEBs will typically hibernate between mid-fall through mid-spring each year.

During the summer NLEBs roost individually or in colonies in cavities, underneath bark, crevices, or hollows of both live and dead trees and/or snags (typically ≥3 inches diameter at breast height [DBH]). NLEBs have also been occasionally found roosting in structures like barns and sheds (particularly when suitable tree roosts are unavailable). NLEBs emerge at dusk to forage in upland and lowland woodlots and tree-lined corridors, feeding on insects, which they catch while in flight using echolocation. Suitable summer habitat for northern long-eared bats consists of a wide variety of forested/wooded habitats where they roost, forage, and travel and may also include some adjacent and interspersed non-forested habitats such as emergent wetlands and adjacent edges of agricultural fields, old fields and pastures. NLEBs typically occupy their summer habitat from mid-May through mid-August each year, and the species may arrive or leave some time before or after this period.

The greatest and most immediate threat for the NLEB is the disease, white-nose syndrome (WNS). Specifically, declines due to WNS have significantly reduced the number and size of NLEB populations in some areas of its range. This disease has reduced these populations to the extent that they may be increasingly vulnerable to other stressors that they may have previously had the ability to withstand.

Sensitive Joint Vetch (Aeschynomene virginica)

Sensitive Joint Vetch was listed as federally threatened in 1992. This species is found in New Jersey, Maryland, Virginia, and North Carolina, and is thought to be extirpated from Pennsylvania and Delaware. Sensitive Joint Vetch grows on brackish tidal river shores and estuarine-river marsh borders with peaty, sandy, or gravelly substrates. Habitat alteration (e.g. development, changes in natural disturbance regime) is the primary threat to this species.

Bald Eagle (Haliaeetus leucocephalus)

Bald eagles are no longer federally or state-listed. Bald eagles were removed from the federal list in 2007 and from the state list in 2013. However, bald eagles currently are protected under the Bald and Golden

Eagle Protection Act, which prohibits the take, possession, sale, purchase, barter, offer to sell, transport, export, or import of any bald or golden eagle, alive or dead, including any part, nest, or egg, unless allowed by permit. The bald eagle is common throughout Virginia where there is suitable habitat. They are a fairly common summer and winter visitor in the Chesapeake Bay region and nearby counties.

The bald eagle forages along coastal areas, rivers, and large bodies of water. Nesting sites are commonly located in large forested areas adjacent to marshes, on farmland, or in seed tree cut-over areas. Although some threats such as contaminants or habitat loss may occur on a localized basis, none of the existing or potential threats are likely to cause the bald eagle to become in danger of extinction within the foreseeable future throughout all or any significant portion of its range (USFWS, 2012).

The DGIF database lists the bald eagle as occurring within the City of Suffolk, and Isle of Wight, Southampton, Sussex, Surry, and Prince George Counties (DGIF, 2014a). Bald eagle nests have been recorded within the study area (CCB, 2014).

State Listed Species

This section describes state-listed protected species that have been documented in cities and counties within the study area.

Rafinesque's Eastern Big-Eared Bat (Corynorhinus rafinesquii macrotis)

Rafinesque's eastern big-eared bat was designated State Endangered in Virginia in 1987 and as a federal candidate in 1994. The species is native to the U.S. Piedmont and occurs mainly in the southern Appalachians. Rafinesque's eastern big-eared bat is most often found in houses, sometimes in hollow trees, behind loose bark, in culverts, or in caves and mines. Rafinesque's eastern big-eared bat is incidental in Virginia because it has adapted to temperate, arboreal zones found only in the extreme southeast. Rafinesque's eastern big-eared bat is rare in Virginia and is particularly susceptible to human disturbance. Within the study area, Rafinesque's eastern big-eared bat is documented to occur in or near the Hickaneck Swamp conservation site northeast of Ivor in Isle of Wight County and in or near the Dendron Swamp conservation site just west of the community of Dendron (DGIF, 2014a).

Black Rail (Laterallus jamaicensis)

Status of the black rail is truly unknown because of their secretive nature. During the breeding season they are thought to be locally common in some areas, but are generally considered rare throughout. In the winter they are only found along the coast. This species was officially listed as endangered in Virginia in January 2013. It previously had no T&E status (DGIF, 2014a).

The black rail is a very secretive species. It shows more of a tendency toward dry fields than other species in its family. Its nest is usually found in tussocks of grass in drier locations up from water. Black rail favor brackish marshes and the drier parts of the salt marsh. It appears to prefer salt marshes, but has also been found along inland tidal creeks and marshes, and it is occasionally found in wet savannah (DGIF, 2014a).

There are no confirmed occurrences of this species within the study area; however, it is predicted that black rail may use portions of the study area during the breeding season (DGIF, 2014a). The preferred habitat of the black rail is not currently known to occur in the study area.

Eastern Tiger Salamander (Ambystoma tigrinum)

Although this species may be more abundant than it appears, the DGIF recognized the eastern tiger salamander as state endangered in 1987. Its distribution is very restricted in Virginia. Because this species

is known from only two breeding sites, it is recommended that the legal status of this species remain endangered. The eastern tiger salamander is native to Virginia and is known mainly from the Coastal Plain and lower Piedmont physiographic provinces. Industrial pollution and intensive agriculture have an adverse effect on this species.

Within the study area, the eastern tiger salamander is documented to occur in the Cat Ponds conservation site just west of Route 10 in northeastern Isle of Wight County (DGIF, 2014a).

Eastern Chicken Turtle (Deirochelys reticularia reticularia)

The eastern chicken turtle was listed as endangered in Virginia in 1987 and is extremely rare in Virginia, known from only two isolated populations: one in the City of Virginia Beach (First Landing State Park) and one in Isle of Wight County. Chicken turtles are omnivores and have been observed to eat crayfish, tadpoles, and aquatic plants. This species is given to wandering long distances from water and can often be found along roadsides and in flat woods. They are active between March and September and hibernate during the rest of the months in muskrat burrows or buried in the mud at the bottom of ponds. In Virginia, the chicken turtle is found in freshwater cypress ponds among forested dunes. In other parts of its range, it inhabits quiet waters such as ponds, lakes, and ditches. Due to the rarity of this species and unknown recruitment, this species appears to be very vulnerable (DGIF, 2014a).

Habitat for the eastern chicken turtle does not appear to occur within the study area as no freshwater cypress ponds among forested dunes have been identified.

Canebrake Rattlesnake (Crotalus horridus atricaudatus)

The canebrake rattlesnake is a large, terrestrial, venomous snake inhabiting the Coastal Plain of the southeastern U.S. from southeastern Virginia to eastern Texas. It is the only species of rattlesnake native to southeastern Virginia. The canebrake rattlesnake species has declined in Virginia; the primary cause in Virginia is habitat loss and fragmentation. Other causes include collecting adults for captivity and human willful killing of snakes. Habitat fragmentation resulting from highways also effectively separates canebrake rattlesnake populations in Virginia. Canebrake rattlesnakes are no longer present in 32 of 58 locations in Virginia where they have been recorded from the 1940s to the present (DGIF, 2011a). This species was listed as a state endangered species in 1992.

Canebrake rattlesnakes in southeastern Virginia prefer mature hardwood and mixed hardwood-pine forests, forested cane thickets, and ridges adjacent to swampy areas. Hardwood forests along riverine corridors often harbor canebrakes. Snakes are known to enter wetlands often for extended periods and they frequently cross at least small rivers. On occasion, individuals will occupy agricultural fields and other less optimal habitats (DGIF, 2011a). Canebrake rattlesnakes have been recorded in Suffolk and Isle of Wight County. Habitat of the type preferred by the canebrake rattlesnake occurs in the study area.

Blackbanded Sunfish (Enneacanthus chaetodon)

The blackbanded sunfish was designated state endangered in 1987. In recent extensive surveys only one additional population was discovered, and this pattern of rarity holds in the North Carolina section of the Chowan (DGIF, 2014a).

The blackbanded sunfish is a small sunfish with bold black bars on its sides. They are found in swampy, acidic water of ponds and streams of the Atlantic Coastal Plain. Throughout its range it is largely restricted to quiet, shallow, heavily vegetated, non-turbid, darkly stained, acidic waters of streams, margins of rivers, ponds, and lakes. It is an inhabitant of vegetated pools of small to large streams and ponds (DGIF, 2014a).

This species is native and quite localized in Virginia; it is extremely localized in the Blackwater and Nottoway systems of the Chowan drainage. Within the study area, the blackbanded sunfish is documented to occur in the Blackwater Swamp in Prince George County and in Sussex County (VDOT, 2014).

Little Brown Bat (Myotis lucifungus)

The little brown bat was designated state endangered in 2016. The hibernacula are typically located in caves in western Virginia. The little brown bat typically roosts in trees or structures, including occupied residences. The DGIF has not identified any roost trees in Virginia; however, DGIF is aware of three structures that serve as roosts for little brown bats. Similar to the NLEB, the WNS is the greatest and most immediate threat for the little brown bat.

Tri-colored Bat (Perimyotis subflavus)

The tri-colored bat was designated state endangered in 2016. Similar to the little brown bat, the hibernacula are typically located in caves in western Virginia. The tri-colored bat typically roosts in trees, rock crevices, or unoccupied structures, such as barns. The DGIF has not identified any trees or structures that serve as roosts for tri-colored bats. Similar to the NLEB, the WNS is the greatest and most immediate threat for the tri-colored bat.

New Jersey Rush (Juncus caesariensis)

New Jersey Rush, a state threatened species, is most abundant in New Jersey. Outside of this area, isolated occurrences of this species can be found in Maryland, Virginia, and North Carolina. Habitat includes very acidic wet spring or seep areas with flowing, but not standing, water. It is most often found on shaded stream banks; pond, bog, and swamp margins; and pine barrens. New Jersey Rush is a perennial rush often associated and found with sphagnum species. Threats to this species include development, disruption of hydrologic regime, sedimentation, and habitat fragmentation.

Henslow's Sparrow (Ammodramus henslowii)

The Henslow's sparrow is a small bird with a striped, olive-colored head and reddish wings. This species is mainly found in eastern Virginia where its preferred habitat includes grasslands, un-mowed hayfields, and meadows that have tall, dense grass and few shrubs. These birds can be found in lightly or moderately grazed areas, but it is not typical. The main threats to this species are habitat loss and habitat fragmentation because the Henslow's sparrow prefers large and open landscapes (Natureserve, 2014).

There are no documented occurrences of the Henslow's sparrow within the study area, but potential habitat is present in the City of Suffolk and Isle of Wight and Surry Counties (DGIF, 2014a).

Barking Tree Frog (Hyla gratiosa)

The barking tree frog is the largest tree frog in North America. This species was designated state threatened in 1992. This species is known to be common in most other states where the barking tree frog occurs but is rare in Virginia. The major threat to this species is from continued logging of stands of native pine. Particularly detrimental is the conversion of these mature pine stands to high density monocultures of loblolly pine. This species is threatened because of limited distribution and attractiveness in the pet trade (DGIF, 2014a).

In general, this species has been found in sandy areas near shallow pools in pine savannas and in lowland woods and swamps. In Virginia, they have been observed in the following habitats: temporary pools in powerline rights-of-way, forested wetland depressions, natural Carolina bays, and sinkhole or cypress ponds. The primary limiting factor for this species is the number of breeding ponds. This species requires

deeper and more permanent ponds than those required by other tree frog species and these ponds must be free of predaceous fish. These ponds and the surrounding forests are being drained and otherwise altered for agriculture, forestry, and urban development.

The barking tree frog has been recorded in the study area in Isle of Wight, Southampton, and Surry Counties (DGIF, 2014a).

Mabee's Salamander (Ambystoma mabeei)

Mabee's salamander is a small and rare terrestrial forest salamander that breeds in temporary pools. This species is found in savannas in burrows at the edges of bogs or ponds. They also occur in low wet woods and swamps. They are found in areas adjacent to water such as ditches and pools and have been found under pieces of paper or small logs in sandy areas adjacent to water. Breeding sites in Virginia consist of fish-free vernal ponds; these are typically Coastal Plain sinkhole ponds surrounded by mixed hardwood and pine forests (DGIF, 2014a).

These salamanders have been recorded in 14 cities/counties in Virginia, including Isle of Wight, Southampton, Suffolk, Surry, and Sussex. Mabee's salamanders are listed as a Threatened species in Virginia. Threats include habitat fragmentation, aquatic and terrestrial habitat loss, road mortality, and alteration of hydrology mostly due to urbanization (DGIF, 2014a). Potential habitat (forested areas adjacent to vernal ponds) occurs in the study area.

Peregrine Falcon (Falco peregrinus)

The peregrine falcon, found in terrestrial inland, aquatic, and coastal areas, is a seasonal breeder on the Coastal Plain. This species, previously listed federal endangered in 1989, was delisted from the federal list in 1999. The reason for their endangered status included shooting, egg collection, removal of young, disease, predation, parasites, climatological changes, decreasing food supply, habitat loss, human disturbance, and egg shell thinning due to DDT and DDE. In Virginia, it is listed as state threatened.

Habitat includes bridges/underpasses, utility poles, buildings, fences/hedgerows, farm ponds, standing snags, rocky outcrops, cliffs/ledges, and islands. It almost exclusively nests on rocky cliffs of varying sizes or on manmade structures such as unfinished bridge piers, bridges, or skyscrapers. Migrant and wintering falcons are well known for frequenting coastal estuaries and intertidal mudflats where they prey heavily on shorebirds and waterfowl (DGIF, 2014a). There are no documented occurrences of the peregrine falcon within the study area (VDOT, 2013).

3.4.2.2.3 Invasive Species

Transportation corridors, such as roads and highways, allow opportunities and can serve as conduits for the dispersal of invasive species (particularly plant species). Where transportation corridors cross waterways, these effects can quickly expand to other areas through downstream transport of seeds. Invasive species can move on vehicles and in the loads they transport. Invasive plants can be moved from site to site during roadside maintenance operations. Weed seed can be inadvertently introduced by equipment into a corridor and through the use of mulch, imported soil, water, or gravel and sod during construction. Some invasive plant species may be deliberately planted as part of erosion control, landscaping, and wildflower projects (NCHRP, 2006).

DCR, in partnership with the Virginia Native Plant Society, has published an advisory Virginia Invasive Plant Species List (obtained at http://www.dcr.virginia.gov/natural-heritage/invsppdflist). This list includes terrestrial, wetland, and aquatic plants. The plants are ranked by their invasiveness, which is based

on their impact on natural areas and other species, their potential to disperse and invade natural landscapes, their distribution and abundance, and their difficulty to manage. The plants are classified as Highly Invasive, Moderately Invasive, and Occasionally Invasive (DCR, 2009b). The list contains 109 species, of which eight aquatic/wetland and 17 terrestrial species are classified as Highly Invasive and are potentially present in Virginia's Coastal Plain (the province in which the study area is located). One Highly Invasive species, Chinese lespedeza (*Lespedeza cuneata*), is recorded throughout eastern Virginia in the Atlas of the Virginia Flora (Virginia Botanical Associates, 2014). In addition, the VISWG has identified three invasive plant species as "High Concern" in Virginia (VISWG, 2014). The vast majority of these are ready colonizers of disturbed areas.

There are many species of invasive animals that are of concern in Virginia. Like the plants, these species can be terrestrial or aquatic. The Virginia Invasive Species Management Plan lists 20 invasive animal species as well as one protozoan, one virus, one fungus, and one prionic species/organism (VISWG, 2012). This list is not a complete list of all invasive species as it contains only those that are managed or discussed in the plan. In addition, VISWG has identified nine invasive animal species as "High Concern" in Virginia (VISWG, 2014). Invasive species are presented in **Tables 5.3-1** and **Table 5.3-2** of the ***Natural Resources Technical Report*** (VDOT, 2014i).

3.4.2.2.4 Mineral Resources and Unique Geological Features

No unique features, such as faults and fractures, were identified within the study area; however there is an abundance of sand and gravel operations. Because of the abundance of sand and gravel operations, sand and gravel are not considered to be a unique geologic feature. The Virginia DMME believes that there may be marl or titanium deposits in the Coastal Plain Province of Virginia that could potentially be mined; however, neither of these is believed to be present within the study area.

The study area is located in the Coastal Plain Physiographic Province of Virginia, which is characterized by poorly to well-sorted unconsolidated marine to fluvial sediments, varying from clay to gravel with lateral variations in thickness. These sediments generally increase in thickness towards the east. Vertical variation within the geologic formations of the Coastal Plain is often controlled by cyclic transgression and regression depositional sequences of the ocean that typically coarsen with depth.

The topography of the Coastal Plain is a terraced landscape that stair-steps down to the coast and to the major rivers. The risers (scarps) are former shorelines. The higher, older plains in the western part of the Coastal Plain are more dissected by stream erosion than the lower, younger terraces. This landscape was formed over the last few million years as sea level rose and fell in response to the repeated melting and growth of large continental glaciers and as the Coastal Plain slowly uplifted.

Regionally, the stratigraphy of the Coastal Plain can be generalized as a wedge of sediments composed of fluvial and coastal plain sands and gravels of Quaternary and upper Tertiary age, underlain by marine, deltaic, and fluvial clays, silts, and sands of lower Tertiary age, underlain by fluvial-deltaic to shallow-shelf sands and clays of Cretaceous age, underlain by crystalline bedrock.

Throughout the study area there are many geologic formations. The two primary formations include the Bacons Castle Formation on the west and the Windsor Formation on the east. Other formations are also present, but are isolated and are typically located around streams, rivers, and swamps (see **Figure 3.4–14**).

The Bacons Castle Formation is located on the western limits of the study area, and consists of massively to thickly bedded gray, yellowish-orange, and reddish brown sand, gravel, silt, and clay. This formation is

massively to thickly bedded pebbly and cobbly gravel grading upward into crossbedded, pebbly sand and sandy and clayey silt. It constitutes the surficial deposits of high plain extending from Richmond eastward to the Surry scarp. At terraces west of the Surry scarp, the fluvial-estuarine deposits are comprised of muddy coarse sand, and gravel that underlay sand silt and clay.

The Surry Scarp is located about mid-way along the study area. A scarp in the Coastal Plain is typically represented by a line of cliffs formed by erosion. The Surry scarp separates the Bacon Castle Formation from the Windsor Formation. The Windsor Formation is gray to yellowish to reddish-brown sand, gravel, silt, and clay. It constitutes the surficial deposits on the extensive plain seaward of the Surry scarp, and was formed at a similar time as the deposits to the west of the scarp. Fine sediments consisting of a pebbly sand beneath the plain grade upward to a sand deposit and massive clayey silt and silty clay. These sediments were deposited in shallow marine, open bay, restricted bay, or lagoonal deposits. These deposits are typically zero to 40 feet thick.

Other minor formations within the study area are discussed below. These formations are limited in their locations:

- Alluvium: Alluvium deposits, consisting of gravelly sand, sandy gravel, silt, and clay, located in channels, point bars, and floodplains, are present in several locations along the study area.
- The Chesapeake Group: Consists of fine to coarse grained sand, silt, and clay; shells can be common. This group is typically limited to the extreme western and eastern ends of the study area.
- Moorings Unit: Consists of white to light gray to grayish-yellow sand and gray to grayish brown clayey silt and silty clay located to the west of the Surry scarp (pockets within the Bacons Castle Formation).
- Shirley Formation: Consists of light to dark gray, blue gray to brown sand, gravel, silt, clay, and peat. It constitutes the surficial deposits of riverine terraces, bay barriers, and bay-floor plains. In the study area, they are adjacent to alluvium deposits.
- Charles City Formation: Found on the eastern limits of the study area in sloping plains near Suffolk. Consists of light to medium gray and light to dark yellow and yellow brown to red brown sand, silt, and clay.

The DMME, Division of Mineral Mining (DMM) regulates the operation and reclamation of all non-coal mineral mining operations, including quarries, sand and gravel pits, and other surface and underground mining in Virginia. DMM provides for the safe and environmentally sound production of Virginia's non-fuel minerals. DMM administers both health and safety and surface mining reclamation regulatory programs.

The only economic mineral resource occurring within the study area is sand and gravel, which is used largely for aggregate. Sand and gravel mining operations are in a constant state of flux regarding closure of active operations and opening of new operations. DMM provided a list of current permitted sand and gravel operations for counties and cities within the study area (DMME, 2014). In 2013, DMM reported that there were 45 permitted sand and gravel operations mining 2,542,216 tons.

3.4.3 Environmental Consequences

3.4.3.1 No Build Alternative

The No Build Alternative, which includes previously programmed projects, as listed in **Table 2.3-1** in **Chapter 2**, would result in some impacts to natural resources in the study area. Although small amounts of new right-of-way may be required for implementation of programmed improvements associated with the No Build Alternative, impacts to natural resources are anticipated to be limited. While these programmed projects have not yet been scoped and cleared through NEPA, the majority of the projects represent minor intersection improvements. Typically, these types of improvements can be addressed through the NEPA process with Categorical Exclusions, because their impacts are not significant.

3.4.3.2 FHWA/VDOT Preferred Alternative

The potential environmental consequences discussed below are only associated with the LOD, or the build portion of the FHWA/VDOT Preferred Alternative. The no build portion of the FHWA/VDOT Preferred Alternative is not anticipated to cause major impacts to natural resources, and therefore is not a part of the discussion below.

3.4.3.2.1 Water Resources and Aquatic Ecology

Surface Water Resources

Water Quality

Construction of the FHWA/VDOT Preferred Alternative would result in a permanent increase of impervious road surface in the study area and would result in an increase in traffic volumes. A major factor that determines concentrations of pollutants in highway stormwater runoff is the volume of traffic carried by a particular segment of roadway. Runoff of standard highway contaminants such as heavy metals, inorganic salts, herbicides, aromatic hydrocarbons, and suspended solids could be expected to increase when construction is complete and the roadway is in operation. Temporary impacts can also be realized during roadway construction activities through increased sedimentation from land disturbing activities and occurrences of fuel spills or hydraulic spills from construction equipment.

The magnitude of stormwater pollutant loading, attributed to a particular construction activity along with the proximity of that activity to sensitive waters (such as public water supplies and special aquatic habitat), can factor into overall water quality. Primary factors that will influence the effect of highway runoff pollutant loading within any particular surface water body include the type and size of the receiving water body, the potential for dispersion, the size of the catchment area, the biological diversity of the receiving water body, and relative effectiveness of proposed mitigation measures (VDOT, 2005a). With respect to highway projects, stormwater pollutant loading is the quantity of pollutants that are transported off the road surface and reach a body of water. This can be reduced through the implementation of stormwater management facilities. If not addressed through appropriate stormwater management, the increase in runoff of these pollutants could contribute to degradation of water quality in the receiving waterbodies. However, VDOT is committed to implementing applicable stormwater management and pollution control measures as part of the project. VDOT submits its standards and specifications for erosion and sediment control and stormwater management annually for VDEQ approval, as provided in the *Instructional and Informational Memorandum Number: IIM-LD-195.8, VDOT – Location and Design Division* (VDOT, 2014). The program serves to implement a stormwater management and long-term monitoring program that maintains water quality and quantity, as nearly as practicable, equal or better than pre-development runoff

characteristics which adheres to the Virginia Stormwater Management Act and the Virginia Stormwater Management Program (VSMP) Regulations.

With respect to short-term effects, clearing and grubbing, earth moving and grading, and other construction-related activities can lead to erosion of soils. If unchecked, these activities can lead to the deposition of eroded sediments within nearby waterways and water bodies. Without implementation of appropriate mitigation measures, short-term effects to surface waters (i.e., during and immediately following construction) may include: (1) a temporary increase in turbidity and sedimentation during and immediately following nearby land disturbances and (2) an increased risk of contamination associated with the presence of heavy equipment fluids (fuels, lubricants, etc.) and construction-related chemicals (paints, concrete additives, etc.).

Impaired Waters

Impaired waters impacts were calculated using the 2012 VDEQ 305(b) Assessed and 303(d) Impaired Waters geodatabase (VDEQ, 2014b). Potential impacts were evaluated by 12 digit Hydrologic Unit Code (HUC) subwatersheds. Although the Inventory Corridor lies within three HUC subwatersheds (Cohoon Creek HUC 020802080102, Lake Prince HUC 020802080103, and Antioch Swamp – Blackwater River HUC 030102020304), all of the impaired waters crossed are located in Antioch Swamp – Blackwater River**.** **Table 3.4-8** describes the impaired waters impacts and **Figure 3.4–15** shows their locations.

Table 3.4-8: Impaired Waters Crossed By FHWA/VDOT Preferred Alternative

Stream Segments	Impaired Waters Crossed (Stream Length Crossed)		Cause(s) of Impairment	Source(s) of Impairment
	LOD of the Preferred Alternative	Inventory Corridor		
Blackwater River - Middle (Middle portion of Blackwater River within watershed, from Rt 460 bridge crossing to downstream (Locations 1, 2, 3, and 4 on Figure 3.4-15)	356 feet	1,646 feet	Escherichia coli, Dissolved Oxygen, Mercury in Fish Tissue	Source Unknown, Natural Conditions - Water Quality Standards Use Attainability Analyses Needed
Blackwater River - Upper (Upper portion of Blackwater R. in K33. Starts at the Rt 617 crossing (Walls Bridger) downstream to above Rt 460 crossing at Zuni. (Location 5 on Figure 3.4-15)	236 feet	836 feet	Benthic-Macroinvertebrate Bioassessments, Escherichia coli, Dissolved Oxygen, Mercury in Fish Tissue	Source Unknown, Natural Conditions - Water Quality Standards Use Attainability Analyses Needed
Burnt Mills Swamp (At confluence of Antioch Swamp to Route 258.), (Location 6 on Figure 3.4-15)	122 feet	515 feet	Benthic-Macroinvertebrate Bioassessments, Mercury in Fish Tissue	Source Unknown
Unsegmented rivers in K33R (Evaluated non-segmented rivers/swamps in K33.) (Location 7 on Figure 3.4-15)	140 feet	501 feet	Mercury in Fish Tissue	Source Unknown
Total	**854 feet**	**3,498 feet**		

Source: VDEQ 2014b and VDOT 2015

Approximately 3,500 total linear feet of impaired waters were identified within the Inventory Corridor and 854 linear feet would be crossed by the LOD of the FHWA/VDOT Preferred Alternative. It is important

to note that the waters already crossed by Route 460 would be expected to experience minimal change in runoff effects to downstream waters compared to what is already experienced under the No Build Alternative. A wider road and increase in traffic volumes would increase the potential for contaminants; however, contaminant inputs to waterways would be expected to be less than they are today due to the implementation of stormwater management measures that do not currently exist on the corridor. The bypass and the new alignment would introduce new sources of roadway runoff; however, they do not cross any impaired waters. Generally, impacts to impaired streams are considered minimal adverse effects due to mitigation measures taken by VDOT during construction and post construction, as described later in **Section 3.4.4**.

Surface Drinking Water Supplies

The LOD of the FHWA/VDOT Preferred Alternative has the potential to affect three surface water intake watersheds – Lake Meade, Lake Prince, and Western Branch (see **Figure 3.4–3**). Two waterways forming the headwaters of Lake Prince are proposed to be crossed with bridges within the Lake Prince watershed, including a bridge over Ennis Pond. Approximately 350 acres of the Lake Meade and Lake Prince watersheds are located within the Inventory Corridor. The FHWA/VDOT Preferred Alternative also has the potential to affect two municipal water supply intakes for the Cities of Portsmouth and Norfolk. The closest Portsmouth intake, located on Lake Meade, is approximately 1.4 miles away when measured over land and 1.9 miles downstream when measured via water surface. However, the intakes are on another arm of the lake and are not immediately downstream of the FHWA/VDOT Preferred Alternative alignment; therefore, no direct impacts would be expected. Additionally, with more than a mile separating the project footprint and the intake, the potential for any effects is negligible. The closest Norfolk intake, located on Lake Prince is approximately four miles downstream. The potential for any effects is negligible due to the distance between the two features. As a measure to prevent degradation of water quality, runoff from bridges will be routed into stormwater management ponds and not discharged directly into the underlying waterbody.

Chesapeake Bay Preservation Act

The FHWA/VDOT Preferred Alternative will be compliant with the Bay Act because it will be designed and constructed in accordance with Virginia Department of Transportation's (VDOT) annual erosion and sediment control and stormwater management standards and specifications. VDOT's annual standards and specifications are approved by the VDEQ.

Groundwater Resources

The primary potential groundwater impact that could be anticipated from the implementation of the FHWA/VDOT Preferred Alternative is hydrocarbon contamination of private wells in shallow and deep aquifers from automobile exhaust and asphalt surfaces. Other impacts could include potentially measurable increases in dissolved metals and chloride, increased risk of spills during construction, and contamination should pollutants be suddenly released as a result of a traffic accident. However, VDEQ considers roadways a low risk to groundwater, according to Appendix F of the 2005 VDEQ Wellhead Protection Plan (VDEQ, 2005).

While there are no records of municipal public groundwater supply wells or community/institutional public groundwater supply wells within the Inventory Corridor; the Inventory Corridor and the LOD of the FHWA/VDOT Preferred Alternative would encroach into the 1,000-foot wellhead protection radii of four wells (see **Table 3.4-9**).

It is likely that this project would result in minimal adverse impacts to groundwater, because of the topography of the land surface and the relative impermeability of the area soils, which result in slow rates of groundwater recharge and discharge. Additionally, most potable and non-potable water supply is obtained from wells between 50-150 feet deep. The depth of the wells and the aquifers would insulate them from any hydrologic or water quality changes that may occur as a result of roadway construction and normal operation and maintenance of the road.

Table 3.4-9: Groundwater Public Water Supply Wells

User Type	Public Water Supply ID #	County/City
Municipal	3093950	Isle of Wight
Business	3800303	Suffolk
Community	3093220	Isle of Wight
Municipal	3093900	Isle of Wight

Source: VDH Community/Institutional Public Groundwater Supply Well GIS Data (VDOT 2013)

Floodways and 100 Year Floodplains

Table 3.4-10 presents floodway crossings by the LOD of the FHWA/VDOT Preferred Alternative. The LOD of the FHWA/VDOT Preferred Alternative would cross six floodplains and one floodway, resulting in additional encroachment into 11 acres of floodplain and one acre of floodway. The location of the piers will be developed during final design; however, they will be designed so that the elevation of the floodways will not be affected, and floodplain elevations will not be altered within an established FEMA Floodplain with Base Flood Elevations.

Table 3.4-10: Route 460 FHWA/VDOT Preferred Alternative Floodplain and Floodway Impacts

Preferred Alternative LOD Impacts				LOD Crossings	
100-year Floodplain		Floodway		Floodplain	Floodway
Sq Feet	Acreage	Sq Feet	Acreage	Count	Count
680,472	11	34,632	1	6	1

* Floodplain acreage includes the floodway areas.
Source: FEMA Digital FIRM maps: DFIRM ID: 510156, 51093C, 51093C, 51149C, 51175C, 51181C, 51183C

The proposed new bridge over the Blackwater River has a greater span length and higher profile than the existing bridge. The existing downstream Norfolk and Southern Railroad Bridge over the Blackwater River controls upstream flood elevations for all major storm events including water surface elevations downstream and upstream of the proposed Route 460 Bridge. However, the new Route 460 bridge over the Blackwater River will have a more sufficient bridge opening and the flood elevations upstream of this new bridge will be less than existing conditions.

At other wetland crossing locations along the project corridor, the proposed bridges, including abutments, span the entire width of the wetland and do not create a constriction to flood flows. During the final design, the hydraulic impacts will be further evaluated to ensure there are no adverse impacts on upstream floodplains.

Wetlands

Permanent Impacts

Construction of the FHWA/VDOT Preferred Alternative will result in direct permanent impacts (cut/fill, secondary, right-of-way conversion, and bridge conversion). Cut/fill impacts are caused by directly placing fill into wetlands. Secondary impacts are those which result when WOUS are hydrologically isolated due to primary impacts, nearby cuts, shading from bridges, and utility isolation. Right-of-way conversion impacts are due to mechanical clearing that permanently keeps wetlands in an emergent state, and bridge conversion impacts are due to bridge decks that limit tree growth and thus keep the aquatic resource in a scrub-shrub, herbaceous, and/or open water state. Total direct permanent wetland impacts of the LOD of the FHWA/VDOT Preferred Alternative would be 39.77 acres of vegetated wetlands, including 32.38 acres of PFO wetlands, 1.91 acres of PSS wetlands, and 5.48 acres of PEM wetlands (see **Table 3.4-11)**. **Figure 3.4-16** (Sheets 1-5) shows the wetlands and proposed bridges within the Inventory Corridor and within the LOD of the FHWA/VDOT Preferred Alternative. Indirect effects are discussed in ***Chapter 4.0, Indirect Effects and Cumulative Impacts***.

Table 3.4-11: Wetlands Within the Inventory Corridor and the LOD

Area of Study	Wetlands (Acres)			
	PFO	PSS	PEM	Total
LOD of the Preferred Alternative	32.38	1.91	5.48	39.77
Inventory Corridor	265	14	38	317

During wetland delineation, wetlands defined by Virginia as "high value[1]" were identified and mapped; these wetlands make up approximately 80 acres of the 265 acres of PFO wetland in the Inventory Corridor. These sites were reviewed to determine whether bridging would be recommended for the purposes of minimizing impacts to sensitive wetlands. The decision of whether or not to propose a bridge at each crossing was informed by construction costs, environmental impacts and practicability. **Figure 3.4–17** provides an example of a proposed bridge over a high value wetland resource area. Additional detail on the methodology used to identify appropriate bridging sites for environmental resources can be found in the ***Supplemental Alternatives Technical Report*** (VDOT, 2016f).

Functional Assessment

In order to assess the functions of project wetlands accurately, it was decided that modifications of two published hydrogeomorphic assessment methodologies (HGM) would be appropriate. "A regional guidebook for assessing the functions of low gradient, riverine wetlands in western Kentucky," by W.B. Ainslie et al., served as the basis for assessing project bottomland hardwoods and cypress/tupelo swamps and "A regional guidebook for applying the hydrogeomorphic approach to assessing wetland functions of wet hardwood flats on mineral soils in the Mid-Atlantic Coastal Plain," by K.J. Havens et al., was used as the basis for assessing wet flatwoods. Both methodologies were modified for the specific region where the project is being constructed and to be practicable within the constraints of the project schedule and available resources.

[1] Virginia defines "High Value" wetlands as wetlands comprising 10 percent or greater by aerial coverage in any stratum of the following species: bald cypress, water tupelo, atlantic white cedar, and/or overcup oak.

In addition, modifications to the model variables were necessary to minimize additional field data collection while still preserving the intended purpose. For example, "Overbank Flood Frequency" (V_{FREQ}), which represents the frequency at which water from a stream overtops its banks and inundates riverine wetlands on the floodplain, was measured using NRCS soils data to infer flooding frequency in lieu of collecting field data. "Woody Debris Biomass" (V_{WD}), which represents the volume of down and dead woody stems greater than or equal to one quarter inch in diameter that are no longer attached to living plants, was measured using a combination of estimated age class derived from available site photos and woody debris/log biomass tables developed using data generated by the U.S. Forest Service EVALIDator Version 1.6.0.02 (a part of the Forest Inventory and Analysis National Program).

Examples of model variables that were not modified and were measured as prescribed by the methods include "Wetland Tract" (V_{TRACT}), which is the area of low gradient, riverine wetland that is contiguous and directly accessible to wildlife from the area being assessed, and "Interior Core Area" (V_{CORE}), which represents the interior portion of a wetland tract with at least a 300 meter buffer separating it from adjacent non-forested habitat.

Functional Capacity Index (FCI) formulas were not altered.

The bottomland hardwood and cypress/tupelo functions that were assessed for the LOD include the following:

Temporarily Store Surface Water – This function is defined as the capacity of a riverine wetland to temporarily store and convey floodwaters that inundate riverine wetlands during overbank flood events. Most of the water that is stored and conveyed originates from an adjacent stream channel. However, other potential sources of water include: (a) precipitation, (b) surface water from adjacent uplands transported to the wetland via surface channels or overland flow, and (c) subsurface water from adjacent uplands transported to the wetland as interflow or shallow groundwater and discharging at the edge or interior of the floodplain.

Maintain Characteristic Subsurface Hydrology – This function is defined as the capacity of a riverine wetland to store and convey subsurface water. Potential sources of subsurface water are direct precipitation, interflow, groundwater, and overbank flooding.

Cycle Nutrients – This function is defined as the ability of the riverine wetland to convert nutrients from inorganic forms to organic forms and back through a variety of biogeochemical processes such as photosynthesis and microbial decomposition.

Remove and Sequester Elements and Compounds – This function is defined as the ability of the riverine wetland to permanently remove or temporarily immobilize nutrients, metals, and other elements and compounds that are imported to the riverine wetland from upland sources and via overbank flooding. In a broad sense, elements include macronutrients essential to plant growth and other elements such as heavy metals that can be toxic at high concentrations. Compounds include pesticides and other imported materials. The term "removal" means the permanent loss of elements and compounds from incoming water sources, and the term "sequestration" means the short- or long-term immobilization of elements and compounds.

Retain Particulates – This function is defined as the capacity of a wetland to physically remove and retain inorganic and organic particulates >0.45 μm from the water column. The particulates may originate from either onsite or off-site sources.

Export Organic Carbon – This function is defined as the capacity of the wetland to export the dissolved and particulate organic carbon produced in the riverine wetland. Mechanisms include leaching of litter, flushing, displacement, and erosion.

Maintain Characteristic Plant Community – This function is defined as the capacity of a riverine wetland to provide the environment necessary for a characteristic plant community to develop and be maintained. In assessing this function, one must consider both the extant plant community as an indication of current conditions and the physical factors that determine whether or not a characteristic plant community is likely to be maintained in the future.

Provide Habitat for Wildlife – This function is defined as the ability of a riverine wetland to support the wildlife species that utilize riverine wetlands during some part of their life cycles. The focus of attention, however, is on the avifauna component of habitat based on the assumption that, if conditions are appropriate to support the full complement of avian species found in reference standard wetlands, the requirements of other animal groups (e.g., mammals, reptiles, and amphibians) will be met.

The wet flatwood functions that were assessed for the LOD include the following:

Maintain Characteristic Habitat – This function reflects the capacity of a wetland to maintain the characteristic attributes of plant and animal communities normally associated with natural hardwood mineral flat ecosystems. Community attributes include presence of woody debris, tree density, component plant species such as those important as a food resource, and amount of natural area (water, forest, wetland) surrounding the site.

Maintain Characteristic Plant Community – This function reflects the capacity of a wetland assessment area to maintain the characteristic attributes of plant communities normally associated with natural hardwood mineral flat ecosystems. Community attributes include relative importance of component species (including percent target species, density) and the effects that alterations have on plant communities in hardwood mineral flats utilizing a FQAI.

Maintain Characteristic Water Level Regime – This function reflects the capacity of a hardwood mineral flat to maintain variations in water level characteristic of the ecosystem, including variations in depth, duration, frequency, and season of flooding or ponding. The function models the effects that alterations to hydrologic regime have on fluctuations in water level. The model assumes that a hardwood mineral flat will maintain its characteristic water level fluctuations if it is not hydrologically modified.

Maintain Characteristic Carbon Cycling Processes – This function reflects the capacity of a hardwood mineral flat to maintain carbon cycling processes at the rate, magnitude, and timing characteristic of the ecosystem, including export of dissolved organic constituents. This function models the effects that alterations have on biogeochemical processes and assumes that hardwood mineral flats will maintain characteristic carbon cycling processes if not altered.

Because impacted wetlands were assessed using modified versions of previously published methodologies, it was important to field test and adjust the model variables and assumptions based on local field data. In this way, the HGM functional assessment methodologies would be as relevant as possible to the project. The modified HGM functional assessment methodologies were field tested at reference standard wetlands. Reference standard wetlands are wetlands that are considered to be in the best condition and least disturbed

within the geographic area. These reference standard wetlands provide functional comparisons to impacted wetlands within the project's LOD.

Prior to fieldwork, potential reference standard wetlands were identified from the desktop utilizing aerial imagery, topographic maps, public lands databases, National Wetlands Inventory (NWI) maps, and hydric soil mapping. Then, field visits were conducted to determine which sites should be used as reference standard wetlands. Factors including disturbance regime, species composition, diameter of trees, basal area, treefall, snags, soils, and hydrology were examined. VDOT, in close coordination with EPA, USACE, and VDEQ reviewed the potential reference wetlands and determined five of them to be representative of the highest quality in the region and thus worthwhile reference standard wetlands. A workshop was conducted in August 2015 where representatives from VDOT, EPA, USACE, and VDEQ reviewed reference standard wetland scores and provided input on modified model variables.

Functions of the wetlands located within the project LOD depend on their physical, geographic, and environmental characteristics. Influencing factors can include size and proximity of wetlands to ongoing development activity, geologic setting, soil characteristics, presence and duration of hydrology, landscape position, vegetation cover type, and dominant ecological community type, all of which were assessed with the modified "western Kentucky" method and "wet flatwoods" method. Functions of impacted wetlands were evaluated within 96 wetland assessment areas that corresponded to preliminary impact areas based on preliminary conceptual design. Approximately 27 acres of wetlands were assessed using the modified "western Kentucky" method and approximately 25 acres of wetlands were assessed using the modified "wet flatwoods" method.

In general, cypress/tupelo and bottomland hardwood systems strongly performed "maintain characteristic subsurface hydrology", "cycle nutrients", "remove and sequester elements and compounds", "export organic carbon", "maintain characteristic plant community", and "provide habitat for wildlife". To a lesser degree, cypress/tupelo performed "temporarily store surface water and retain particulates"; this is a model constraint – if a FEMA floodplain is not present, the model assumes these two functions are not being performed. Although these functions are performed at cypress/tupelo and bottomland hardwood wetlands, the model is not sensitive enough to evaluate these functions effectively. Mineral flat wetlands strongly performed "maintain characteristic water regime", and to a lesser degree, "habitat", "maintain characteristic plant community", and "carbon cycling processes" were performed. Most mineral flats have been logged in the past, and therefore vegetation species composition and structure are in the process of transitioning to climax communities, and do not perform these functions at high levels.

Temporary Impacts

Construction of the FHWA/VDOT Preferred Alternative will also result in temporary impacts to approximately 1.31 acres of PEM wetlands. Temporary impacts are required to construct the project and will mostly consist of the construction of temporary access routes. Where practicable, the existing natural root mat, stumps and herbaceous vegetation will be used as a base for any temporary access routes. Geotextile fabric will be placed on the existing surface and best management practices (BMPs) will be used for all wetland crossings such as temporary ground protection wooden mats, prefabricated equipment pads, or washed free-draining aggregate placed on geotextile fabric. All mats, aggregate and fabric will be removed after construction is complete. Temporarily wetlands impacted will be restored to preconstruction elevations once construction is completed and compacted soil will be loosened by ripping or other approved methods. No functional assessments were conducted on temporarily disturbed wetlands.

Navigable Waters of the U.S. (Section 10 Waters)

The FHWA/VDOT Preferred Alternative crosses only one Section 10 Navigable Water, the Blackwater River. Temporary impacts to navigation are anticipated during construction of bridges over the Blackwater River. Temporary portages may be needed for river use during construction. Construction of bridges and culverts into and around water bodies may also temporarily and/or permanently change the water velocity and depth, which could in turn impact navigability. Construction duration may be the best measure for determining temporary impacts to navigability. There would be no long-term impacts since the FHWA/VDOT Preferred Alternative would cross in the same vicinity as the existing bridge, but the new bridge would be much longer than the existing bridge.

Waterways, Waterbodies, and Associated Deepwater Habitat

The primary direct impact of highway construction on surface water resources is associated with the number and nature of the surface water crossings. Stream crossings by bridges have less direct impact than culvert crossings. The bridging of sensitive resources discussed in the previous section, as well as the bridging of streams for hydraulic purposes, results in a reduction in direct impacts to streams. Bridge locations are presented in **Figure 3.4-16**.

Streams delineated in the Inventory Corridor include approximately 47,833 linear feet of stream (46,030 linear feet of perennial/intermittent stream and 1,803 linear feet of ephemeral stream). The total linear feet of stream impacts within the LOD is 6,874 linear feet of stream, including 5,027 linear feet of perennial stream, 1,453 linear feet of intermittent stream, and 394 feet of ephemeral stream (see **Table 3.4-12**). The stream impacts are depicted in **Figure 3.4–16** (Sheets 1-5). Additionally, a total of 789 linear feet of existing pipe will be replaced where streams are currently culverted beneath existing Route 460.

Table 3.4-12: Streams Within the Inventory Corridor and the LOD

Area of Study	Streams (Linear Feet)		
	Linear Perennial/Intermittent	Ephemeral	Total
LOD of the Preferred Alternative	5,027	394	6,874
Inventory Corridor	46,030	1,803	47,833

Source: Field Delineated Streams

Through the placement of fill, the project will result in permanent impacts to seven open waterbodies (*i.e.*, ponds) totaling approximately 3.9 acres. The ponds being impacted by the project are less than 20 acres in size, lack active wave-formed or bedrock shoreline features, have a water depth less than six feet at low water, and have a salinity due to ocean-derived salts less than 0.5 parts per thousand, and are, therefore, classified as palustrine open water according to the Cowardin Classification System.

In order from west to east, the first pond is a portion of a wetland/stream complex located just east of Yellow Hammer Road that has been impounded between existing Route 460 and the Norfolk Southern Railroad most likely due to a non-functioning culvert under existing Route 460. The second and third ponds are in active aquacultural use as part of the Perry Minnow Farm. These ponds appear to have been historically part of a stream/wetland complex, but have been excavated and expanded significantly to their current capacity. These ponds are routinely drawn down and maintained. The fourth pond is located on a crop farm just east of Old Myrtle Road and is comprised of a portion of a stream/wetland complex that has been impounded by an earthen dam. The fifth pond is located on a hunt club property and is comprised of a portion of a stream/wetland complex that has been impounded by an earthen dam. The sixth pond is located on a crop farm just west of Route 58 and is comprised of the headwater portion of a stream/wetland complex

that has been impounded and partially excavated. The seventh pond is located on the same crop farm and is comprised of a portion of a wetland/stream complex that has been impounded by a small earthen dam. This pond also receives significant input from drain tiles that drain the surrounding fields.

In addition, approximately 9,339 linear feet of jurisdictional ditch are within the LOD of the FHWA/VDOT Preferred Alternative (see **Table 3.4-13**). Other waterbodies that are present in the Inventory Corridor include approximately 18 acres of open water (ponds) and 38,584 linear feet of jurisdictional ditch.

Table 3.4-13: Waterbodies and Jurisdictional Ditch Within the Inventory Corridor and the LOD

Area of Study	Type	
	Ponds (Acres)	Jurisdictional Ditch (Linear Feet)
LOD of the Preferred Alternative	3.9	9,339
Inventory Corridor	18	38,584

Source: Field Delineated Streams

Additionally, the project will result in temporary impacts to streams, ponds, and ditches caused by construction access necessary to place roadway embankments, install pipe culverts and headwalls, and erect retaining walls and bridge abutments.

Temporary impacts to 1,225 linear feet of stream are also projected, including 973 linear feet of perennial stream, 206 linear feet of intermittent stream, and 46 linear feet of ephemeral stream.

Temporary impacts to other waters of the U.S. include 1,763 linear feet of jurisdictional ditch and 0.12 acres of open water (two ponds). The two ponds being temporarily impacted are located on a hunt club property comprised of a portion of a stream/wetland complex that has been impounded by an earthen dam and on a crop farm just west of Route 58 comprised of the headwater portion of a stream/wetland complex that has been impounded and partially excavated.

Wild and Scenic Rivers

Since there are no federally designated wild and scenic rivers in Virginia, there will be no impacts to national wild or scenic rivers.

Impacts to the state-listed Blackwater River will include both short- and long-term impacts. The FHWA/VDOT Preferred Alternative would span the Blackwater River within the same location as the existing bridge, but with a wider bridge footprint and longer bridge. Short-term impacts would be expected from the presence of construction and construction equipment in the project area that crosses the Blackwater River watershed. Adverse impacts to water quality in the Blackwater River are anticipated from increased runoff and impacts related to construction would be short-term and minor as appropriate BMPs and mitigation measures would be implemented to reduce impacts. Negligible impacts to recreational uses of the Blackwater River such as boating or fishing would also be expected during construction as passage through the construction area may be impeded in the vicinity of the bridge construction. Portaging around this area would be possible.

The proposed Blackwater River bridge will have a minimal vertical clearance of approximately 11 feet at the abutments and a maximum vertical clearance of approximately 35 feet toward the center of the bridge. Overall, this new structure will be more visible than the current bridge and would, therefore, alter to some degree the aesthetic and landscape resources of the Blackwater River and its scenic nature for users of the

river. Alternatively, motorists crossing the Blackwater River would be afforded a much better and more scenic view of the Blackwater River.

Coastal Zone Management Resources

Impacts to subaqueous lands are described in the **Waterways, Waterbodies, and Associated Deepwater Habitat** section. Impacts to wetlands can be found in the **Wetlands** discussion. Impacts from point and non-point pollution are described in the **Water Quality** discussion. The project is not expected to cause or contribute to a new violation of any NAAQS, increase the frequency or severity of any violation, or delay timely attainment of any NAAQS.

VDOT has provided the Commonwealth of Virginia with the Virginia Department of Transportation's Consistency Certification and necessary data and information under Coastal Zone Management Act (CZMA) Section 307(c)(3)(A) and 15 CFR Part 930, subpart D, for the project, seeking concurrence from DEQ that the proposed activity complies with the enforceable policies of Virginia's Coastal Zone Management Program (VCP) and will be conducted in a manner consistent with the Program.

Aquatic Biology

Aquatic organisms and their associated habitats will incur some effects as a result of roadway construction, maintenance, and vehicular passage. These impacts may result from the movement and compaction of soils, thus causing alterations to hydrology, water quality, and habitat. The construction of bridges and culverts into and around water bodies may change the water velocity, depth, and sedimentation rates, which in turn could impact downstream habitat. These activities also may impede the normal movement of aquatic biota. Refer to **Surface Water Resources** in **Section 3.4.3.2.1** for the location and description of stream crossings and bridges.

It is expected that construction activities would temporarily increase turbidity levels and sedimentation. Following construction, the expected traffic would impact water quality through vehicular deposition of pollutants. The pollutants in highway runoff generally include heavy metals, inorganic salts, aromatic hydrocarbons, and suspended solids (FHWA, 1998). Additional detail about water quality impacts is included in **Water Quality** in **Section 3.4.3.2.1**.

Fish Species and Associated Habitat

Stream and pond impacts are accounted for in the **Waterways, Waterbodies, and Associated Deepwater Habitat** (**Section 3.4.3.2.1**). Fish assemblages within the Inventory Corridor are comprised of abundant and commonly occurring warmwater game and non-game species typical of Coastal Plain streams. Smaller streams and ponds (intermittent and early perennial streams) act as breeding grounds for a number of fish species and their prey. Without implementation of BMPs and low-impact hydraulic design measures, direct effects to warmwater fisheries of the Inventory Corridor could include loss of habitat and impediments to upstream/downstream migration. With proposed spanning of major streams on structures and minimizing the amount of fill placed in the vicinity of stream crossings, direct effects to warmwater fisheries habitat or fish populations will be minor. Given the large number of warmwater fishery streams in the vicinity, the minor proposed loss of streams is not anticipated to have a substantial effect on fisheries.

All seven of the ponds being permanently impacted by the project were created within stream/wetland complexes and likely harbor fish assemblages. Two of the ponds are being actively managed for aquaculture. As such, they are frequently drawn down, cleaned, and restocked and would, therefore, contain little, if any, natural fish communities. The remaining five ponds are very small and may or may not be

stocked with game fish for recreational fishing. Ponds that are not fully drained as a result of the project would be expected to maintain a similar level of fish assemblage after project construction is completed and the ponds re-stabilize. Impacts to the ponds are expected to have a minimal effect on fisheries.

Benthic Communities

Benthic macroinvertebrates would be affected by construction of the project. Habitat would be temporarily affected by changes in turbidity and sedimentation rates. Community diversity may be temporarily affected by clearing activities that would cause changes in acidity or alkalinity and temperature. Without BMPs being implemented during construction, such affects would be more intense and potentially damaging. Habitat within the footprint of any fill in aquatic systems will be permanently lost. However, the seasonal fluctuations and the itinerant nature of benthic communities would likely allow for any impacts to be more temporary than permanent, and provide for re-population of affected stream reaches post-construction. It is anticipated that temporary impacts to benthic communities will be proportional to the length of stream bottom and ditches and area of open water (ponds) impacted by the FHWA/VDOT Preferred Alternative.

Waterfowl and Other Water-Dependent Migratory Birds

Minor effects on waterfowl and water-dependent migratory bird habitat would occur during implementation of the FHWA/VDOT Preferred Alternative, including reduction of area, fragmentation, and isolation of within the FHWA/VDOT Preferred Alternative.

Biota with life histories dependent on aquatic habitat, including waterfowl and water-dependent migratory birds, would be directly impacted from losses of wetlands, streams, and ponds. Road construction would lead to the placement of fill that could cause alterations to hydrology, water quality, and aquatic habitat. Impacts to waterfowl and water-dependent migratory birds would generally be related to construction activities that remove aquatic habitat. Construction of bridges and culverts, while avoiding complete removal of aquatic habitat, could still change water velocity, depth, and erosion and sedimentation rates, which could alter waterfowl movements. Generally, these birds would be expected to avoid the construction area and move to similar undisturbed habitats nearby; however, impacts could occur if disturbances result in increased stress, increased travel time to foraging areas from roosts or nest sites, disturbance of nests, or lower foraging success. These birds would be expected to repopulate in the vicinity of a given impact area after construction if conditions were favorable to their life history requirements and ecological tolerances. Additionally, roadway noise could result in impacts to waterfowl and water-dependent migratory birds, because roadway noise could alter habitat utilization, strain communication, and increase stress, since avian species are particularly vulnerable to such disturbance.

The FHWA/VDOT Preferred Alternative would produce temporary and permanent impacts to approximately 41.08acres of vegetated wetlands. These wetland impact numbers include the major riparian corridors where these species' habitat occurs.

Other Wildlife Species Associated with Aquatic Habitats

Direct impacts on other wildlife species associated with aquatic habitat would be expected as a result of the FHWA/VDOT Preferred Alternative new roadway and associated infrastructure construction. Direct impacts to wetlands, streams, and ponds from construction and construction-related activities would result in certain losses of biota that are dependent on aquatic habitat (see **Other Wildlife Species Associated with Aquatic Habitats** in **Section 3.4.2.1.9** for these species). Additionally, direct impacts on habitat quality through fragmentation would occur. The presence of construction equipment and unavoidable disturbance of stream bottoms would result in both permanent and temporary losses of aquatic organisms.

Organisms present at the time of displacement that could not migrate would experience the greatest impact. Most mammals, amphibians, and reptiles associated with aquatic habitat could translocate to adjacent or nearby areas that would be undisturbed or significantly less disturbed where they could re-populate.

Temporary and direct impacts to wildlife species would also be expected from land disturbance activities that remove vegetative cover of wetlands, streams, and ponds. Disturbance related to canopy removal would result in animal relocation and could create a situation that encourages development of opportunistic edge-dwelling communities. Direct impacts could also result from road operation as incidental death of aquatic-associated species could occur from road crossings. All of the impacts discussed here, such as fragmentation and removal of vegetative cover, would be less in the areas where the FHWA/VDOT Preferred Alternative is aligned along the existing location of Route 460, since these areas already experience fragmentation and disturbance from the existing road.

3.4.3.2.2 Terrestrial Resources

Natural Communities, Wildlife Habitat, and Biodiversity

Construction of the FHWA/VDOT Preferred Alternative would result in effects to the general ecology of its surroundings, including effects to terrestrial natural communities and associated wildlife habitat through conversion of existing land coverage to paved road surfaces and maintained right-of-way. This conversion would result in the loss of wildlife habitat and could affect wildlife migration patterns on a local scale as a result of this habitat fragmentation (see the **Wildlife Corridors, 3.4.2.2.1** discussion for further explanation). Those affected terrestrial natural communities large enough to be captured in the field surveys of natural communities are summarized according to community classification as described in **Table 3.4-14**. Natural communities located within the LOD of the FHWA/VDOT Preferred Alternative and Inventory Corridor are shown on **Figure 3.4–19** (Sheets 1-7).

Table 3.4-14: Potential Impacts to Natural Communities

Natural Communities of Virginia	Within LOD of the Preferred Alternative (acres)	Inventory Corridor (acres)
Mesic Mixed Hardwood Forests	63.8	229.44
Piedmont/Coastal Plain Oak-Beech/Heath Forests	26.1	113.28
Bald Cypress-Tupelo Swamps	6.8	80.71
Coastal Plain/Piedmont Bottomland Forests	18.9	100.6
Pine Scrub Oak Sandhills	0.3	1.37
Coastal Plain Depression Wetlands	0	0.95
Semi-Permanent Impoundments	0.9	5.84
Subtotal (before Pine Plantation):	**116.8**	**532.19**
Non-Riverine Flatwoods and Swamps, Planted-Pine Variant[1]	46.8	216.71
Total (with Pine Plantation):	**163.6**	**748.9**

Source: Fleming et al, 2013

1 For the purposes of this study, pine plantations were categorized as Non-Riverine Flatwoods and Swamps, Planted-Pine Variant, as this is likely the natural community in which they would be classified if unaltered. Since Non-Riverine Flatwoods and Swamps, Planted-Pine Variant is not a Natural Communities of Virginia classification, this category was separated from the other classifications in the table.

Agricultural Lands and Brush/Old Fields

Land used for agricultural crops is prevalent throughout the study area and would be impacted by the FHWA/VDOT Preferred Alternative. Approximately 909 acres of agricultural land is located within the

Inventory Corridor; 251 acres of land is located within the LOD of the FHWA/VDOT Preferred Alternative (see **Table 3.4-15**).

Table 3.4-15: Potential Impacts to Agricultural Lands and Brush and Old Fields

Area of Study	Agricultural Lands (acres)	Brush and Old Fields (acres)
LOD of Preferred Alternative	251	8.9
Inventory Corridor	909	22.45

Source: NOAA 2010a

Brush-covered lands and old fields are difficult to quantify as they are typically in a transitional process, often from fallow cropland into forest or from clearcut forest to agriculture or pine plantation. Brush and old fields were mapped in the field during the natural community field mapping effort. Approximately 22.45 acres of brush and old fields are located within the Inventory Corridor; 8.9 acres are located within the LOD of the FHWA/VDOT Preferred Alternative (see **Table 3.4-15**.

Through the development of the VDOT/FHWA Preferred Alternative, impacts to agricultural lands and brush/old fields have likely increased due to avoidance of impacts to wetlands and more significant habitat areas.

Regional Biodiversity

The construction of the FHWA/VDOT Preferred Alternative would lead to the direct loss, fragmentation, and/or degradation of habitat and, in turn, potentially impact biodiversity. The types of activities that may potentially impact biodiversity include vegetation removal, earth moving in the form of cut and fill, and direct construction impacts to sensitive habitats. In addition to the physical destruction of habitat, soil erosion and other forms of pollution may degrade habitat and impact biodiversity. Upon completion of construction, roadway operation and maintenance may result in continued impacts to wildlife that may impact regional biodiversity. These impacts may include physical barriers to wildlife movements, vehicle wildlife collisions, degradation of aquatic habitats due to contaminated runoff and fuel, or chemical spills associated with vehicular accidents. Maintenance activities that may cause impacts include vegetation management (including physical and chemical vegetation controls) and salting and sanding roads during winter storms. These activities can result in an increase in runoff pollution. Additional potential impacts may include impacts to animal foraging behavior and displacement of wildlife, alteration of topography, noise and visual disturbance, and introduction of invasive species (EPA, 1994).

Of particular concern to biodiversity would be the FHWA/VDOT Preferred Alternative's direct impact to two biodiversity-ranked communities (see **Figure 3.4–20**).

The 3,158-acre Antioch Swamp SCU encompasses much of the main stem of the Blackwater River and its tributaries in Southampton and Isle of Wight Counties just west and east of Zuni. The LOD of the FHWA/VDOT Preferred Alternative would cross this SCU two times, once across the main stem of the Blackwater River just west of Zuni and once over a tributary of the Blackwater River just east of Zuni. Potential impacts at both of the crossings include direct loss of riparian habitat and potential degradation of water quality from erosion and construction activities. It is not anticipated that there would be substantial increases in fragmentation of the existing riparian corridor, because Route 460 already crosses these locations. The FHWA/VDOT Preferred Alternative would directly impact 2.75 acres of this SCU, which is less than one percent of the acreage of the SCU.

The 184-acre Zuni Conservation Site does not have legal protections, nor is it actively managed by DCR (DCR 2014a). The site is currently bisected by existing Route 460 and Fire Tower Road. The LOD of the FHWA/VDOT Preferred Alternative will serve to widen existing Route 460 and Fire Tower Road and will, therefore, not represent a substantial new impact to this resource. Potential minor impacts include direct loss, potential degradation of water quality, and fragmentation of habitat, although any such impacts are expected to be minimal as the crossing is collocated with the existing Route 460 and Fire Tower Road. No existing culverts provide connectivity at this crossing, and as a part of this project, no new culverts are proposed. The FHWA/VDOT Preferred Alternative would directly impact 2.57 acres of this conservation site.

Wildlife Corridors

Wildlife corridors would potentially be bisected following the construction of the FHWA/VDOT Preferred Alternative (see **Figure 3.4–12**). These impacts would be expected to be limited in nature at the Blackwater River and Burnt Mills Swamp crossings as these crossings are collocated with the existing Route 460 crossing. The two crossings of the wildlife corridor along Ennis Mill Swamp are on new location, and as such would be expected to have more significant impacts on that corridor. Other narrower riparian corridors, even small streams, also provide some function for wildlife movement and will be impacted as a result of the proposed project. These potential impacts may include fragmentation of the wildlife corridor, creation of a barrier that could limit the movement of terrestrial and aquatic life, direct habitat loss, increased noise that may interfere with the ability of wildlife to continue to use the corridor, and highway lighting that could potentially impact some animals' usage of the wildlife corridor (Beier, et al., 2008).

Forest Interior Dwelling Species Habitat

Additional potential impacts could occur to FIDS habitat. Potential direct impacts would be loss and fragmentation of mature hardwood and mixed hardwood/pine forests from construction of the FHWA/VDOT Preferred Alternative. The direct loss of forest habitat results in smaller forest tracts that may no longer be adequate to accommodate a bird's territory, to provide an ample supply of food, or to provide the necessary forest structure for breeding. In addition to area requirements, many FIDS have additional habitat requirements for nesting. Reduction of forest size often results in the loss of specialized habitats/microhabitats. Small forests cannot sustain the same environmental conditions that larger forests can, such as higher humidity and complex vegetative structure (Jones, et. al., 2001). The FHWA/VDOT Preferred Alternative crossings of Ennis Mill Swamp and Eley Swamp would potentially impact FIDS habitat as these crossings are on new alignment through the riparian corridor, and would increase fragmentation of the system, which is already bisected by several roads. The crossings of Ennis Mill Swamp have the potential to impact two FIDS habitats, each of which are approximately 470 acres. The crossing of Eley Swamp has the potential to impact one FIDS habitat that is approximately 250 acres.

Threatened and Endangered Species

Since the publication of the Draft SEIS, VDOT has continued to conduct threatened and endangered species coordination with resource agencies through field visits, pre-application meetings, and phone discussions. The following summarizes threatened and endangered species agency coordination efforts conducted in 2015:

- On April 1, 2015, representatives from VDOT, EPA, VMRC, VDEQ, DGIF, and DCR-DNH met in person and over conference call to discuss rare, threatened, and endangered species, and whether or not any species surveys would be required within the 2015 survey windows. As part of the

discussion, DGIF recommended surveys for barking tree frog and Mabee's salamander due to the high probability of potential habitat.

- On April 23, 2015, representatives from VDOT, USACE, EPA, VDEQ, and DGIF visited high quality and representative lower quality sites for Mabee's salamander and the barking tree frog within the Inventory Corridor. The purpose of this field meeting was to obtain concurrence from DGIF regarding the suitability of potential breeding habitats as identified in the field by VDOT, and determine where presence/absence surveys should occur.

In addition to coordinating with resource agencies, VDOT queried threatened and endangered species databases to determine if any federal- or state-listed species have been documented within the vicinity of the Inventory Corridor. Because of the variability in relevance of the various species "hits" returned from query results, an initial screening process was used to pare down the list of species returned from the database queries to a smaller list of species relevant to the project. This initial screening process was informed using a combination of site-specific knowledge, species life history requirements, resource agency coordination, and best professional judgement. Ten species were identified from the database query results for initial assessment (see **Table 3.4-16**).

Table 3.4-16: Threatened and Endangered Species Evaluation Matrix

Common Name	Scientific Name	Legal Status	IPaC	DCR-DNH (12 Digit HUC)	VAFWIS (2-Mile Buffer)	Habitat Present (Field-Verified)	Further Coordination Recommended
Northern long-eared bat	*Myotis septentrionalis*	FT	X	---	---	YES	YES
Red-cockaded Woodpecker	*Picoides borealis*	FE/SE	X	---	---	NO	NO
Bald Eagle	*Haliaeetus leucocephalus*	MBTA/ BGEPA[2]	---	---	C	YES	NO
Dismal Swamp Southeastern Shrew[1]	*Sorex longirostris fisheri*	ST	---	---	C	YES	NO
Mabee's Salamander	*Ambystoma mabeei*	ST	---	X	P	YES	NO
Barking Tree Frog	*Hyla gratiosa*	ST	---	---	---	YES	NO
Canebrake Rattlesnake	*Crotalus horridus*	SE	---	---	P	NO	NO
Henslow's Sparrow	*Ammodramus henslowii*	ST	---	---	P	NO	NO
Blackbanded Sunfish	*Enneacanthus chaetodon*	SE	---	---	P	NO	NO
Black Rail	*Laterallus jamaicensis*	SE	---	---	P	NO	NO
Little Brown Bat	*Myotis lucifungus*	SE	---	---	---	NO	NO
Tri-colored Bat	*Perimyotis subflavus*	SE	---	---	---	NO	NO

FE = federal endangered; FT = federal threatened; SE = state endangered; ST = state threatened;
P = potential habitat; C = confirmed observation 1) The Dismal Swamp southeastern shrew was delisted in April 2016, after the habitat assessments were completed. 2) The bald eagle has been delisted at both the state and federal levels; however, it is still afforded legal protection under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA)

Of the ten species included in **Table 3.4-16**, four are listed as "potential" by the VAFWIS query results, but are not listed by any other database queries. "Potential" species are those that, through DGIF modeling, have been identified as having potential habitat within the query radius. DGIF's VAFWIS Coordination Recommendations indicate that no coordination is recommended if a species is only documented by this dataset and no others; therefore, canebrake rattlesnake, black rail, blackbanded sunfish, and Henslow's sparrow were not considered further.

Field habitat assessments were conducted for six species: northern long-eared bat, red-cockaded woodpecker, bald eagle, Dismal Swamp southeastern shrew, Mabee's salamander, and barking tree frog. Habitat assessments were conducted from April 2015 to July 2015. Based on the results of the habitat assessment and DGIF recommendations, VDOT conducted presence/absence surveys for the barking tree frog and Mabee's salamander during the respective species sampling seasons in 2015. VDOT conducted a field review of potentially suitable sampling sites with DGIF and chose four Mabee's salamander sampling sites and ten barking tree frog sampling sites. The results of the habitat assessments and presence/absence surveys are presented in detail below.

Northern Long-eared Bat (Myotis septentrionalis)

The Inventory Corridor does not contain suitable winter hibernacula or habitat for the NLEB; however, there is suitable summer roosting and foraging habitat. Therefore, the NLEB has the potential to occur within nearly the entirety of the LOD of the FHWA/VDOT Preferred Alternative. To determine the amount of potential habitat that may be impacted by the Project, forested land with trees greater than 3-inch DBH were estimated within the Inventory Corridor (approximately 743 acres). Of this total, approximately 162.7 acres of suitable forested habitat is anticipated to be impacted by construction of the FHWA/VDOT Preferred Alternative.

On February 16, 2016, the USFWS promulgated the final 4(d) rule which significantly changed USFWS' recommended conservation measures. The final 4(d) rule states:

> *Under this final 4(d) rule, incidental take within the WNS zone involving tree removal is not prohibited if two conservation measures are followed. The first measure is the application of a 0.25 mile (0.4 km) buffer around known occupied northern long-eared bat hibernacula. The second conservation measure is that the activity does not cut or destroy known occupied maternity roost trees, or any other trees within a 150-foot (45-m) radius around the maternity roost tree, during the pup season (June 1 through July 31).*

No known or documented hibernacula or maternity roosts occur within the FHWA/VDOT Preferred Alternative Inventory Corridor; therefore, VDOT is proposing no further work for this species. In VDOT's opinion, the project may affect, but is not likely to adversely affect the northern long-eared bat.

Red-Cockaded Woodpecker (Picoides borealis)

This species was listed in the IPaC database query results for the Inventory Corridor due to historic records. All known existing occurrences of this species in Virginia are now confined within Piney Grove Preserve which is located well outside of the Inventory Corridor. There is no suitable habitat and no known occurrences of this species in the Inventory Corridor; therefore, the project will result in no effect to the red-cockaded woodpecker and no further coordination is proposed.

Bald Eagle (Haliaeetus leucocephalus)

The Inventory Corridor contains suitable foraging and roosting habitat for bald eagle, but no active nests currently occur within the Inventory Corridor. The closest active bald eagle nest is located on Lake Meade

approximately 4,500 feet southeast of the project's eastern terminus. Because no active nests occur within the Inventory Corridor, no effects to bald eagle are anticipated and no further coordination is proposed.

Mabee's Salamander (Ambystoma mabeei)

Potential habitat for Mabee's salamander (forested areas adjacent to vernal ponds) occurs in the Inventory Corridor. Based on a field assessment of potential habitat and agency coordination, DGIF recommended that presence/absence surveys be conducted at four locations. The Mabee's salamander surveys were conducted according to the DGIF's approved survey methods, and involved qualified biologists dip netting at least 50 percent of each of the pond areas during each sampling event in an attempt to capture adult or larval Mabee's salamanders. These sites were surveyed on four occasions in May of 2015. No Mabee's salamanders were found. According to DGIF survey protocols and personal communication with DGIF's state herpetologist salamanders do not breed consistently every year; therefore, two consecutive years of survey would be required to determine definitively whether or not Mabee's salamander is present.

Initial negative survey results suggest that there is a low probability that the Mabee's salamander occurs within the Inventory Corridor. In addition, since the field review with DGIF, the design of the LOD of the FHWA/VDOT Preferred Alternative has been advanced and is avoiding all four locations of identified suitable habitat; therefore, it appears that there will be no effect to Mabee's salamander and no further survey work is proposed.

Barking Tree Frog (Hyla gratiosa)

Potential habitat for barking tree frog occurs within the Inventory Corridor. Based on a field assessment of potential habitat and agency coordination, DGIF recommended that presence/absence surveys be conducted at ten locations.

Barking tree frog surveys involved visiting each site within 48 hours of an adequate rain event from 30 minutes after sunset to 1:00 am. Biologists conducted five minute audio surveys at each location, listening for barking tree frog vocalizations. Sites were visited on May 21, June 4, July 15 and August 8 of 2015. No barking tree frog vocalizations were identified during the 2015 surveys. According to DGIF's state herpetologist, frogs do not breed consistently every year; therefore, two consecutive years of surveys would be required to determine definitively whether or not barking tree frogs are present.

Initial negative survey results suggest that there is a low probability that barking tree frogs occur within the Inventory Corridor. It is VDOT's opinion that the proposed project will result in no effect to barking tree frog and no further work is proposed.

Little Brown Bat and Tri-colored Bat

Subsequent to the screening process and the field surveys two additional bats species were listed as state-endangered – the little brown bat and the tri-colored bat. According to the DGIF Guidance Document on Best Management Practices for Conservation of Little Brown Bats and Tri-colored Bats (approved February 16, 2016):

- *The DGIF knows about 132 hibernacula (places where these animals hibernate during the winter) with little brown and or tri-colored bats present. These hibernacula typically are located in western Virginia and are typically caves;*
- *The DGIF has not tracked and is not aware of any little brown or tri-colored bat roost trees (places where the animals live when not hibernating) in Virginia; and,*

- *Little brown and big brown bats are the two species most commonly found in human-occupied dwellings and the ones most likely to cause human conflicts. The DGIF is currently aware of three structures that serve as roosts for little brown bats. Tri-colored bats utilize human structures as well, but are more commonly found in barns, sheds, and abandoned structures and less so in occupied dwellings. Currently, the DGIF is not aware of any tri-colored bat roosts in Virginia.*

VDOT has no knowledge of hibernacula or roosts for little brown bat or tri-colored bat within the Inventory Corridor of the FHWA/VDOT Preferred Alternative; therefore, VDOT is currently not proposing any conservation measures or presence/absence surveys for these two bat species.

Invasive Species

There is potential for invasive species to become established along the LOD of the FHWA/VDOT Preferred Alternative during and following construction. Invasive species that have been previously recorded in the Inventory Corridor and are colonizers of disturbed areas are of the most concern. Species that meet both criteria are listed in **Table 3.4-17**. Construction of the project has the potential to spread invasive species via the entering and exiting of construction equipment, the inclusion of invasive species in seed mixtures and mulch, and the improper removal and disposal of invasive species so that seed is spread along the highway. Invasive species can also become introduced by vehicles using the highway post-construction. Additional information regarding invasive species is described in **Section 4.3.4 of the *Supplemental Natural Resources Technical Report* (VDOT, 2016f)**.

Table 3.4-17: Highly Invasive Plant Species Observed with Potential to Occur Within the Vicinity of the Inventory Corridor

Common Name	Scientific Name	Aquatic/ Wetland or Terrestrial	Recorded in Inventory Corridor County/City
Alligator weed	*Alternanthera philoxeroides*	Aquatic/ Wetland	Isle of Wight
Amur Honeysuckle	*Lonicera maackii*	Terrestrial	Suffolk
Chinese lespedeza	*Lespedeza cuneata*	Terrestrial	Southampton, Isle of Wight, and Suffolk
Chinese privet	*Ligustrum sinense*	Terrestrial	Southampton, Isle of Wight, and Suffolk
Cinnamon vine	*Discorea polystachya*	Terrestrial	Isle of Wight and Suffolk
Common reed	***Phragmites australis ssp. australis***	**Aquatic/ Wetland**	**Southampton, Isle of Wight, and Suffolk**
Japanese honeysuckle	*Lonicera japonica*	Terrestrial	Southampton, Isle of Wight, and Suffolk
Japanese knotweed	*Reynoutria japonica*	Terrestrial	Southampton, Isle of Wight, and Suffolk
Japanese stiltgrass	***Microstegium vimineum***	**Aquatic/ Wetland**	**Southampton, Isle of Wight, and Suffolk**
Johnson-grass	*Sorghum halepense*	Terrestrial	Southampton, Isle of Wight, and Suffolk
Kudzu vine	*Pueraria montana* var. *lobata*	Terrestrial	Southampton, Isle of Wight, and Suffolk
Marsh dewflower	*Murdannia keisak*	Aquatic/ Wetland	Southampton, Isle of Wight, and Suffolk
Mile-a-minute	*Persicaria perfoliata*	Terrestrial	Suffolk
Multiflora rose	*Rosa multiflora*	Terrestrial	Southampton and Suffolk
Oriental bittersweet	*Celastrus orbiculatus*	Terrestrial	Isle of Wight

Common Name	Scientific Name	Aquatic/ Wetland or Terrestrial	Recorded in Inventory Corridor County/City
Parrot feather	*Myriophyllum aquaticum*	Aquatic/ Wetland	Southampton and Isle of Wight
Purple loosestrife	*Lythrum salicaria*	Aquatic/ Wetland	Suffolk
Spotted knapweed	*Centaurea stoebe* ssp. *micranthos*	Terrestrial	Isle of Wight
Tree-of-heaven	***Ailanthus altissima***	**Terrestrial**	**Southampton, Isle of Wight, and Suffolk**
Wineberry	*Rubus phoenicolasius*	Terrestrial	Southampton and Isle of Wight
Winged euonymus	*Euonymus alatus*	Terrestrial	Not Recorded in Inventory Corridor

Species in **bold** typeface are species of "High Concern" in Virginia (VISWG, 2014).
Sources: DCR, 2009b, CISE, 2014, VISWG, 2014.

Mineral Resources and Unique Geological Features

There are no known sand and gravel operations located within the Inventory Corridor or the LOD of the FHWA/VDOT Preferred Alternative. This could change over time as new sand and gravel operations are developed. Other potential direct impacts could occur as a result of construction of the FHWA/VDOT Preferred Alternative on new alignment on top of existing sand and gravel deposits, thus preventing future access to those deposits.

Impacts may also be realized through the development of new sand and gravel mining operations as a result of the need for fill material for the roadway. Development of new mining operations would represent a positive economic impact to the region, but could represent an adverse effect on other natural resources such as forestland, agricultural lands, and wetlands where the mining operations occur.

3.4.4 Mitigation

3.4.4.1 Water Resources and Aquatic Ecology

3.4.4.1.1 Surface Water Resources

Water Quality

Highway runoff is considered a nonpoint source and can be managed effectively by employing proper stormwater BMPs and managing for the major causes of a particular stream/watershed's impairment. These practices provide means of avoiding or minimizing the negative impacts of various pollutants that can be carried by rainfall into the groundwater and receiving waters. These pollutants include materials discharged by vehicles using the highway system, pesticides and fertilizers from adjacent landscapes, and particulates from breakdown of pavement (TRB, 2006).

Direct impacts have been reduced by bridging over the larger streams and reducing the footprint width and extending bridge lengths. Implementation of strict erosion and sediment control measures as outlined in Chapter 10 of VDOT's Drainage Manual (VDOT, 2012) during construction will minimize temporary impacts to surface waters. Control measures that will be incorporated include sediment traps, sediment basins, silt fences, etc. Under the regulatory framework of the Virginia Pollution Discharge Elimination System (VPDES) and Virginia Erosion and Sediment Control and Stormwater Control laws, VDOT will employ stormwater management control features, including use of BMPs during construction and post

construction, to minimize temporary and permanent, and direct and indirect impacts to surface waters. These BMP's have been proven to be an effective means of capturing and treating highway runoff to remove heavy metals and nutrients. Properly managed BMP's can intercept runoff and store nonpoint pollutants like sediment, nutrients, and certain heavy metals. Vegetation also can slow runoff and dissipate its energy; therefore, temporarily disturbed areas will be revegetated.

Additionally, design and construction techniques that reduce water quality impacts and protect aquatic species, as described in the Virginia Stormwater Management BMP Clearinghouse, will be incorporated into the project. Techniques include stabilization of slopes, channels, swales, and embankments after construction activities are completed; minimization of excavation; and installation of turbidity barriers around the area of construction.

Direct impacts to fish and macroinvertebrates will be avoided or minimized through various project design considerations, such as bridging, countersinking of culverts, and minimizing the roadway footprint and median; reducing such direct impacts should also reduce the potential for indirect impacts. Bridging protects the natural stream bottom and general hydrologic conditions, thus accommodating aquatic organisms. While culverts do not retain the natural stream bottom, they will be countersunk to allow normal and high flows and to provide for adequate passage for aquatic organisms and natural stream bottom materials will collect in the pipe. Long-term impacts to water quality from contaminant loadings will be reduced through the design for the FHWA/VDOT Preferred Alternative that will incorporate runoff pre-treatment, including vegetated medians and swales, stormwater BMPs, and forebays.

VDOT's hazardous materials program works with state and federal environmental agencies and other stakeholders to ensure that appropriate precautions for all hazardous materials are employed in all phases of project development, construction and maintenance. In addition, as part of the Specific Stormwater Pollution Prevention Plan (SWPPP) that will be prepared prior to submission of the registration statement for coverage under the VSMP construction general permit, the pollution prevention plan will be developed. The pollution prevention plan will describe all of the pollution prevention measures that will be employed during construction and include minimizing discharge of pollutants from activities such as vehicle washing, painting, and concrete washout; minimizing exposure to hazardous materials such as pesticides, fuels, and construction materials; and leak prevention and spill response procedures.

Impaired Waters

BMPs and other stormwater techniques would be employed to minimize further impacts on impaired waters. As stated in the **Water Quality** section above, VDOT will use construction techniques designed to reduce water quality impacts. Minimizing or restricting the use of fertilizers and using proper stormwater management BMPs to treat nutrient laden runoff would be employed. Clearing practices would be limited to the areas within the LOD which will serve to minimize clearing around impaired waters.

Surface Drinking Water Supplies

Stormwater management BMPs will be designed in accordance with specifications set forth in Section 3.14 of the Virginia Erosion and Sediment Control Handbook (1992) and VDOT's Annual Erosion and Sediment Control and Stormwater Management Standards and Specifications, as approved by DCR. Detention/retention basins will be designed to function as temporary basins for sediment and erosion control during the construction of the project. After construction is complete, most basins will be restored to their original depth or converted into permanent stormwater management facilities. The locations and abatement capacities of stormwater management facilities have been determined and they are not located in wetlands

or streams. Stormwater management facilities have been designed to retain and discharge stormwater runoff to pre-development levels at non erosive velocities and the outfall locations will include rip rap as necessary to prevent scouring. The stormwater management facilities will also provide water quality control by treating impervious surfaces.

Certain components of the FHWA/VDOT Preferred Alternative are close enough to, or over, public surface water supplies as to require special mitigation measures, both during and following construction. To protect public drinking water supplies, bridge runoff will be collected and treated at stormwater management facilities rather than running directly off the bridges into underlying waters. Stormwater management basins located near public water supplies will be designed with adequate detention time to allow spilled contaminants to be pumped out before they can enter the water supply. Although a spill consisting of the entire contents of a tanker truck would be unlikely, in the event of a spill, local spill response personnel would contain the spill and prevent its spread through the use of absorbent booms and pads.

A VSMP Permit from DCR will be required for construction activities affecting greater than one acre, as well as an approved erosion and sediment control plan. During and immediately following construction, multiple measures (such as erosion and sediment controls, a phased plan to limit the amount of exposed soil, and oversight by a full-time erosion and sediment control inspector) will be implemented in the vicinity of surface waters critical to public water supplies or special aquatic habitat. With implementation of appropriate mitigation measures and BMPs, the long-term operation and maintenance of the FHWA/VDOT Preferred Alternative is not expected to result in adverse impacts to water supplies.

3.4.4.1.2 Groundwater Resources

During the design phase of the project, all private or public wells located in the right-of-way would be identified and measures for their protection from contamination will be implemented in accordance with VDOT's Road and Bridge Specifications. Measures to be evaluated by VDOT during later design phases to avoid or minimize effects to groundwater supplies include (1) pollution prevention plans implemented during critical phases of construction, and (2) design of stormwater drainage systems to prevent the infiltration of liquid contaminants or contaminated runoff. Measures that VDOT will consider to protect nearby groundwater supply wells include (1) routing of runoff laden with deicing agents away from well recharge zones, (2) stormwater management facilities developed during later design phases to optimize free ion retention through use of organic soil linings, etc., and (3) development of Spill Prevention Control and Countermeasure (SPCC) plans. Plans will be developed in accordance with Virginia Waterworks Regulations and any wellhead protection ordinances developed by local governments and service authorities. To mitigate temporary construction impacts, an erosion and sediment control plan developed in accordance with the Virginia Sediment and Erosion Handbook and VDOT's Annual Erosion and Sediment Control and Stormwater Management Standards and Specifications (as approved by DCR) will be implemented.

3.4.4.1.3 Floodways and 100 Year Floodplains/Only Practicable Alternative Finding

As the FHWA/VDOT Preferred Alternative advances to more detailed design, continued focus will be on avoiding and minimizing floodplain encroachment to ensure that the FHWA/VDOT Preferred Alternative meets the goals of Executive Order 11998, as amended, Executive Order 13690, and FHWA policy as set forth in 23 CFR §650. Encroachments have been minimized and avoided during engineering and design of the roadway prism through use of steeper-than-conventional road embankments, use of vertical retaining walls, alignment adjustments, and crossing floodplains and floodways at a perpendicular angle (e.g., the Blackwater River crossing is perpendicular). Because of the linear nature and location of the

FHWA/VDOT Preferred Alternative, crossing major drainages and associated 100-year floodplains and floodways is the only practicable alternative. In particular, the location of the Blackwater River crossing is dictated by the location of existing Route 460; the options evaluated that included a crossing of the river on new location (northern bypass of Zuni) were found to have far greater wetland impacts. The alternative to placing fill in the 100-year floodplains and floodways would be to construct bridges. Bridge crossings are being proposed at four locations (including the Blackwater River) that will result in reduced encroachment into 100-year floodplains and floodways.

Alternatives that were considered in the Draft SEIS would have resulted in impacts to floodplains and floodways ranging from 49.5 to 131.4 acres for floodplains and from 5.6 to 13.2 acres for floodways. These impacts are reported in **Table 3.4-13** of Chapter 3 of the Draft SEIS. Through avoidance and minimization, impacts to floodplains and floodways has been reduced substantially. The FHWA/VDOT Preferred Alternative will result in impacts to 11 acres of floodplains and 1 acre of floodways.

The proposed new bridge over the Blackwater River has a greater span length and higher profile than the existing bridge and will also have a more sufficient bridge opening. The existing bridge span is approximately 175 feet long and the new bridge span will be approximately 340 feet long. As a result, the flood elevations upstream of the proposed new bridge over the Blackwater River are anticipated to be less than existing conditions.

VDOT will construct bridge crossings using the minimum number of piers to ensure structural stability within floodways. Breastwalls and fill placed within floodplains for bridge abutments will be minimized. Based on engineering analysis of bridge construction methods for the project, VDOT has determined that bridges can be constructed over streams and wetlands without the use of temporary fill causeways. Therefore, in order to avoid impacts from temporary fill, VDOT will not use temporary causeways to construct bridges over wetlands and streams. VDOT will use a “top down” approach or similar method for the construction of bridge structures over wetlands.

In addition to mitigation measures designed to reduce the amount of floodplain encroachment, Sections 107 and 303 of VDOT’s Highway Construction Specifications require implementation of stormwater management practices to address concerns such as post-development runoff associated with storm events and downstream channel capacity. These standards require that stormwater management facilities be designed to reduce stormwater flows to pre-construction conditions for up to a 10-year storm event. VDOT and its construction contractors will adhere to the specifications to prevent an increase in flooding risks associated with any highway construction.

During final design, a detailed hydraulic survey and hydrology study will evaluate the effect of the proposed roadway improvements on stormwater discharge. The hydraulic study will ensure that no substantial increase in downstream flooding would occur and/or would document the need for any Letters of Map Revision (LOMR) or Conditional Letters of Map Revision (CLOMR) and that all encroachments will conform with all applicable State and local floodplain protection standards.

3.4.4.1.4 Wetlands

Avoidance and Minimization

VDOT has conducted extensive coordination with USACE, EPA, and VDEQ to avoid and minimize impacts to wetlands and streams to the greatest extent practicable. Through the development and refinement of the proposed project, a variable width Inventory Corridor, typically 500 feet, was maintained

for the purposes of identifying resources within a reasonable proximity to the Project alignment and for providing greater flexibility to further avoid and minimize impacts as design advanced. The potential wetland impact baseline within the Design Corridor was 49 acres prior to the application of any avoidance and minimization measures.

As a part of the avoidance and minimization process, VDOT evaluated the merits of modifying the following three design elements:

1. Horizontal Alignment: A horizontal alignment shift to primarily avoid but to also minimize impacts to each wetland group. Several horizontal shifts were applied to the project as a direct result of the avoidance and minimization meetings and discussions with USACE, EPA, and VDEQ.
2. Vertical Alignment: Vertical alignment shifts to reduce the impact of roadway fill slopes and in turn minimize wetland impacts. Wherever possible, across the entire length of the project, the engineering team lowered the proposed vertical profile for the roadway in an attempt to further reduce wetland impacts, while balancing any vertical alignment adjustments against drainage design requirements.
3. Typical Section: A modification to the typical section to reduce wetland impacts based on reducing the section width and increasing the side slope steepness. Section modifications included the use of guardrail at the outside shoulder to reduce clear zone requirements, retaining walls at the edge of shoulders to reduce the side slope footprint, and median barriers to reduce the median width.

As a result of the avoidance and minimization measures, the current project will result in a reduction of permanent impacts (including cut/fill, permanent conversion from bridge shading and clearing of right-of-way outside of the fill prism, and secondary impacts) to 39.77 acres of vegetated wetlands. The acreage of these impacts is small in relation to the total amount of wetlands within the HUCs, as seen in **Table 3.4-18**.

Table 3.4-18: Wetland Impacts Compared to Wetlands Within Each HUC

HUC	Wetland Impacts[1]	Wetlands within Each HUC [1,2]	Percent of Wetlands in HUC Impacted by the Preferred Alternative
03010202 (HUC-8)	15 acres	206,399 acres	0.007%
0301020203 (HUC-10)	15 acres	68,664 acres	0.022%
030102020304 (HUC-12)	15 acres	16,195 acres	0.093%
02080208 (HUC-8)	24 acres	318,578 acres	0.008%
0208020801 (HUC-10)	24 acres	121,724 acres	0.020%
020802080102 (HUC-12)	10 acres	13,415 acres	0.075%
020802080103 (HUC-12)	14 acres	8,156 acres	0.172%

[1] Acreage is rounded to the nearest whole number; acreage is not cumulative among HUC-8, HUC-10, and HUC-12.
[2.] The acreage of wetlands in each HUC-8 and HUC-12 was estimated by comparing the delineated wetlands to the NWI wetlands within the LOD and applying the same factor to the NWI wetlands within the HUC-8 and HUC-12.

Compensatory Mitigation

In 2008, USACE and EPA issued regulations (33 CFR §325 and 332, the "Mitigation Rule") governing compensatory mitigation for activities authorized by permits issued by USACE. The regulations establish performance standards and criteria for the use of permittee-responsible compensatory mitigation, mitigation banks, and in-lieu programs to improve the quality and success of compensatory mitigation. Compensatory mitigation is a critical tool in helping the federal government to meet the longstanding national goal of ''no net loss'' of wetland acreage and function. Function means the physical, chemical, and biological processes that occur in ecosystems. The Mitigation Rule emphasizes a watershed approach to compensatory

mitigation and presents the following "preference hierarchy" for compensatory mitigation (in order of preference):

- **Mitigation Banking:** A wetlands mitigation bank is a wetland area that has been restored, established, enhanced, or preserved, which is then set aside to compensate for future conversions of wetlands for development activities. Permittees, upon approval of regulatory agencies, can purchase credits from a mitigation bank to meet their requirements for compensatory mitigation. The value of these "credits" is determined by quantifying the wetland functions or acres restored or created. The bank sponsor is ultimately responsible for the success of the project. Mitigation banking is performed "off-site," meaning it is at a location not on or immediately adjacent to the site of impacts, but generally within the same watershed. Federal regulations establish a flexible preference for using credits from a mitigation bank over the other compensation mechanisms. Mitigation banking is a form of "third party" compensation, where the liability for project success is transferred to the mitigation bank.
- **In-Lieu-Fee Mitigation:** In-lieu-fee mitigation is mitigation that occurs when a permittee provides funds to an in-lieu-fee (ILF) sponsor (a public agency or non-profit organization). Usually, the sponsor collects funds from multiple permittees in order to pool the financial resources necessary to build and maintain the mitigation site. The ILF sponsor is responsible for the success of the mitigation. Like banking, ILF mitigation is also "off-site," but unlike mitigation banking, it typically occurs after the permitted impacts. Similar to mitigation banking, ILF mitigation is a form of "third party" compensation, where the liability for project success is transferred to the ILF sponsor. In Virginia, the ILF program is administered as the Virginia Aquatic Resources Trust Fund Program Instrument (VARTF). It is a binding agreement among the USACE Norfolk District, DEQ, and the Nature Conservancy of Virginia (TNC). This agreement details the VARTF, which allows land owners and developers to offset their project's impacts on Virginia's streams, rivers, and wetlands. When the impact to a wetland, stream, or river is minimized but remains unavoidable, the program allows permit applicants to pay into a trust fund. This trust fund is used for aquatic resource creation or restoration. The overall goal of the program is a no-net-loss of wetland acreage. The TNC administers the program by providing a web-based portal to submit project documentation, receive payment vouchers, and to serve as a regulatory clearinghouse for verifying impacts, watersheds, payments, and verifications under the Final Rule.
- **Permittee-Responsible Mitigation:** Permittee-responsible mitigation involves the restoration, establishment (*i.e.*, creation), enhancement, or preservation of wetlands undertaken by a permittee in order to compensate for wetland impacts resulting from a specific project. The permittee performs the mitigation after the permit is issued and is ultimately responsible for implementation and success of the mitigation. Permittee-responsible mitigation may occur at the site of the permitted impacts or at an off-site location within the same watershed. With permittee-responsible mitigation, the permittee maintains liability for the construction and long-term success of the site.

Under the Mitigation Rule, compensatory mitigation may be performed through four methods: restoration, enhancement, establishment, and in certain circumstances, preservation. Restoration should generally be the first option considered because the likelihood of success is greater and the impacts to potentially ecologically important uplands are reduced compared to establishment, and the potential gains in terms of aquatic resource functions are greater, compared to enhancement and preservation. The four compensatory mitigation methods are as follows:

- **Restoration:** Re-establishment or rehabilitation of a wetland or other aquatic resource with the goal of returning natural or historic functions and characteristics to a former or degraded wetland. Restoration may result in a gain in wetland function or wetland acres, or both. Restoration is divided into two categories: re-establishment and rehabilitation.
    - Re-establishment means the manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural/historic functions to a former aquatic resource. Re-establishment results in rebuilding a former aquatic resource and results in a gain in aquatic resource area and functions.
    - Rehabilitation means the manipulation of the physical, chemical, or biological characteristics of a site with the goal of repairing natural/historic functions to a degraded aquatic resource. Rehabilitation results in a gain in aquatic resource function, but does not result in a gain in aquatic resource area.
- **Establishment (Creation):** The development of a wetland or other aquatic resource where a wetland did not previously exist through manipulation of the physical, chemical and/or biological characteristics of the site. Successful establishment results in a net gain in wetland acres and function.
- **Enhancement:** Activities conducted within existing wetlands that heighten, intensify, or improve one or more wetland functions. Enhancement is often undertaken for a specific purpose such as to improve water quality, flood water retention, or wildlife habitat. Enhancement results in a gain in wetland function, but does not result in a net gain in wetland acres.
- **Preservation:** The permanent protection of ecologically important wetlands or other aquatic resources through the implementation of appropriate legal and physical mechanisms (*i.e.*, conservation easements, title transfers). Preservation may include protection of upland areas adjacent to wetlands as necessary to ensure protection or enhancement of the aquatic ecosystem. Preservation does not result in a net gain of wetland acres and may only be used in certain circumstances, including when the resources to be preserved contribute significantly to the ecological sustainability of the watershed.

When considering options for successfully providing the required compensatory mitigation, the USACE district engineer shall consider the type and location options in the order presented in §332.3 (b)(2) through (b)(6) of this section, i.e.: mitigation bank credits; in-lieu fee program credits; permittee-responsible mitigation under a watershed approach; permitee-responsible mitigation, on-site and in-kind; permittee-responsible mitigation, off-site and/or out-of-kind. However, the Mitigation Rule also states that when evaluating compensatory mitigation options, the USACE district engineer will consider what would be environmentally preferable. In making this determination, the district engineer must assess the likelihood for ecological success and sustainability, the location of the compensation site relative to the impact site and their significance within the watershed, and the costs of the compensatory mitigation project. Compensatory mitigation requirements must be commensurate with the amount and type of impact that is associated with a permit.

A wetland functional assessment (see **Section 3.4.3.2.1**) was conducted in part to help determine the type and amount of compensation required for the Project that would adequately replace the lost wetland acreage and functions. The functional assessment resulted in FCI scores for each wetland. Impacted wetlands were divided into two categories by the interagency team based on a combination of FCI scores, site-specific knowledge, and best professional judgement. These categories helped determine the type and amount of required compensation, as described below.

Category I Wetlands

Category I wetlands are those for which in-kind compensation is available through current mitigation banking credits. In general, Category I wetlands have lower FCI scores when compared to other wetlands within the project corridor. These wetlands comprise all of the mineral flat wetlands and the lower functioning riverine wetlands within the project corridor. Compensation for impacts to Category I wetlands will be achieved through purchase of wetland credits from approved mitigation banks with the ratios typically applied in Virginia – 2:1 for forested wetlands; 1.5:1 for scrub-shrub wetlands, and 1:1 for emergent wetlands. VDOT proposes to compensate for permanent impacts to 9.303 acres of Category I wetlands located in the Blackwater River sub-basin (HUC 03010202) through the application of 13.6 wetland credits previously purchased from the Halifax Farm mitigation bank. VDOT proposes to compensate for permanent impacts to 18.349 acres of Category I wetlands located in the Hampton Roads sub-basin (HUC 02080208) through the application of 32.1 wetland credits previously purchased from the Great Dismal Swamp Restoration Bank – Lewis Farm Mitigation Bank. These ratios will compensate for the wetland acreage and functions lost by Category I wetlands as a result of the proposed project.

Category II Wetlands

Category II wetlands are those wetlands for which in-kind compensation is not available through current mitigation banking credits. Moreover they are characterized by high ecological function (e.g., FCI), relatively uncommon occurrence in Virginia, and are difficult to replace. In general, Category II wetlands have higher FCI scores compared to Category I wetlands and typically consist of bald cypress/tupelo wetlands and bottomland hardwood wetlands that are seasonally inundated to permanently saturated.

During pre-application coordination meetings, the USACE, EPA, and VDEQ indicated that because of the reasons above, currently available credits from mitigation banks would not adequately compensate for the lost functions of these wetlands and that any such compensation would be considered "out-of-kind". Therefore, VDOT is proposing to compensate for impacts to Category II wetlands through project-specific mitigation solutions, described below.

Functional Loss Determination

Using the HGM methodologies, the functional loss of Category II wetlands impacted by the proposed project was determined by scoring the wetlands in their existing, pre-construction conditions as well as their projected post-construction conditions. The functional loss for each post-construction impact was based on one of four categories of impact:

- **cut/fill** – where no wetland functions remain after construction;
- **permanent right-of-way conversion** - where a partial loss of wetland function is realized, mainly due to cleared vegetation;
- **bridge conversion**, where a partial loss of wetland function is realized, mainly due to cleared vegetation; and,
- **secondary impacts**, where no wetland functions remain after construction.

Following is a summary of the functional loss associated with each category. The ***Supplemental Natural Resources Technical Report*** (VDOT, 2016f) provides more detail regarding the HGM model variables that are expected to change as a result of the project.

In the Blackwater River sub-basin, a total of 3.79 acres of permanent cut/fill impacts to PFO, PSS, and PEM Category II wetlands are expected as a result of the project. In the Hampton Roads sub-basin, a total

of 2.62 acres of permanent cut/full impacts to PFO Category II wetlands are expected as a result of the project. Cut/fill impacts will result in a loss of all wetland functions within the immediate footprint of the impact.

In the Blackwater River sub-basin, a total of 1.303 acres of permanent right-of-way conversion impacts to PFO and PSS Category II wetlands are expected as a result of the project. In the Hampton Roads sub-basin, a total of 0.4280 acres of right-of-way conversion impacts to PFO Category II wetlands are expected as a result of the project. Because forested and scrub-shrub vegetation will be permanently converted and maintained as emergent vegetation, the loss of vegetation structure is the primary impact to the wetland.

In the Blackwater River sub-basin, a total of 1.026 acres of bridge conversion impacts to PFO Category II wetlands are expected as a result of the project. In the Hampton Roads sub-basin, a total of 2.875 acres of bridge conversion impacts to PFO Category II wetlands are expected as a result of the project. Because vegetation will be maintained, the temporal loss of vegetation will be the most apparent parameter lost.

In the Blackwater River sub-basin, a total of 0.071 acres of secondary impacts to PFO Category II wetlands are expected as a result of the project. In the Hampton Roads sub-basin, no secondary impacts to Category II wetlands are expected as a result of the project. Secondary impacts will result in a loss of all wetland functions.

Restoration

VDOT is proposing to restore approximately 20.99 acres of degraded/impounded Category II wetlands. The goal of the proposed restoration sites is to restore natural/historic functions to aquatic resources that have been significantly degraded from impoundment. VDOT conducted an initial search to identify sites that could offer potential Category II wetland restoration in the Blackwater River (03010202) and Hampton Roads sub-basins (HUC 02080208) by reviewing a variety of sources including aerial imagery, NWI maps, United States Geological Survey (USGS) maps, and other publically available sources. In general, three major categories of disturbed wetlands occur in the vicinity of the project corridor:

- farmed wetlands that currently have wetland hydrology but through repeated disturbance are not functioning as mature wetlands;
- prior converted wetlands that have been drained and cleared for crop or timber production and do not currently exhibit wetland hydrology; and,
- wetlands that have been degraded though flooding from diking/impounding.

Farmed wetlands and prior converted wetlands were typically wet mineral flats and other non-riverine wetlands that were dry enough, at least during some portion of the growing season, to effectively drain, if necessary, and work the land. Riverine wetlands and swamps were typically not as easily drained and cultivated and therefore represent a very small percentage of converted wetlands. Thus, the majority of alteration or degradation to Category II wetlands was in the form of diking or impounding. Because of this, restoring farmed wetlands and prior converted wetlands typically results in restoration of Category I wetlands and not Category II wetlands unless significant excavation is performed. For this reason, VDOT's search focused on diked/impounded areas that are situated adjacent to existing Category II wetlands and would have likely been Category II wetlands prior to conversion.

Likelihood of success was also considered during site selection. Characteristics that were considered include the presence of NWI mapped wetlands with water regimes characteristic of Category II wetlands,

the presence of NRCS mapped hydric soils, and aerial signatures of Category II wetlands. A total of seven sites (two sites in the Hampton Roads watershed and five sites in the Blackwater River watershed) were considered. A field reconnaissance was conducted for each of the sites to determine suitability – two sites in Hampton Roads and two sites in Blackwater River sub-basins were determined to possess qualities that would provide restoration of Category II wetlands and, therefore, were selected as mitigation sites for the project.

The plans developed for each restoration site were designed to approximate as closely as possible the pre-impounded, historic footprint of the degraded wetland. To the extent practicable, modification of the existing contours will be kept to a minimum and will be used mainly to re-establish pre-impounded, historic contours. The footprint of the restored wetland may vary slightly form the historic limits, but will be mostly be within the limits of the historic footprint of the pre-ponded wetland.

In order to determine functional uplift of each potential mitigation site, FCI scores were calculated for the existing, pre-construction conditions, as well as what the FCI score would be immediately after removing impoundments. This change would show what functional uplift is provided without any further implementation of site design. When impoundments are removed, model variables such as $V_{SOILPERM}$, the permeability of the soil; V_{PORE}, the porosity of the soil; and V_{FREQ}, the flooding frequency of the soil would change as hydrology returns to historic conditions. Then the FCI score was calculated for post-construction conditions to determine what the functional uplift would be from establishment of a site. Model variables such as V_{COMP}, the composition of plant communities; V_{GVC}, the amount of groundcover, and V_{WD}, the volume of woody debris would increase due to the establishment of a site. The results of this analysis show that the proposed restoration sites would offset the functional loss as a result of the construction of the FHWA/VDOT Preferred Alternative (refer to the ***Supplemental Natural Resources Technical Report*** (VDOT, 2016f).

Preservation

Successful establishment of shrubs and trees within the restoration sites will take several years. According to the assessment models, the proposed restoration sites will adequately replace functions and acreage that would be lost as a result of the project; however, the assessment models are not sensitive enough to fully account for temporal loss of vegetative structure. In order to replace the temporal loss of late successional and climax communities, VDOT is proposing to preserve approximately 100 acres of mature bald cypress/tupelo wetlands located along the Blackwater River and Antioch Swamp, referred to hereafter as the Antioch Tract (which includes three parcels in Isle of Wight County).

Preservation of the Antioch Tract would add approximately 164.5 acres (including 100 acres of mature bald cypress/tupelo wetlands) to the 1,017-acre Antioch Pines Natural Area Preserve owned by the DCR. It has two miles of frontage along the Blackwater River, a state-designated scenic waterway, and one mile along Antioch Swamp. These waterways support occurrences of several rare plants and animals including the state rare eastern lampmussel (*Lampsilis radiata*, G5/S2S3/NL/NL), and are designated by DCR as the Antioch Swamp Stream Conservation Unit. The property also lies within the Zuni Pine Barrens Conservation Site which encompasses 68 occurrences of rare plants and animals and significant natural communities. The Antioch Tract is also home to the largest single specimen of overcup oak in the United States. A significant number of rare species could be restored to the property's uplands through habitat management. The landowner has expressed interest in permanently conserving the property and DCR has indicated a desire to serve as the long-term land steward.

Through the purchase of 45.7 mitigation bank wetland credits, restoration of 20.99 acres of degraded Category II wetlands, and preservation of 100 acres of mature bald cypress/tupelo wetlands identified by DCR as having significant ecological value, VDOT will compensate for losses associated with wetland impacts that will result from the project.

Temporary Impacts to Wetlands

The project will also result in temporary impacts to wetlands. To reduce temporary impacts, avoidance and minimization measures were employed similar to permanent impacts. All temporarily disturbed wetland areas will be restored to preconstruction conditions and will include re-establishing pre-construction contours, and planting or seeding with appropriate wetland vegetation according to cover type (emergent, scrub/shrub, or forested). Compensatory mitigation is not proposed for temporary wetland impacts.

3.4.4.1.5 Navigable Waters of the U.S. (Section 10 Waters)

Impacts to the navigability of Section 10 waters will be closely coordinated with USACE and other relevant agencies and will be minimized to the maximum extent practicable. A navigation channel opening will be maintained during the majority of the construction period, which will be marked appropriately, with signage at a sufficient distance up and downstream to alert river users. All impacts to navigation are anticipated to be temporary, and navigability should be restored after completion of construction. It may be necessary to provide temporary portage options during construction.

3.4.4.1.6 Waterways, Waterbodies, and associated Deepwater Habitat

Avoidance and minimization was applied to streams in the same manner as discussed above for wetlands. Minimization included bridging of streams and installing properly designed culverts with rip rap placed to prevent scour. The baseline impacts to streams within the Design Corridor was 9,473 linear feet. With the application of avoidance and minimization measures, stream impacts have been reduced to 6,874 linear feet.

Required compensation for the remaining stream impacts was determined using stream scores derived from the January 2007 Unified Stream Methodology (USM) for use in Virginia that was developed jointly by USACE and VDEQ. Streams were assessed using Form 1 (perennial/and intermittent streams) and Form 1a (ephemeral streams) of the USM to assign a Reach Condition Index (RCI) to each stream reach. The RCI can then be used to calculate compensation requirements for stream impacts associated with the Project. Parameters used to determine RCI include channel condition, riparian buffers, instream habitat/available cover, and channel alteration.

To compensate for stream impacts due to construction of the project, VDOT will purchase a total of 8,873 stream credits. In the Blackwater sub-basin, 2,354 stream credits will be purchased from approved mitigation banks. In the Hampton Roads sub-basin, a combination of 6,519 approved stream credits from mitigation banks and “advance credits” from the Virginia Aquatic Resources Trust Fund (VARTF) will be purchased.

The project will also result in impacts to seven open water (ponds); however, compensation is typically not required for losses of ponds and impoundments. These areas were avoided where practicable. Compensation was not proposed by VDOT for these ponds; however, USACE has determined that compensation is required for four of the ponds that were impounded streams.

The project will also result in impacts to jurisdictional ditches. Compensation is typically not required for losses of ditches; therefore, no compensation is proposed.

Additionally, the project will result in temporary impacts to streams, ponds, and ditches. Where practicable, the existing natural root mat, stumps, and herbaceous vegetation will be used as a base for any temporary access routes. Geotextile fabric will be placed on the existing surface and BMPs will be used for all stream crossings such as temporary ground protection wooden mats, prefabricated equipment pads, or washed free-draining aggregate placed on geotextile fabric. All mats, aggregate and fabric will be removed after construction is complete.

All temporarily impacted areas of streams, ponds, and ditches will be restored to their original elevations and contours and the banks will be seeded or planted with the same vegetative cover type originally present along the banks. A specific planting plan for temporarily impacted areas would be developed as the project advances to final stages of design; no invasive plant species will be included in any planting plan.

3.4.4.1.7 Wild and Scenic Rivers

The Blackwater River will be subjected to equipment noise, visual intrusions, and nonpoint source pollution during construction activities. These impacts will be mitigated through the use of BMPs and stormwater management techniques. Design and engineering measures will also be used to preserve the Blackwater River floodplains and areas along the Blackwater River where the FHWA/VDOT Preferred Alternative would intersect the river. Minimal tree clearing techniques will be utilized.

3.4.4.1.8 Coastal Zone Management Resources

Mitigation of impacts to fisheries are described in the **Aquatic Biology** section. Impacts to subaqueous lands are described in the **Waterways, Waterbodies, and Associated Deepwater Habitat** section. Mitigation of impacts to wetlands can be found in the **Water Resources and Aquatic Ecology** discussion. Mitigation of impacts from point and non-point pollution are also described in this section. In order to mitigate air pollution emissions from construction, all construction activities will be performed in accordance with VDOT Road and Bridge Specifications. Impacts to coastal lands would be mitigated by adhering to both the Erosion and Sediment Control Law (§10.1-560 et seq. of the Code of Virginia) and the Stormwater Management Act (§10.1-603.1 et seq. of the Code of Virginia). The FHWA/VDOT Preferred Alternative will be constructed according to an approved erosion and sediment control plan and a stormwater management plan. With concurrence from VDEQ that the proposed activity complies with CZMP, adherence to these mitigation measures and any required permits will provide consistency with the enforceable policies of the Virginia CZMP.

3.4.4.1.9 Aquatic Biology

Impacts to aquatic-associated species will be minimized through project design, such as bridging and reducing roadway footprints. Bridges will minimize habitat impacts by allowing the natural hydrologic processes to remain largely intact while also providing wildlife crossings. Additionally, culverts will be designed to maintain low-flow channels to minimize aquatic passage obstruction. Direct impacts on species associated with aquatic habitat would be mitigated to the maximum extent practicable through the use of BMPs, engineering controls, or other stormwater management techniques. Impacts to habitat would likely be offset in the watershed by habitat restoration or enhancement via wetland, stream, and riparian buffer mitigation sites.

Temporary construction impacts to fish and macroinvertebrates will be minimized through appropriate use of temporary stream crossing structures and strict adherence to erosion and sedimentation controls.

Temporary construction activities would adhere to proper erosion and sediment controls and stormwater BMPs to reduce impacts to adjacent water bodies. Stormwater management basins will be located outside of streams and rip rap will be placed at outfalls to prevent scour to streams. Performing in-stream activities during low- or no-flow conditions will also mitigate impacts from run-off and sedimentation. In areas where work must be done within a stream, silt fencing and other engineering controls will be used to minimize run-off and sedimentation. Temporary impacts would also be reduced by minimizing staging areas and construction access roads in valuable habitat areas.

3.4.4.2 Terrestrial Resources

3.4.4.2.1 Natural Communities, Wildlife Habitat, and Biodiversity

Natural Communities

Impacts to terrestrial habitats would be reduced through measures that reduce the roadway footprint as the design progresses. A compensatory mitigation plan has been developed for the FHWA/VDOT Preferred Alternative for impact to wetland habitats as discussed in **Section 3.4.4.1.4**. Further mitigation measures are detailed in the Regional Biodiversity and Wildlife Corridor sections below.

Agricultural Lands and Brush and Old Fields

Impacts to agricultural lands and old fields have been minimized through project design that incorporates alignment shifts and narrowing of the roadway footprint. No direct compensatory mitigation measures are anticipated.

Regional Biodiversity

Mitigation for biodiversity impacts is intended to address the cumulative impacts of all project-related activities within the LOD of the FHWA/VDOT Preferred Alternative. The presence of biodiversity-ranked communities that may be impacted by the FHWA/VDOT Preferred Alternative requires special consideration and coordination with various federal and state agencies. Through coordination with these agencies, potential impacts to target species and their habitats have been evaluated and avoided by implementing various practices as part of the project design. In general, mitigation measures that have been considered and employed wherever practicable to avoid impacts to biodiversity include shifting alignment to avoid potential areas; spanning/bridging resources, countersinking of new culverts; limiting clearing of existing vegetation to within the LOD; and the strict adherence to erosion and sediment control guidelines and the implementation of stormwater BMPs. For unavoidable and direct impacts to natural communities and biodiversity, mitigation includes the components of the compensatory mitigation plan, such as habitat restoration and/or enhancement (as part of wetland and stream compensation being provided in the watershed), riparian corridor restoration as part of wetland and stream compensation, establishing vegetated buffers along field edges for edge habitat in wetland restoration and preservation sites, and upland forest corridor restoration in wetland restoration and preservation sites. Additionally, mitigation measures such as expanding the size of existing State Natural Area Preserves is planned in cooperation with DCR-DNH, as part of the compensatory mitigation plan.

Wildlife Corridors

Bridges and culverts are of a size that will allow a variety of terrestrial and aquatic life to pass underneath or through the structure to minimize vehicle collisions (Bond, 2003). Bridge crossings will have a minimum "edge" for wildlife passage that is either upland or wetlands that are not inundated that would allow passage of some mammals. Efforts to maintain or improve the native riparian vegetation adjacent to bridges and

culverts have been demonstrated to further encourage usage of the passages by wildlife, especially in relation to identified wildlife corridors (Bond, 2003). Vegetation outside of the LOD will not be affected and should provide for continued use of riparian corridors by wildlife. While right-of-way fencing provided along the limited access roadway will be an obstruction to some movements of wildlife, fencing will be installed in a manner that provides a pathway through and under bridges and culverts. The fencing will help to funnel the wildlife to the bridges and culverts, thus allowing some passage. Fencing will tie to the bridge abutments and culvert headwalls.

Forest Interior Dwelling Species Habitat

Impacts to FIDS habitat have been minimized through project design that incorporates alignment shifts and narrowing of the roadway footprint. Although no direct compensatory mitigation measures are anticipated, preservation of the Antioch Tract for wetland mitigation will also preserve a large area of FIDS habitat.

3.4.4.2.2 Threatened and Endangered Species

The potential impacts to threatened or endangered species resulting from the project have been avoided and minimized by conducting presence/absence surveys, identifying potential habitat, and incorporating design measures such as bridging, countersinking culverts, and reducing the roadway footprint and median width. In addition, temporary impacts will be further reduced through proper location and minimization of staging areas, construction access roads, and modifying construction techniques in valuable habitats.

VDOT has completed due diligence studies and coordinated with DGIF, DCR, and USFWS. On March 29, 2016, VDOT provided a letter to DGIF outlining species conclusions, avoidance and minimization measures, and proposed conservation measures. In an email dated April 20, 2016, DGIF provided concurrence with VDOT's survey results and proposed conservation measures.

On March 29, 2016 VDOT provided a letter to USFWS outlining species conclusions, avoidance and minimization measures, and proposed conservation measures. In an email dated April 12, 2016, USFWS recommended that VDOT re-coordinate the project under the northern long-eared bat final 4(d) rule which was promulgated on February 16, 2016. VDOT re-coordinated the project using the USFWS' online IPaC database. Re-coordination through IPaC resulted in findings of "no effect" for red-cockaded woodpecker, "may affect, not likely to adversely affect" for northern long-eared bat, "no effect" for critical habitat, and "no Eagle Act permit required." On April 24, 2016 VDOT transmitted an April 20, 2016 Self-Certification Letter and Project Review Package to USFWS.

USFWS typically does not respond to Self-Certification Letters since the certification letter is USFWS' official response. However, if USFWS has additional questions or does not concur with project determinations, USFWS will contact VDOT during the 30-day review period. Because USFWS did not respond to VDOT's Self-Certification Letter within the 30-day review period, the Self-Certification Letter and the Project Review Package, complete the review of this project in accordance with the Endangered Species Act of 1973 (16 U.S.C. 1531-1544, 87 Stat. 884), as amended, and the Bald and Golden Eagle Protection Act (16 U.S.C. 668—6680, 54 Stat. 250), as amended.

As a result of the implementation of the aforementioned conservation measures, coordination, and due diligence, no further action or coordination with USFWS, DGIF, or DCR is required.

3.4.4.2.3 Invasive Species

While VDOT may not be directly responsible for the encroachment of invasive plants and animals into the right-of-way for the FHWA/VDOT Preferred Alternative, VDOT is responsible for discouraging their

introduction and spread, particularly following new construction projects, in accordance with the FHWA directive implementing EO 13112.

Invasive species must be managed through a variety of strategies to minimize their environmental and economic impact. Potential methods to eliminate and control invasive plant and animal species are described in VDOT's Road and Bridge Specifications, which is a required guideline for highway construction projects in Virginia. Construction methods that minimize the potential for encroachment or establishment of invasive species include selective tree removal, trimming, and cleanup; proper application of topsoil; seeding; sodding; planting; soil retention covering to suppress invasive species colonization; herbicides; mowing; proper clearing and grubbing; installation of drainage structures; and earthwork.

In order to effectively control invasive species, contractors' bidding packages will be required to include specific provisions that manage acquired rights-of-way for invasive species control by implementing the VDOT Road and Bridge Specifications applicable to the circumstances. While rights-of-way are at risk from invasive species colonization from adjacent properties, implementing these provisions would reduce or minimize potential for introduction, proliferation, and spread of invasive species. In addition, the implementation of BMPs for erosion/sediment control and abatement of pollutant loading would minimize secondary impacts to adjoining communities and habitat by reducing excess nutrient loads that could encourage invasive species proliferation.

With respect to invasive species, federal and state resource agency guidelines and requirements will be applied to assist with invasive species management responsibilities, including the 2012 Virginia Invasive Species Management Plan and guidance provided by the USFWS program website (https://www.fws.gov/invasives/). VDOT will implement control techniques into management plans at the preliminary design level.

3.4.4.2.4 Mineral Resources and Unique Geological Features

The loss of any potential future mining operations or the removal of potential mining deposit areas that lie within the footprint of the roadway itself should be offset by the opening of new mining sites for production of suitable fill material for construction of the roadway.

3.5 HAZARDOUS MATERIAL SITES

The presence of hazardous waste materials and contaminants are key issues of concern for worker health and safety, water management and disposal, as well as public safety during the construction of transportation projects. The purpose of this section is to identify sites potentially impacted by contamination within the Inventory Corridor and LOD in order to understand the possible risks associated with the FHWA/VDOT Preferred Alternative and determine the necessary waste handling and management and disposal measures that may be required. A detailed hazardous materials survey was conducted as part of the Draft SEIS and is included in the ***Hazardous Materials Technical Memorandum*** (VDOT, 2014h).

3.5.1 Regulatory Context and Methodology

VDEQ regulates hazardous materials under multiple federal statutes. Two statutes that regulate materials of primary concern include the Resource Conservation and Recovery Act of 1976 (RCRA) and the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and their respective amendments.

To initiate the hazardous materials site inventory, the State regulatory database was reviewed to identify areas of concern within the Inventory Corridor. The VDEQ maintains database information for the following programs in Virginia:

- **Leaking Underground Storage Tank (LUST) and Leaking Petroleum Storage Tank (LTANKS) (Petroleum Releases)** – maintains the records in Virginia of all leaks/spills of petroleum and/or regulated substances into the environment from underground and aboveground storage tanks;
- **State Registered Underground Storage Tanks (USTs) and Aboveground Storage Tanks (ASTs) (Petroleum Facilities)** – provides certification of all facilities in Virginia with USTs and ASTs regulated under Subtitle I of RCRA;
- **RCRA Corrective Action** – administers the EPA RCRA Corrective Action Program in Virginia that requires investigation and cleanup of hazardous waste releases at RCRA hazardous waste treatment, storage, and disposal facilities;
- **Landfills or Solid Waste Disposal (Solid Waste)** – authorizes and inspects solid waste management facilities such as landfills, incinerators, transfer stations, and recovery facilities;
- **VPDES** – regulates discharges of pollutants into surface waters from point sources including stormwater discharges and certain industrial facilities; and,
- **Voluntary Remediation Program (VRP) Sites** – provides certification of satisfactory completion to VRP properties for cleanup of hazardous substance releases not otherwise subject to environmental regulatory enforcement.

VDEQ provides access to records of the above programs online with their "What's in my backyard" application contained within their Virginia Environmental Geographic Information Systems (VEGIS) database (VDEQ, 2014f). All of the files within the Inventory Corridor in the above databases were collected and attempts were made to verify each site/facility location, whether each was located within the LOD of the FHWA/VDOT Preferred Alternative, and whether it was located within the Inventory Corridor. Some of the site/facility locations could not be verified due to incorrect/inaccurate location information within the databases.

3.5.2 Affected Environment

The petroleum release database includes all of the LUST and LTANKS cases and also includes hazardous materials spills information. Within the database, VDEQ assigns a Pollution Complaint number to each petroleum release case. Each of the Pollution Complaint cases are assigned a status in the database that defines whether the case has been an authorized closure by VDEQ or whether the case is open with ongoing corrective action efforts. Facilities with open Pollution Complaint cases may include active site remediation, monitoring of a confirmed petroleum release into the environment or VDEQ is awaiting information in regards to a suspected or reported spill or release before authorizing closure.

There were 179 petroleum release cases associated with 139 sites within the Route 460 study area. Of these petroleum release sites, there are six that have been identified with an open case status. All of the confirmed petroleum release sites within the Route 460 study area are presented in **Figure 3.5–1**.

The petroleum facilities database was analyzed for all facilities that have a registered UST or AST within the Route 460 study area. Within the database, VDEQ lists the unique Facility ID given to each property. The VDEQ VEGIS database does not include a street address for the facility; instead it lists the city and the county in which it is located and also contains the latitude/longitude of the site for mapping purposes

(VDEQ, 2014f). For this reason, the locations of 25 of the 145 total petroleum facilities in the Route 460 study area could not be verified, resulting in a total of 120 confirmed petroleum facility locations. All of the petroleum facilities within the Route 460 study area are presented in **Figure 3.5–2**

VDEQ is responsible for administering the RCRA Corrective Action program in Virginia that requires investigation and cleanup of hazardous waste releases at RCRA hazardous waste treatment, storage, and disposal facilities. There are currently 121 RCRA Corrective Action facilities in Virginia (VDEQ, 2014c). There were two RCRA Corrective Action sites identified within the Route 460 study area.

VDEQ authorizes and inspects solid waste management facilities in Virginia. In 2008, there were 197 solid waste treatment, storage, and disposal facilities located in Virginia. Solid waste facilities include composting facilities, waste transfer stations, energy recovery and incineration facilities, and landfills (VDEQ, 2009). There were a total of eight solid waste facilities listed within the Route 460 study area.

VDEQ is the authority that administers the National Pollution Discharge Elimination System program in Virginia. The VPDES program regulates discharges of pollutants into surface waters from point sources, including stormwater discharges and certain industrial facilities. There were six VPDES sites listed within the Route 460 study area. No VRP sites were identified within the study area. All of the RCRA Corrective Action sites, solid waste facilities, VPDES sites, and VRP sites within the study area are identified in **Figure 3.5–3**.

3.5.3 Environmental Consequences

3.5.3.1 No Build Alternative

Small amounts of new right-of-way may be required for implementation of programmed improvements associated with the No Build Alternative. The projects would undergo individual environmental evaluations to determine the potential presence of hazardous materials on a case by case basis. Residual contamination may potentially exist in the study area in underlying soils resulting from former industrial sites, existing and former gas stations and other petroleum storage tank sites. The sponsors of the No Build Alternative projects have the potential to encounter these materials and will need to establish procedures for identifying and addressing such materials if and when those projects are designed and constructed.

3.5.3.2 FHWA/VDOT Preferred Alternative

The hazardous materials sites determined to be located within the LOD of the FHWA/VDOT Preferred Alternative and within the Inventory Corridor are listed in **Table 3.5-1**.

Table 3.5-1: Hazardous Materials Sites

Type of Hazardous Material Site	LOD of the Preferred Alternative	Inventory Corridor
Open Petroleum Release Sites	NA	NA
Closed Petroleum Release Sites	3	7
Petroleum Facilities	2	7
RCRA Corrective Action	NA	NA
VRP Sites	NA	NA
Solid Waste Facilities	NA	NA
VPDES Sites	NA	NA

As illustrated above, no open petroleum release sites were identified within the LOD or Inventory Corridor of the FHWA/VDOT Preferred Alternative. A total of seven closed petroleum release sites in addition to

seven petroleum facilities were identified to be located within the Inventory Corridor. Three of the petroleum release sites were identified to be located within the LOD of the FHWA/VDOT Preferred Alternative: Glenn Martin Chevrolet and the Jesse L. Williams Jr. residence located in Suffolk, and the Redd Residence located in Windsor. Two of the petroleum facilities were identified to be located within the LOD of the FHWA/VDOT Preferred Alternative: Glenn Martin Chevrolet located in Suffolk and Country Mini Mart located in Zuni. No identified solid waste facilities, RCRA, VPDES or VRP sites were identified within the Inventory Corridor of the FHWA/VDOT Preferred Alternative.

Results from the VEGIS database do not state in the LUST or LTANKS cases how much of a hazardous substance was released, how much was removed, and whether substances are likely to remain in place. Hazardous materials sites including petroleum release sites, solid waste facilities, and other hazardous material facilities determined to be within the LOD warrant additional evaluation because petroleum constituents and other hazardous materials may remain within the subsurface of release sites or may be undocumented at petroleum facilities.

3.5.4 Mitigation

In order to develop mitigation measures for identified hazardous materials, additional evaluations will be required during final design. These sites provide potential sources of contamination that could affect or delay property acquisition and construction activities if these sites are found to have ongoing remediation and/or high levels of subsurface contamination. Accordingly, some sites may require some form of mitigation. The selection of mitigation measures for specific sites would include avoidance, minimizing impacts through redesign or alignment shift, and site remediation/closure. Any site remediation or corrective action measures would be performed in accordance with applicable state and federal laws. Performance of such measures would occur prior to or during the course of construction, depending on site conditions.

3.6 AIR QUALITY

Air quality can be described as the concentration of various pollutants in the atmosphere within a given air basin and is influenced by a combination of factors including the type and amount of pollutants emitted into the atmosphere, the size and topography of the area, and the prevailing climate and meteorology. This section is intended to document the existing air quality conditions within the study area and determine the degree to which the FHWA/VDOT Preferred Alternative would result in any effects on ambient air.

3.6.1 Regulatory Context and Methodology

Air quality rose to national significance in the mid to late-1960s, culminating in the passage of the Air Quality Act in 1967. Pursuant to the Clean Air Act of 1970 (CAA), the EPA established National Ambient Air Quality Standards (NAAQS) for major pollutants known as “criteria pollutants” and pursuant to the federal Clean Air Act Amendments (CAAA) of 1990 individual states were to implement additional steps to reduce airborne pollutants and improve regional and local conditions.

Local air quality is measured on a micro-scale by evaluating carbon monoxide (CO) concentrations at the project level. Higher concentrations of CO tend to occur in areas of high traffic volumes or areas adjacent to a stationary source of the pollutant. The CO emissions are associated with the incomplete combustion of fossil fuels in motor vehicles and are considered to be a good indicator of vehicle pollution.

3.6.2 National Ambient Air Quality Standards

Under NEPA, federal agencies must consider changes in air quality, and the effects of such changes on human health and welfare are among the factors to be considered. Currently, EPA regulates six criteria pollutants: ozone, carbon monoxide, nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter (PM), and lead (Pb). PM is divided into two particle size categories: course particles with a diameter less than 10 micrometers (PM_{10}) and fine particles with a diameter of less than 2.5 micrometers ($PM_{2.5}$). Automobile emissions have been identified as a critical element in attaining the federal NAAQS for CO, ozone (O_3), and $PM_{2.5}$. shows the primary and secondary NAAQS for the criteria pollutants. The NAAQS are two-tiered. The first tier (primary) is intended to protect public health; the second tier (secondary) is intended to protect public welfare and prevent further degradation of the environment (see **Table 3.6-1)**.

Table 3.6-1: National Ambient Air Quality Standards

Pollutant	Averaging Time	Primary Standards [1,2]	Secondary Standards [1,3]
CO	8- hour	9 ppm* (10 mg/m^3)**	None
	1- hour	35 ppm (40 mg/m^3)	None
Lead [4]	Rolling 3-Month Average[5]	0.15 µg/m^3	Same as Primary
NO_2	Annual Arithmetic Mean	0.053 ppm (100 µg/m^3)	Same as Primary
	1-hour	0.100 ppm[6]	None
PM_{10}	Annual Arithmetic Mean	None	None
	24-hour	150 µg/m^3	Same as Primary
$PM_{2.5}$	Annual Arithmetic Mean	12 µg/m^{3,9}	15 µg/m^3
	24-hour	35 µg/m^3	Same as Primary
O_3	8-hour (2008 standard)	0.075 ppm	Same as Primary
	8-hour (1997 standard)	0.08 ppm	Same as Primary
	1-hour	0.12 ppm[7]	Same as Primary
SO_2	1-hour	75 ppb[8]	None
	3-hour	None	0.5 ppm

Source: Table and footnotes are excerpted from USEPA Website: http://www.epa.gov/air/criteria.htm.
*ppm - parts per million; **mg/m3 - milligrams per cubic meter
1. National standards (other than ozone, particulate matter, and those based on annual averages) are not to be exceeded more than once per year. The ozone standard is attained when the fourth highest 8-hour concentration in a year, averaged over three years, is equal to or is less than the standard. For PM_{10}, the 24-hour standard is attained when the expected number of days per calendar year with a 24-hour average concentration above 150 ug/m^3 is equal to or is less than one. For $PM_{2.5}$, the 24-hour standard is attained when 98 percent of the daily concentrations, averaged over three years, are equal to or are less than the standard.
2. Primary Standards: Levels necessary to protect public health with an adequate margin of safety.
3. Secondary Standards: Levels necessary to protect the public from any known or anticipated adverse effects.
4. Lead is categorized as a "toxic air contaminant" with no threshold exposure level for adverse health effects determined.
5. National lead standard, rolling three-month average: final rule signed October 15, 2008.
6. To attain this standard, the 3-year average of the 98th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 0.100 ppm (effective January 22, 2010).
7. EPA revoked the 1-hour ozone standard in all areas; however, some areas have continuing obligations under that standard.
8. Final rule signed June 2, 2010. To attain this standard, the 3-year average of the 99th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 75 ppb.
9. EPA updated the NAAQS for $PM_{2.5}$ to strengthen the primary annual standard to 12 *u*g/m^3.

Section 176(c) of the CAA requires federal agencies to assure that all of their actions conform to applicable implementation plans for achieving and maintaining the NAAQS. Federal actions must not cause or contribute to any new violation of any standard, increase the frequency or severity of any existing violation, or delay timely attainment of any standard. apply to the concentration of a pollutant in outdoor ambient air.

If the air quality in a geographic area is equal to or better than the national standard, EPA will typically designate the region as an attainment area. Areas where air quality does not meet the national standards are typically designated as non-attainment areas. Once the air quality in a non-attainment area improves to the point where it meets the standards and the additional requirements outlined in the CAAA, EPA may redesignate the area as an attainment/maintenance area, upon approval of a Maintenance Plan, and these areas are then referred to as "maintenance areas."

Each state is required to prepare a state implementation plan (SIP) that outlines measures the region will implement to attain the applicable air quality standard in non-attainment areas, and to maintain compliance with the applicable air quality standard in maintenance areas.

The CAAA of 1990 require states to make recommendations to EPA regarding the attainment status of all areas within their borders when EPA finalizes an update to any NAAQS. Under its CAAA authority, EPA further classifies non-attainment areas for some pollutants such as ozone based on the severity of the NAAQS violation as marginal, moderate, serious, severe, and extreme. Under the 1997 8-hour ozone standards, many of the localities in the project area were originally designated nonattainment. Over time, these areas came back into compliance with the 1997 8-hour ozone NAAQS and were redesignated to attainment/maintenance by the EPA.

In an effort to further improve the nation's air quality, the EPA lowered the ozone standard again in 2008 and designated those areas that were not in compliance with the new standard as non-attainment. With the exception of northern Virginia, which is part of the Washington, D.C. ozone non-attainment area, all areas in the state were designated attainment for the 2008 8-hour ozone standard. In addition, EPA revoked the 1997 8-hour ozone standards for transportation conformity purposes effective July 20, 2013; therefore transportation conformity requirements do not currently apply in the project area.

3.6.3 Mobile Source Air Toxics:

In December of 2012, FHWA issued an Interim Guidance Update on Mobile Source Air Toxics (MSAT) Analysis in NEPA Documents that outlines when and how to analyze MSAT under the NEPA review process for highway projects. The revised guidance reflects the recent implementation of the EPA Motor Vehicle Emissions Simulator (MOVES) emission model for estimating MSAT emissions from mobile sources and updated the scientific research in the MSAT arena.

EPA identified seven compounds with significant contributions from mobile sources that are among the national and regional-scale cancer drivers from their 1999 National Air Toxics Assessment (NATA). The seven compounds identified were acrolein, benzene, 1,3-butadiene, diesel particulate matter plus diesel exhaust organic gases, formaldehyde, naphthalene, and polycyclic organic matter (POM). While FHWA considers these the priority MSATs, the list is subject to change and may be adjusted in consideration of future EPA rules.

The FHWA guidance developed a tiered approach for assessing MSATs in NEPA documents and identified three levels of analysis. The three levels identified were for projects with no meaningful MSAT effects,

low potential MSAT effects, and high potential MSAT effects. The FHWA guidance defines the levels of analysis for each type of MSAT effect:

- No analysis for projects with no potential for meaningful MSAT effects;
- A qualitative analysis for projects with low potential MSAT effects; and
- A quantitative analysis for projects with high potential MSAT effects.

Since the FHWA/VDOT Preferred Alternative is not the type of project that will add significant capacity to roadways where the Average Daily Traffic (ADT) is expected to exceed 140,000 to 150,000 in the design year, the project was categorized as one having low potential MSAT effects. Therefore, a qualitative analysis was conducted consistent with the updated FHWA guidance.

3.6.4 Attainment Status

The study area encompasses the Richmond Area Metropolitan Planning Organization (MPO), Tri-Cities MPO, and the Hampton Roads Transportation Planning Organization (HRTPO) which are responsible for air quality planning in their respective planning area boundaries in central and southeastern Virginia. Prince George County is located in the Richmond-Petersburg Ozone Attainment/Maintenance Area, and the Isle of Wight County and the City of Suffolk are located in the Hampton Roads Ozone Attainment/Maintenance Area for the 1997 8-hour ozone standard. The project area is designated as attainment for all other NAAQS, including the 2008 8-hour ozone NAAQS.

3.6.5 Transportation Conformity

In nonattainment and maintenance area, the federal transportation 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). As indicated above, the EPA revoked the 1997 8-hour ozone standard for transportation conformity purposes in July 2013, and the jurisdiction making up the study area are currently classified as attainment. Therefore, transportation conformity requirements do not apply to the project.

3.6.6 Environmental Consequences

An air quality project level assessment was conducted for CO and MSATs. The methodologies and assumptions for addressing the type of analysis for each pollutant are discussed below and are consistent with all FHWA and EPA regulations and guidance.

3.6.6.1 Carbon Monoxide Methodology and Assessment Procedures

In 2009, FHWA and VDOT finalized an agreement for addressing project-level CO air quality analyses in NEPA documents. Under this agreement, project-level air quality (hot-spot) analyses are typically conducted for CO for projects that exceed ADT and level of service (LOS) thresholds specified in the agreement. A CO hot-spot analysis was conducted for this Route 460 analysis because the agreement also requires one for any project for which an EIS is being prepared.

The CO hot-spot analysis utilized the traffic assessment conducted by the design team for the 2013 Existing year, 2021 Interim Build and No Build, and 2040 Build and No Build. Emissions of CO were estimated using the EPA MOVES model. Ambient concentrations at sensitive receptor locations were estimated using the EPA CAL3QHC dispersion model, and the results were added to appropriate background concentrations for comparison to the CO NAAQS to determine compliance. Further details of the

methodologies and assumptions can be found in the ***Air Quality Analysis Technical Report*** (VDOT, 2016d).

A review of the daily traffic volumes and LOS for the FHWA/VDOT Preferred Alternative determined that the worst-case intersections and interchanges chosen for inclusion in the CO hot-spot analysis were:

- Route 460 and Route 58 Interchange including the Route 58 eastbound and westbound on and off ramp as well as Existing Route 460 at Sadler Pond Drive/Murphy's Mill Connector;
- Godwin Boulevard Interchange including the Route 58 eastbound and westbound on and off ramps intersections.

The traffic analysis demonstrated that the intersections/interchanges evaluated in the CO hot-spot analysis have the worst-case LOS and/or highest traffic volumes within the project corridor and are therefore representative of the locations where peak CO concentrations would be expected to occur. It is assumed that if peak ground-level CO concentrations at these worst-case intersections/interchanges remain below the CO NAAQS, then all other locations in the study area will also remain below the CO NAAQS.

CO vehicle emission rates were estimated using the EPA MOVES model, (version MOVES2010b) consistent with the Draft SEIS air quality study. The methodologies and assumptions used in the analysis were consistent with the EPA guidance document "*Using MOVES in Project Level Carbon Monoxide Analyses*" (EPA, 2010). For the modeling analysis, receptor locations were placed in the vicinity of each intersection/interchange at worst-case locations such as sidewalks, property lines, and parking lots where the public generally has access for the Existing, No Build Alternative, and FHWA/VDOT Preferred Alternative. Consistent with EPA modeling guidelines, the receptors were located a minimum of three meters from the edge of the roadway and positioned at a height of 1.8 meters above the ground. The locations of these receptors are shown on **Figures 3.6–1**, **3.6–2**, and **3.6-3**.

The results of the 1-hour and 8-hour CO hot-spot analysis for the worst-case eastern terminus intersection/interchange are presented in **Table 3.6-2** for the Existing, Interim, and Design years for the No Build and Preferred Alternatives. The table includes the overall worst-case modeled concentrations for the AM and PM peak periods, including the modeled receptor number in parenthesis. The concentrations in **Table 3.6-2** also include the 1-hour and 8-hour background concentrations of 3.6 ppm and 2.5 ppm, respectively, for comparison to the CO NAAQS. The highest 1-hour predicted concentrations for the Existing, Interim, and Design Build conditions were 4.7 ppm, 4.3 ppm and 4.3 ppm, respectively. The maximum 1-hour concentration of 4.7 ppm was predicted to occur for the 2013 Existing condition at the Route 58 and Godwin Boulevard interchange while the worst-case concentrations were predicted to be lower than the existing peak concentrations for both future conditions (build/no-build). All predicted 1-hour CO concentrations will remain well below the 1-hour CO NAAQS of 35 ppm.

The 1-hour values generated by CAL3QHC were then scaled by a persistence factor of 0.7 to generate 8-hour CO concentrations for comparison to the CO NAAQS. The 8-hour concentrations for the Existing, Interim and Design year conditions are 3.3 ppm, 3.0 ppm and 3.0 ppm, respectively. Similar to the 1-hour concentrations, the maximum 8-hour CO concentrations of 3.3 ppm was predicted to occur for the 2013 Existing condition at the Route 58 and Godwin Boulevard interchange, while the worst-case concentrations are expected to be lower than the existing conditions for both future conditions (build/no-build). All predicted 8-hour CO concentrations are also well below the 8-hour CO NAAQS standard of 9 ppm.

These results demonstrate that traffic related to the worst-case interchange for the FHWA/VDOT Preferred Alternative would not cause or contribute to a violation of the CO NAAQS within the project corridor, and thereby satisfies CAA and NEPA requirements pertaining to CO.

Table 3.6-2: Peak Modeling Results for the Eastern Terminus Intersection/Interchange (ppm)

Intersection/ Interchange	Averag-ing Period	2013		2021				2040				NAAQS
		Existing		No Build		Build		No Build		Build		
		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	
Eastern Terminus Interchange-Godwin Boulevard at Route 58 EB and WB On/Off ramps Intersection	1-hour	4.6 (23)	**4.7 (36)**	4.1 (8)	4.3 (27)	4.3 (24)	**4.3 (24)**	4.2 (25)	4.3 (25)	4.2 (26)	**4.3 (25)**	35
	8-hour	3.2 (8)	**3.3 (36)**	2.9 (8)	3.0 (27)	3.0 (24)	**3.0 (24)**	2.9 (25)	3.0 (25)	2.9 (26)	**3.0 (25)**	9
Eastern Terminus Interchange-US 460 Business and Route 58 EB and WB On/Off ramps and Sadler Pond Dr Intersections	1-hour	4.2 (8)	4.4 (7)	4.0 (7)	4.2 (7)	4.1 (8)	4.2 (7)	4.1 (8)	4.2 (7)	4.2 (21)	4.3 (21)	35
	8-hour	2.9 (8)	3.1 (7)	2.8 (7)	2.9 (7)	2.9 (8)	2.9 (7)	2.9 (8)	2.9 (7)	2.9 (21)	3.0 (21)	9

Notes: Total concentration is the sum of the modeled concentration plus background concentrations. Number in parenthesis represents the modeled receptor number of maximum modeled concentration. Refer to Figures 3.6-1, 3.6-2, and 3.6-3. ppm = parts per million.

3.6.6.2 PM_{10} and $PM_{2.5}$ Analysis

The project is located in the Counties of Prince George, Sussex, Southampton, Surry, and Isle of Wight and the City of Suffolk. All of these areas are designated by EPA as attainment for the course 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 project. In addition, the latest monitoring data reported by the VDEQ show that the 24-hour and annual $PM_{2.5}$ background concentrations throughout the project corridor are less than 21 micrograms per cubic meter (ug/m^3) and 9 ug/m^3, respectively, which are both well below the respective $PM_{2.5}$ NAAQS of 35 ug/m^3 and 12 ug/m^3.

3.6.6.3 MSAT Analysis

Since the FHWA/VDOT Preferred Alternative is not the type of project that will add significant capacity to roadways where the ADT is projected to exceed 140,000 to 150,000 by the design year the project was categorized as one having Low Potential MSAT Effects. Therefore, a qualitative analysis was conducted consistent with the latest FHWA guidance.

Table 7.1-1 of the ***Supplemental Air Quality Analysis Technical Report*** (VDOT, 2016d) shows the forecasted ADT for the FHWA/VDOT Preferred Alternative for 2040 within the study corridor.

For the FHWA/VDOT Preferred Alternative, the amount of MSAT emitted is generally proportional to the vehicle miles travelled, or VMT, assuming that other variables such as fleet mix and diesel vehicle percentages remain constant for the FHWA/VDOT Preferred Alternative. The total VMT within the entire project corridor (including existing Route 460 plus new Design Corridor where appropriate) was estimated for the 2040 conditions for the FHWA/VDOT Preferred Alternative and is presented in **Table 3.6-3**.

Table 3.6-3: Congestion Performance Metrics Summary Between Zuni and Suffolk

Alternative	Daily VMT	Distance (miles)[1]	Average Off Peak Speed (mph)[2]	Average Off Peak Travel Time (minutes)	Average Peak Period Speed (mph)[3]	Average Peak Period Travel Time (minutes)
Existing 2013	205,900	15	46.0	20.3	44.5	21.0
2040 No Build Existing Route 460	363,200	15	42.8	21.9	37.2	25.2
2040 No Build for Existing Route 460 (new Route 460 to Route 58)	275,400	11	40.9	15.8	35.0	18.5
2040 Build New Route 460 (not including existing Route 460 below)	391,800	16	56.0	17.0	52.2	18.3
2040 Build for Existing Route 460 (new Route 460 to Route 58)	114,500	11	45.9	14.1	44.4	14.6

Notes: * Distances are as follows: Existing and No Build distances are from the western project limit to the westbound Route 58 interchange ramps intersection. The Build New Route 460 distance is from the western project limit to the merge/diverge for the system ramps from/to Route 58. The Build and No Build Existing Route 460 distance is from the New Route 460 intersection west of Windsor to the westbound Route 58 interchange ramps intersection. 1) Average Off Peak denotes the twelve hour period from 6PM to 6AM. 2) Average Peak Period denotes the periods from 6AM to 9AM and 3PM to 6PM.

The 2040 VMT estimated for the FHWA/VDOT Preferred Alternative throughout the entire project corridor is projected to be higher when compared to the No Build Alternative. The FHWA/VDOT Preferred Alternative's 2040 VMT estimate is higher than the No Build Alternative because the project improvements would attract trips that would not otherwise occur in the area.

Diesel vehicle percentages currently range from 10 to 20 percent of the total traffic on Route 460 along the existing alignment, and these percentages are expected to remain unchanged for the 2040 FHWA/VDOT Preferred Alternative. Since future VMT for the FHWA/VDOT Preferred Alternative is forecast to be higher than the No Build Alternative due to an expected increase in traffic, the increase in diesel vehicle VMT associated with the FHWA/VDOT Preferred Alternative could lead to higher MSAT emissions in the vicinity of the project corridor when compared to the No Build condition, although any projected increase in MSAT emissions is not considered to be substantial.

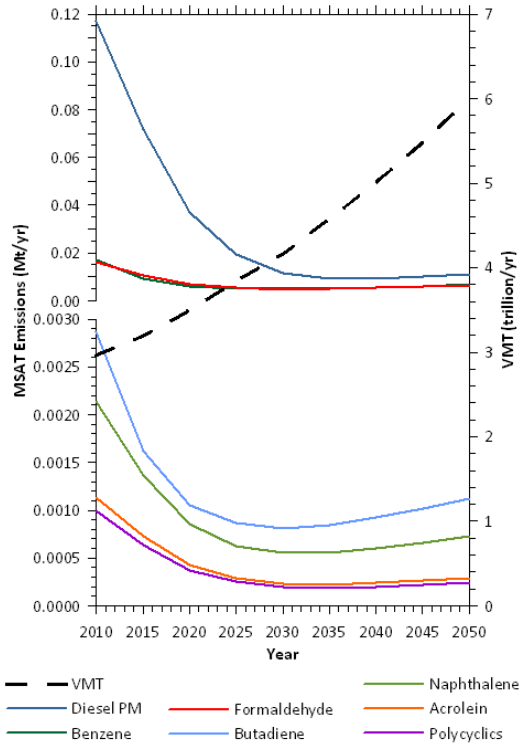
In addition, any increase in MSAT emissions is expected to be offset somewhat by increased speeds on area highways and reduced travel time compared to the No Build condition as shown in **Table 3.6-3**. Additionally, EPA's vehicle and fuel regulations, coupled with fleet turnover, would, over time, cause substantial reductions that, in almost all cases, would cause region-wide MSAT levels to be significantly lower than exist today.

The additional travel lanes of the FHWA/VDOT Preferred Alternative may have the effect of moving some traffic closer to nearby homes, schools, and businesses; therefore, there may be localized areas where concentrations of MSAT could be higher under the FHWA/VDOT Preferred Alternative than the No Build Alternative. The localized increases in MSAT concentrations would likely be most pronounced along any new location sections within the project corridor. However, the magnitude and the duration of these potential increases compared to the No Build Alternative cannot be reliably quantified due to incomplete or unavailable information in forecasting project-specific MSAT health impacts. In sum, the localized level of MSAT emissions for the FHWA/VDOT Preferred Alternative could be higher relative to the No Build Alternative in the design year, but this would likely be offset due to increases in speeds and reductions in congestion (which are associated with lower MSAT emissions) as shown in **Table 3.6-3**. Also, MSATs would be lower in locations where traffic shifts away from them. However, on a regional basis, EPA's vehicle and fuel regulations, coupled with fleet turnover, would gradually cause substantial reductions that, in almost all cases, would cause region-wide MSAT levels to be significantly lower than exist today.

Under the FHWA/VDOT Preferred Alternative there may be localized areas where VMT would increase, and other areas where VMT would decrease resulting in localized increases and decreases in MSAT emissions. However, even if these increases do occur, they too would be substantially reduced in the future due to implementation of EPA's vehicle and fuel regulations when compared to existing conditions.

Based on an FHWA analysis using EPA's MOVES2010b model, as shown in **Figure 3.6–4** below, even if vehicle-miles travelled (VMT) increases by 102 percent as assumed from 2010 to 2050, a combined reduction of 83 percent in the total annual emissions for the priority MSAT is projected for the same time period.

Figure 3.6-4: Nation MSAT Trends 1999-2050 Using EPA's MOVES 2010b Model



What is currently known about MSATs is still evolving. Information is currently incomplete or unavailable to credibly predict the project-specific health impacts due to changes in MSAT emissions associated with the FHWA/VDOT Preferred Alternative. Under the FHWA/VDOT Preferred Alternative, there may be higher MSAT emissions in the design year relative to the No Build Alternative due to increased VMT. There could also be increases in MSAT levels in a few localized areas where VMT increase. However, EPA's vehicle and fuel regulations are expected to result in significantly lower MSAT levels in the future than exist today due to cleaner engine standards coupled with fleet turnover. The magnitude of the EPA-projected reductions is so great (even after accounting for VMT growth), that MSAT emissions in the study area are likely to be substantially lower in the future than they are today, regardless of the FHWA/VDOT Preferred Alternative.

3.6.6.4 Climate Change and Greenhouse Gas Impacts

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 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 (ppm) in 1900 to over 400 ppm 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.[2] 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 U.S. 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.[3]

[2] 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.
[3] "U.S.-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.

GHG emissions from vehicles using roadways are a function of distance travelled (expressed as vehicle miles travelled, or VMT), vehicle speed, and road grade. GHG emissions are also generated during roadway construction and maintenance activities.

Since climate change is global in nature, it is more appropriate to consider the project's impact on the entire region to capture shifts in VMT more systematically. Using the Tidewater Superregional Travel Demand Model results, the No Build Alternative shows an increase in daily VMT on the regional network from 87.7 million in 2013 to 118.2 million in 2040, an increase of 30.5 million (34.8 percent) (refer to the ***Supplemental Traffic and Transportation Technical Report*** (VDOT, 2016h)). This increase is in line with the Energy Information Administration (EIA) national forecasts which indicate that VMT will increase by approximately 38 percent between 2012 and 2040 for the country as a whole.[4] The regional network with the FHWA/VDOT Preferred Alternative shows an increase in the daily VMT from 87.7 million in 2013 to 118.3 million in 2040, an increase of 30.6 million (34.9%). The net increase due to the FHWA/VDOT Preferred Alternative is 80,000 VMT, a 0.07 percent increase over the No Build Alternative VMT in 2040. It is important to note that the model-wide vehicle hours traveled (VHT) decreases with the addition of the FHWA/VDOT Preferred Alternative. Thus while the VMT is projected to increase, VHT are expected to decrease within the larger region producing GHG emission benefits through expected increases in average vehicle speeds and a net reduction in total travel time.

A major factor in mitigating this increase in VMT is EPA's GHG emissions standards, implemented in concert with 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 is more than sufficient to offset the increase in VMT. Thus, it is expected that the project area would see a net reduction in GHG emissions under the FHWA/VDOT Preferred Alternative, even though VMT increases relative to the 2013 level.

Other factors related to the project would also help reduce GHG emissions relative to the No Build Alternative. The shift in traffic to Route 460 reduces traffic (and therefore potential congestion) elsewhere in the system. The travel model forecast estimated a reduction of 7,810 hours of travel per day, which will reduce vehicle delay and idling. The project would increase the average travel speed throughout the study area, from 41 miles per hour in the No Build scenario to 48 miles per hour in the FHWA/VDOT Preferred Alternative. GHG emissions rates decrease with speed over the range of average speeds encountered in this corridor, although the rates do increase at speeds higher than these average speeds. Finally, The FHWA/VDOT Preferred Alternative is predicted to have fewer crashes in 2040 even though the vehicle miles traveled on Route 460 in that scenario is forecasted to be over 45 percent greater. The number of crashes predicted in the No Build Alternative is 179, compared to 154 with the FHWA/VDOT Preferred Alternative. The safety improvements associated with the new route 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; manufacture of 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,

[4] Calculated from Annual Energy Outlook 2015, Table A7.

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 has 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*. [5] 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 six and 59 centimeters. For each scenario, regularly inundated areas, at-risk areas, and the affected transportation system (i.e. highways, railroads, ports, and airports) were estimated. Based on the analysis, the FHWA/VDOT Preferred Alternative falls outside the estimated regularly inundated and at-risk areas due to sea level rise and storm surge for all scenarios. This is not to say that the project area would not be subject to extreme weather events and associated flooding. As documented in **Chapter 1**, outdated design standards related to the elevation of existing Route 460 makes it prone to flooding at several locations within the corridor, which has closed sections of Route 460 in the past. Of these flooding locations, three primary flood-prone areas were identified in or near Zuni, Wakefield and Waverly. The flood-prone area in Zuni, which is in the limits of the FHWA/VDOT Preferred Alternative, is associated with the Blackwater River and addressed as part of the project. A new bridge crossing approximately 500 feet in length and fourteen feet higher than it is today will be provided over the Blackwater River to satisfy hydraulic requirements. Over 4,000 feet of existing Route 460 will also be elevated in the approaches to the new bridge. For the sections of the FHWA/VDOT Preferred Alternative on new location, the roadway will be designed for a 50-year storm event, which would have a lower probability of occurring (i.e. a storm event that would have a higher flood elevation associated with it) than the storm event for which existing Route 460 was designed for. New-location Route 460 is also an example of redundant infrastructure which is one strategy for adapting to extreme weather events; new-location Route 460 reduces the risk associated with flooding in the existing Route 460 corridor by providing an alternative when flooding leads to road closures.

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

3.6.7 Construction Activities

The temporary air quality impacts from construction activities are expected to be minor. Construction activities will be performed in accordance with VDOT's current "Road and Bridge Specifications". The specifications require compliance with all applicable local, state, and federal regulations. All reasonable precautions should be taken to limit the emissions of volatile organic compounds (VOCs) and nitrogen oxides (NO_x). In addition, the following VDEQ air pollution regulations will be adhered to during the construction: 9 VAC 5-130 et seq., Open Burning restrictions; 9 VAC 5-45, Article 7 et seq., Cutback Asphalt restrictions; and 9 VAC 5-50, Article 1 et seq., Fugitive Dust precautions.

3.6.8 Conclusion

The air quality analysis has demonstrated that the FHWA/VDOT Preferred Alternative for the Route 460 Corridor Study SEIS is not expected to cause or contribute to a new violation of any NAAQS, increase the frequency or severity of any violation, or delay timely attainment of any NAAQS.

3.7 NOISE

In 2014, VDOT conducted a noise analysis for the five Build Alternatives and the No Build Alternative studied in the Draft SEIS. The FHWA/VDOT Preferred Alternative is a combination of the previously evaluated alternatives, and therefore the noise analysis conducted for the Draft SEIS is valid for the FHWA/VDOT Preferred Alternative. Although the alignment has shifted in some locations, the impacts to each Common Noise Environment (CNE) are representative of the impacts that would be associated with the Preferred Alternative. The FHWA/VDOT Preferred Alternative and potential mitigation measures will be evaluated fully during the Final Design Noise Analysis, per VDOT's State Noise Abatement Policy.

The noise analysis and results of the alternatives assessed in the Draft SEIS can be found in the ***Noise Analysis Technical Report*** (VDOT 2014j), however, only a portion of it pertains to the FHWA/VDOT Preferred Alternative. This section presents a summary of the analysis as it pertains to the FHWA/VDOT Preferred Alternative. Detailed results are included in **Appendix E – Noise**.

The ***Noise Analysis Technical Report*** (VDOT, 2014j) provides more details on traffic noise, noise impact analyses, and the effects of rail noise, including details on modeling methodologies, predicted sound levels, and tables of the existing condition and future design year traffic peak hour volumes. Construction noise provisions are also summarized in the Technical Report, taken from Section 107.16(b)3 Noise of the 2007 VDOT Road and Bridge Specifications.

3.7.1 Noise Model, Data, and Results

3.7.1.1 Noise Prediction Model

All traffic noise computations for this SEIS were conducted using the latest version of the FHWA Traffic Noise Model (FHWA TNM 2.5). The FHWA Traffic Noise Model (TNM) incorporates state-of-the-art sound emissions and sound propagation algorithms, based on well-established theory or on accepted international standards. The SEIS considered noise sensitive sites within approximately 500 feet of the Design Corridor and project termini. Results of the noise modeling conducted for the Draft SEIS were used to identify the impacts associated with the FHWA/VDOT Preferred Alternative – which corresponds with sections of the No Build Alternative and Alternatives 1, 2N, 3, and 4.

3.7.1.2 Traffic Data for Noise Prediction

As required by FHWA and VDOT, the noise analysis was performed for the loudest ("worst noise") hour of the day. Noise levels have been predicted for that hour of the day when the vehicle volume, operating speed, and number of trucks (vehicles with 3 or more axles) combine to produce the worst noise conditions. According to FHWA guidance, the "worst hourly traffic noise impact" occurs at a time when truck volumes and vehicle speeds are the greatest, typically when traffic is free flowing and at or near LOS C conditions.

Due to the size of the proposed project, the worst noise hour did not always correlate with the peak traffic hour. The worst noise hour for the mainline Route 460 (existing and proposed alignment) was the 4:00 PM-5:00 PM hour. The worst noise hour for the eastern terminus was different for nearly every condition. This was mainly due to a projected 20 percent daily truck volume on Route 58, which caused overcapacity issues for several hours of the day. The hours where a lack of sufficient capacity on Route 58 prevented free flowing conditions were removed from consideration as the worst noise hour.

The worst noise hour for the eastern terminus is as follows:

- Existing Condition - 5:00 PM - 6:00 PM
- Future No Build Condition - 2:00 PM - 3:00 PM
- FHWA/VDOT Preferred Alternative - 10:00 AM - 11:00 AM

The ***Noise Analysis Technical Report*** (VDOT, 2014j) provides tables of the existing and future traffic data used in the noise model for all roadways in the network.

3.7.1.3 Noise Level Results

The study area includes residential, recreational, and commercial land use adjacent to the study area roadways. Receptors are grouped into "Common Noise Environments" (CNEs) per current guidance from FHWA and VDOT. CNEs are areas that have similar sources of noise and land uses within the CNE. All predicted noise levels were the A-weighted equivalent sound level, or Leq, in dB(A). Worst-hour noise levels were predicted for the existing conditions (2014) and the future design-year (2040) No Build and FHWA/VDOT Preferred Alternatives.

Appendix E – Noise includes a table containing the ranges of predicted noise levels at the receptors within each of the CNEs for the No Build and FHWA/VDOT Preferred Alternatives. The table provides a description of location and land use of each CNE. Figures are also provided to show the locations of the CNEs and the individual receptors.

3.7.1.3.1 No Build Alternative

The existing condition (2014) exterior noise levels range from 38 to 75 dB(A) and future design year (2040) No-Build exterior noise levels range from 39 to 77 dB(A). Approximately 142 residences and five sites associated with recreational areas/parks/cemeteries would experience noise impacts under the No Build Alternative along Route 460, due to increasing traffic volumes over time.

3.7.1.3.2 FHWA/VDOT Preferred Alternative

Future design year (2040) build noise levels range from 48 to 77 dB(A), with changes ranging from a decrease of six decibels to an increase of 31 decibels. Predicted sound levels at receptors under the future design year build condition are different from the future No Build Alternative noise levels for a variety of reasons. First, some receptors that may have been removed from traffic noise would now be much closer to the new roadway, such as along the new location alignment. Second, the potential acquisition and

elimination of some buildings adjacent to the study corridor have the potential to eliminate the existing noise shielding provided by existing buildings. Since shielding would be reduced, predicted noise levels from the FHWA/VDOT Preferred Alternative are predicted to increase at the remaining receptors. Finally, sound levels are predicted to decrease in some areas because new roadways are moving traffic farther from some receptors, specifically with the proposed sections of roadway on new alignment.

3.7.2 Noise Impact Assessment

The State Noise Abatement Policy has adopted the Noise Abatement Criteria (NAC) that have been established by FHWA (23 CFR §772) for determining traffic noise impacts for a variety of land uses. The NAC, listed in **Table 3.7-1** for various activities, represent the upper limit of acceptable traffic noise conditions and also a balancing of that which may be desirable with that which may be achievable.

The NAC applies to areas having regular human use and where lowered noise levels are desired. They do not apply to the entire tract of land on which the activity is based, but only to that portion where the activity takes place. The NAC is given in terms of the hourly, A-weighted, equivalent sound level in decibels (dB(A)). The noise impact assessment is made using the guidelines listed in **Table 3.7-1**. Noise-sensitive sites potentially affected by this project are classified as Categories B, C, D, and E.

Table 3.7-1: FHWA Noise Abatement Criteria

Hourly A-Weighted Sound Level Decibels (dB(A))			
Activity Category	**Activity Leq(h)**	**Evaluation Location**	**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*	67	Exterior	Residential.
C*	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	---	Exterior	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	---	---	Undeveloped lands that are not permitted.

Source: 23 CFR §772
* Includes undeveloped lands permitted for this activity category

In summary, noise impacts are predicted under the future design year (2040) build condition wherever noise levels are predicted to approach within one decibel of or exceed 67 dB(A) Leq at exterior noise-sensitive land uses in Activity Categories B (residential) and C (recreational) during the loudest hour of the day. For Category D (noise-sensitive institutional), land uses such as schools and church buildings, noise impacts

are predicted where interior noise levels due to the future design year build condition approach or exceed 52 dB(A) Leq during the loudest hour of the day. For Category E (commercial) exterior land uses, noise impacts are predicted to occur when noise levels approach or exceed 72 dB(A) Leq. Noise impacts are also predicted when future design year build condition noise levels would cause a substantial noise level increase over existing noise levels. A substantial noise increase occurs when predicted highway traffic noise levels exceed existing noise levels by 10 dB(A) or more. FHWA and VDOT policy also requires evaluations of undeveloped lands if they are considered "permitted," that is, when there is a definite commitment to develop land as evidenced by the issuance of at least one building permit.

Only three subdivisions were identified from the GIS layers for the entire project corridor that appeared to not be fully constructed or in some form of development and warranted further investigation to determine if they met the permitted criterion:

- ***Waverly Meadows (Sussex County)*** – Correspondence with Sussex County states that the Waverly Meadows subdivision has been issued building permits, dating back to 2012 and 2013. As a result of these issued building permits, this subdivision meets the "permitted criterion" and may be considered for potential noise mitigation, if the associated noise sensitive sites are predicted to be impacted under the future design year build condition.
- ***Watson Subdivision (Windsor)*** – Coordination with the Windsor Planning Department indicated there has been no activity. It is zoned A-1 Agricultural with very small lots, and the setbacks are so large that houses cannot be placed there unless several lots are merged to create something that is buildable with the setbacks. This subdivision is not noise sensitive, does not meet the "permitted criterion", and will not be considered for potential noise mitigation.
- ***Holland Meadows (Windsor)***
    - Phase 1 – Coordination with the Windsor Planning Department indicated that Holland Meadows Phase 1 currently contains approximately 33-34 structures, all of which have building permits dating back to 2007. This subdivision meets the "permitted criterion" and may be considered for potential noise mitigation, if the associated noise sensitive sites are predicted to be impacted in the future design year build condition.
    - Phase 2 – Coordination with the Windsor Planning Department indicated that Holland Meadows Phase 2 has no building permits issued to date. Without an active building permit, this phase is not available for potential noise abatement (if impacted).

The ***Noise Analysis Technical Report*** (VDOT, 2014j) documents the results of this effort, and will be reevaluated during the final design phase.

The figures in Appendix E show the locations of individual receptors where noise impacts are predicted under the future design year build condition. Also shown in the figures are individual receptors adjacent to areas of the FHWA/VDOT Preferred Alternative where alignment adjustments have been made to minimize impacts to aquatic resources since the Draft SEIS noise analysis was conducted. Changes in predicted noise levels at these receptors are possible and will be evaluated when further noise analysis is conducted for the FHWA/VDOT Preferred Alternative in final design. As a general rule of thumb, an alignment shift that doubles the distance between a noise source and its receptor will cause noise levels to decline by 3 db(A) provided it is a straight-line scenario where noise is unimpeded between the receptor and its source. The opposite would hold true if the distance between a noise source and its receptor were halved. **Table 3.7-2** presents a summary of locations with sounds levels above the NAC for the existing condition (2014) and for the future design year (2040) No Build and FHWA/VDOT Preferred Alternatives.

The FHWA/VDOT Preferred Alternative is predicted to impact 292 noise sensitive sites under the future design year (2040) build condition – 218 residences and 74 noise sensitive sites associated with recreational areas, parks, and cemeteries. Of these impacted sites, 144 are predicted to be impacted by traffic noise due to noise levels approaching or exceeding the NAC only, 98 are impacted because of the substantial increase criterion only, and 50 impacts are a result of both the NAC and substantial increase impact criterion.

Table 3.7-2: Noise Impact Summary Table

Land Use	Total Impacts		
	Existing (2014)	Future No Build (2040)	Preferred Alternative
Residential (NAC B)	133	142	218
Recreational/Parks/Cemeteries (NAC C)	5	5	74
Interior (NAC D)	0	0	0
Commercial (NAC E)	0	0	0
Total	**138**	**147**	**292**

*For each recreational area, park, and cemetery considered, multiple noise sensitive sites were evaluated at each one. Therefore, 74 represents the total number of impacts predicted at the recreational areas, parks, and cemeteries considered; 74 is not the total number of recreational areas, parks, and cemeteries impacted.

3.7.3 Noise Abatement Measures

Predicted noise levels under the future design year (2040) build condition either approach or exceed the NAC and/or meet the substantial increase criterion; therefore, per VDOT's State Noise Abatement Policy, noise abatement considerations are warranted for these impacted noise sensitive areas. Determining that noise abatement is warranted is the first phase of the three-phase noise abatement criteria. Noise abatement was considered only for those areas in the vicinity of the LOD of the FHWA/VDOT Preferred Alternative.

3.7.3.1 Alternative Noise Abatement Measures

In general, noise abatement measures can include alternative measures (traffic management, the alteration of horizontal and vertical alignment, and low-noise pavement) in addition to the 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 since a substantial decrease in speed is necessary to provide a significant noise reduction. A 10-mph reduction in speed would result in only a two decibel decrease in noise level. Furthermore, the limited access roadway is being developed with a 75 mile per hour design speed. Restricting truck usage on the new roadway is not practical because one of the components of the purpose and need is to accommodate increasing freight traffic that is forecast to grow with the expansion at the Port of Virginia.

Alteration of the horizontal and vertical alignment was also considered. For portions of the FHWA/VDOT Preferred Alternative that improve the existing alignment of Route 460, relocating the roadway would not be a practicable option because it is an existing facility and moving the alignment to reduce noise impacts could have significant impacts elsewhere. For example, minor shifts away from impacted receptors could have a greater impact on aquatic resources or on the built up areas resulting in additional relocations than currently anticipated. Likewise, making large shifts of existing Route 460 onto new location, while it may decrease noise impacts and relocations along existing Route 460, can be expected to increase other resource

impacts, such as farmland and aquatic resources.

For the portions of the FHWA/VDOT Preferred Alternative that propose a new location, the alteration of the horizontal or vertical alignment may be practical to reduce noise impacts, and this option will be reevaluated during final design. However, other factors, such as aquatic resources, agricultural access, and geometric design requirements have been evaluated extensively to arrive at the current location and horizontal shifts to reduce noise effects are likely not practicable. In addition, as a general rule of thumb, noise levels will only decrease three dB(A) if the distance between the noise source and receptor is doubled (i.e. the road is shifted further away from the impacted receptor). The use of acoustical insulation is only considered for interior public-use and non-profit facilities sites that are impacted by traffic noise. While some of the interior sites were addressed with noise barriers the determination of installing acoustical insulation will be reevaluated during final design, when more detailed engineering data will be available.

3.7.4 Noise Barriers

Construction of noise barriers can be an effective way to reduce noise levels at areas of outdoor activity. Noise barriers can be wall structures, earthen berms, or a combination of the two. The effectiveness of a noise barrier depends on the distance and elevation difference between roadway and receptor and the available placement location for a barrier. Gaps between overlapping noise barriers, which may be needed because of utilities, environmental conditions, or access requirements, also decrease the effectiveness of the barrier, as opposed to a single connected barrier. The barrier's ability to attenuate noise decreases as the gap width increases.

Noise walls and earth berms are often incorporated into the highway design in response to the identified noise impacts. The effectiveness of a freestanding (post and panel) noise barrier and an earth berm of equivalent height are relatively consistent; however, an earth berm is perceived as a more aesthetically pleasing option. The use of earth berms is not always an option due to the excessive space they require adjacent to the roadway corridor. At a standard slope of 2:1, every one-foot in height would require four feet of horizontal width. This requirement becomes more complex in built up areas where residential and commercial properties abut the proposed roadway corridor. In these situations, implementation of earth berms can require significant property acquisitions to accommodate noise mitigation and result in additional impacts to other resources, such as wetlands and streams. The cost associated with the acquisition of property to construct a berm can significantly increase the total cost to implement this form of noise mitigation.

Availability of fill material to construct the berm also needs to be considered. On proposed projects where proposed grading yields excess waste material, earth berms are often cost effective mitigation options. On projects where fill material needs to be brought in, the implementation of earth berms is often an expensive solution due to the need to identify, acquire, and transport the material to the project site. Since the project would primarily be built on fill, earth berm may not be considered a viable option.

As a general practice, noise barriers are most effective when placed at a relatively high point between the roadway and the impacted noise sensitive land use. To achieve the greatest benefit from a potential noise barrier, the goal of the barrier should focus on breaking the line-of-sight (to the greatest degree possible) from the roadway to the receptor. In roadway fill conditions, where the highway is above the natural grade, noise barriers are typically most effective when placed on the edge of the roadway shoulder or on top of the fill slope. In roadway cut conditions, where the roadway is located below the natural grade, barriers are

typically most effective when placed at the top of the cut slope. Engineering and safety issues have the potential to alter these typical barrier locations.

The feasibility of noise barriers was preliminarily evaluated in locations where noise impacts were predicted under the future design year build condition, as described below.

To be constructed, noise barriers identified in this document must satisfy final feasibility and cost reasonableness criteria. Therefore, the noise barrier design parameters and cost identified in this document are preliminary. As such, noise barriers that are found to be feasible and reasonable during the preliminary noise analysis may not be found to be feasible and reasonable during the final design noise analysis. Conversely, noise barriers that were not considered feasible and reasonable during the preliminary noise analysis may meet the established criteria and be recommended for construction. Conceptual roadway design was used for most of this analysis, whereas the final design noise analysis would use specific, detailed information corresponding to the refined alignment along the FHWA/VDOT Preferred Alternative.

3.7.4.1 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, i.e., it must reduce noise levels at noise sensitive locations by at least five decibels, thereby "benefiting" the property. VDOT requires that the proposed noise barrier must reduce design year noise levels by five dB(A) (or more) for 50 percent (or more) of impacted receptors for it to be feasible.

A second feasibility criterion is that it must be possible to 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. Due to the limited available engineering data for this analysis, a constructability review has not been performed at this time. Barrier constructability will be evaluated during the final design phase.

Barrier reasonableness is based on three factors: cost-effectiveness, ability to achieve VDOT's noise reduction design goal, and the views of the benefited receptors.

Typically, the limiting factor related to barrier reasonableness is the cost effectiveness value, where the total surface area of the barrier is divided by the number of benefited receptors receiving at least a 5 dB(A) reduction in noise level. VDOT's approved cost is based on a maximum square footage of abatement per benefited receptor, a value of 1,600 square feet per benefited receptor. Where multi-family housing includes balconies at elevations that exceed a 30-foot high barrier or the topography causes receptors to be above the elevation of a 30-foot barrier, these receptors are not assessed for barrier benefits and are not included in the computation of the barrier's reasonableness. For non-residential properties such as parks and public use facilities, a special calculation is performed in order to quantify the type and duration of activity and compare to the cost effectiveness criterion. The determination is based on cost, severity of impact, and amount of noise reduction.

The second reasonableness criterion is VDOT's noise reduction design goal. The design goal establishes a criterion, selected by VDOT, which noise abatement must achieve to be considered reasonable. VDOT's noise reduction design goal is defined as a 7 dB(A) of noise reduction for at least one impacted receptor, which means that at least one impacted receptor must realize a 7 dB(A) or greater reduction in noise with

the barrier in place to satisfy this criterion. The design goal is not the same as acoustic feasibility, which defines the minimum level of effectiveness for a noise abatement measure. Acoustic feasibility indicates that the noise abatement measure can, at a minimum, achieve a discernible reduction in noise levels.

The third reasonableness criterion relates to the views of the owners and residents of potentially benefited properties. A majority of benefited receptors must favor the barrier for it to be considered reasonable. Community views are surveyed in the final design phase of projects. Community views in and of themselves are not sufficient for a barrier to be found reasonable if one or both of the other two reasonableness criteria are not satisfied.

3.7.5 Noise Abatement Summary

A total of 19 barriers (systems) were evaluated for areas predicted to be impacted by traffic noise under the future design year build condition within the vicinity of the LOD of the FHWA/VDOT Preferred Alternative. A barrier unit cost of $31 per square foot was used to calculate the noise barrier's cost. The $31 per square foot unit cost was used because it is the current state wide barrier unit cost for barrier quantities greater than 50,000 square foot. This cost is based on two years of historic data and is updated accordingly about every other year.

A total of five barriers were found to be both feasible and reasonable in accordance with VDOT's State Noise Abatement Policy under the Preferred Alternative. **Appendix E** summarizes the evaluated barriers (systems) and includes graphics showing the evaluated barrier locations.

The barrier analysis for the SEIS examined barrier heights in two-foot increments. This process does not allow for fine-tuning of the square foot per benefited receptor value with a variety of barrier heights; which would be carried out in the final design noise analysis. As a result, this analysis gives initial impressions of the potential cost-effectiveness of barriers for each CNE, but should not be construed to be the final determination on the reasonableness of any of the noise barriers evaluated. The barrier analysis was largely conducted separately for each CNE, unless the receptors in two adjacent CNEs clearly needed to be combined for a barrier evaluation. The FHWA/VDOT Preferred Alternative was evaluated in each CNE to determine if any refinements made to the alignment since the preliminary noise analysis would have the potential to change the results of the reasonableness and feasibility of barriers. These refinements to the FHWA/VDOT Preferred Alternative may result in small changes to the number of impacted receptors and barrier alignments; however, these changes were so minor that they were found not to have the potential to alter the preliminary feasibility and reasonableness evaluations. **Table 3.7-3** shows the details for all barriers that met both feasible and reasonable criteria. **Figure 3.7–1** shows the general locations of the barriers that met both criteria.

Table 3.7-3: Feasible and Reasonable Noise Barriers

Barrier	Insertion Loss (IL)	Previous Alternative Equivalent	Height (Range) (ft)	Total Length (ft)	Benefited	Area/ Benefited	Cost ($31/ft^2)
Barrier 3-12	5-9	3	14	2,516	23	1,531	$1,091,944
Barrier 3-13	4-13	3	14	2,304	41	787	$999,936
Barrier 1-06	2-14	1	18	1,982	91	392	$1,105,956
Barrier 1-07	4-9	1	14	2,004	23	1,220	$869,736
Barrier 1-08	4-11	1	14	3,322	50	930	$1,441,748
TOTAL				**12,128**	**228**	**--**	**$5,509,537**

3.8 HISTORIC AND ARCHAEOLOGICAL RESOURCES

Section 106 of the National Historical Preservation Act (NHPA) of 1966 (as amended) (54 U.S.C. 300101 et seq.) and its implementing regulations (36 CFR §800) require federal agencies to take into account the effects of their undertakings on historic properties and to provide the Advisory Council on Historic Preservation (ACHP) a reasonable opportunity to comment. Historic properties are prehistoric- or historic-period sites, buildings, structures, districts, or objects that are listed in or eligible for listing in the National Register of Historic Places (NRHP). The specific steps to accomplish these requirements are defined in 36 CFR §800. Throughout the Section 106 process, federal agencies are required to consult with the State Historic Preservation Officer (SHPO), which in Virginia is the director of the Virginia Department of Historic Resources (VDHR), and with other parties with an interest in the effects of the undertaking on historic properties. The goal of consultation is to identify historic properties potentially affected by the project, assess the effects on historic properties, and seek ways to avoid, minimize, or mitigate any adverse effects.

In May 2007, in accordance with 36 CFR §800.2(a)(2), the USACE designated the FHWA lead federal agency to act on its behalf to fulfill the collective federal responsibilities of the two agencies under Section 106 for the Route 460 project. Present consulting parties to the Section 106 process for the Route 460 project include the Nottoway Indian Tribe of Virginia, Inc. and the Cheroenhaka (Nottoway) Indian Tribe.

3.8.1 Regulatory Context and Methodology

The VDOT efforts to identify archaeological (below-ground) and architectural (above-ground) historic properties potentially affected by the Route 460 Location Study were begun as early as 2003, continued through the summer of 2015, and have been conducted in accordance with the Secretary of the Interior's Standards and Guidelines for Archaeology and Historic Preservation (Federal Register, Vol. 48, No. 190, September 1983, P. 44716-44742) as well as the VDHR's Guidelines for Conducting Historic Resources Survey in Virginia (2011), and the Programmatic Agreement Between the Virginia Departments of Transportation and Historic Resources Concerning Interagency Project Coordination (1999).

Identification and evaluation of historic and archeological resources were completed by conducting background research; reviewing USGS 7.5-minute quadrangles for the study area and GIS information; using local historical sources and GIS imaging databases; conducting field investigations of architectural resources; consulting records in the VDHR's Virginia Cultural Resources Information System (V-CRIS); and consulting with the SHPO and other consulting parties as identified in **Appendix B**.

3.8.2 Affected Environment

All architectural resources identified within the study area through surveys conducted as part of this SEIS, as well as previous surveys conducted for this project that are listed on the NRHP or have been determined by the SHPO to be eligible for listing on the NRHP, are listed and shown in **Figure 3.8–1**. Specific information concerning the location, nature, and significance of these resources can be found in the ***Architectural Survey for Route 460 Location Study Supplemental Environmental Impact Statement: Management Summary*** (VDOT, 2014b), and in previous cultural resource studies prepared for the Route 460 Location Study between 2004 and 2014. A more focused review was conducted for the Area of Potential Effect (APE) of the FHWA/VDOT Preferred Alternative following the Commonwealth Transportation Board's (CTB) approval of the alignment. The APE for direct effects on architectural resources included 500 feet on each side of the centerline developed for the FHWA/VDOT Preferred Alternative for a total of 1,000 feet. This information is summarized below.

A detailed archaeological survey was conducted for the Inventory Corridor of the FHWA/VDOT Preferred Alternative. The findings of the survey are described in ***Archaeological Survey Report*** (VDOT, 2016a) and ***summary for Archaeological Survey*** (VDOT, 2016c) and are summarized below.

3.8.3 Environmental Consequences

3.8.3.1 No Build Alternative

Where reasonably feasible, programmed projects that would be advanced under the No Build Alternative projects would be developed to avoid or minimize impacts to historic and archaeological properties by using existing public right-of-way. While it may not be possible to avoid right-of-way impacts, displacement of historic properties is unlikely given the scope of the programmed projects identified. The No Build Alternative projects have potential for affecting archaeological properties if land disturbance occurs on currently undisturbed lands.

3.8.3.2 FHWA/VDOT Preferred Alternative

3.8.3.2.1 Architectural Resources

The cultural resource studies VDOT conducted for the Draft SEIS, in consultation with the SHPO, identified no architectural properties on or eligible for the NRHP within the LOD of the FHWA/VDOT Preferred Alternative. However, there are seven architectural properties on, determined eligible for, or determined potentially eligible for the NRHP that are within the APE that could be indirectly affected by changes to their historic setting or view shed (refer to **Table 3.8-1**). VDOT determined that none of these changes will be adverse and in February 2016, the SHPO concurred with these effect determinations.

Table 3.8-1: Previously Identified Architectural Properties Located within the APE and Determined in Consultation with the SHPO to be On, Eligible for, or Potentially Eligible for the NRHP

Property (VDHR ID No., Name, Address)	Description	NRHP Status	Effects Determination
046-0006, Henry Saunders House, 13009 East Windsor Blvd.	Late 18th-c house	Listed on NRHP 2004	No Adverse Effect
046-0086, William Scott Farmstead, 12649 Shiloh Dr.	Late 18th-c house and 19th-c outbuildings	Listed on NRHP 1991	No Adverse Effect
046-5101, Hobbs Store and Motel, 6635 Windsor Blvd.	Early 20th-c store and tourist cabins	Determined eligible for NRHP by the SHPO 2005	No Adverse Effect
091-5098, Norfolk and Petersburg Railroad; Norfolk and Western Railroad (Norfolk Southern Railway)	Mid-19th-c railroad corridor	Determined eligible for NRHP by the SHPO 2005	No Effect
133-0100, Langford Farm, 5345 Pruden Blvd.	Late 19th-c rural farmhouse	Determined potentially eligible for NRHP by the SHPO 2014	No Adverse Effect
133-0101, Rountree Farm, 4801 Pruden Blvd.	Early 19th-c house and outbuildings	Determined potentially eligible for NRHP by the SHPO 2014	No Adverse Effect
133-0102, Pruden Farm, 4127 Pruden Blvd.	Early 19th-c house and outbuildings	Determined potentially eligible for NRHP by the SHPO 2014	No Adverse Effect

In the course of conducting the archaeological survey of the Inventory Corridor for the FHWA/VDOT Preferred Alternative in 2015, VDOT identified an additional four resources that are recorded in the VDHR's V-CRIS system with architectural resource numbers (refer to **Table 3.8-2**), although the resources also have below-ground components. Only one of these resources, a 1911 balloon track foundation related to the former Dwight Coaling Station of the Norfolk and Western Railroad (VDHR No. 091-5098), is located within the LOD of the FHWA/VDOT Preferred Alternative. VDOT determined that this resource is not individually eligible for the NRHP and does not contribute to the significance of the NRHP-eligible Norfolk and Western Railroad.

Table 3.8-2: Newly Recorded or Newly Evaluated Architectural Resources within the Inventory Corridor

Resource (VDHR ID No., Name, Address)	Within LOD of the Preferred Alternative	NRHP Eligibility Determination to be Coordinated with the SHPO
091-5098, 1911 Balloon Track Foundation related to Dwight Coaling Station, Norfolk and Western Railroad, located on the southwest side of Windsor Blvd. (U.S. Route 460) and on the northwest side of Yellow Hammer Rd. (SR 645)	Yes	Non-contributing element of NRHP-eligible Norfolk and Western Railroad and not individually eligible
046-5063, Bradshaw Family Cemetery, 13241 Old Suffolk Rd. (part of farmstead property previously determined by SHPO to be not eligible for the NRHP)	No	Not eligible
046-5107, Mumford Family Cemetery, located at the northeast corner of the intersection between Yellow Hammer Rd. (SR 645) and Barrett Town Rd. (SR 641), approximately 90 feet back from the edge of Barrett Town Rd.	No	Not eligible
133-5501, Anderson Family Cemetery, 4501 Pruden Blvd.	No	Not eligible

In February 2016, the SHPO concurred with these eligibility determinations. The SHPO also concurred that the balloon track foundation related to the former Dwight Coaling Station is also not individually eligible for the NRHP. Although the Anderson Family cemetery is not located within the LOD, VDOT is evaluating access to the cemetery.

3.8.3.2.2 Archeological Resources

Archaeological survey conducted for the Final SEIS identified 68 archaeological sites within the Inventory Corridor. Only 29 of these sites are located within the LOD of the FHWA/VDOT Preferred Alternative (refer to **Table 3.8-3**); the remaining sites are avoided by the FHWA/VDOT Preferred Alternative.

VDOT has determined that 26 of the sites within the LOD are not eligible for the NRHP; three are potentially eligible (44IW0284, 44IW0285, and 44SK0580), but would require Phase II-level evaluation studies to definitively establish their NRHP eligibility. In February 2016, the SHPO concurred with the eligibility determinations for the three sites. They also concurred that the three sites are important chiefly for the information they contain and have minimal value for preservation in place. Therefore, Section 4(f) does not apply to these three sites.

Table 3.8-3: Archaeological Sites Located within the Limits of Disturbance

Archaeological Site No. *	Description	Previous NRHP Determination by SHPO	NRHP Eligibility Determination
44IW0279	Native American Woodland-period artifact scatter; 20th-c artifact scatter		Not eligible
44IW0280	19th- to early 20th-c artifact scatter		Not eligible
44IW0284	**Native American artifact location (lithic debitage); late 18th- to mid-19th-c artifact scatter**		**Potentially eligible based on historic-period component**
44IW0285	**Mid-18th- to early 19th-c artifacts scatter, near ca. 1780 Scott Farmstead (VDHR No. 046-0086)**		**Potentially eligible**
44IW0286	Late 19th- to mid-20th-c artifact scatter		Not eligible
44IW0289	18th- to 20th-c artifact scatter		Not eligible
44IW0292	Native American artifact location (lithic debitage); late 19th- to mid 20th-c artifact scatter		Not eligible
44IW0293	Late 19th – to early 20th-c artifact scatter; semi-ruinous early 20th-c dwelling (VDHR No. 046-5061)		Not eligible
44IW0295	Mid-20th-c artifact scatter		Not eligible
44IW0297	Late 19th – to early 20th-c artifact scatter		Not eligible
44IW0299	Late 19th- to mid-20th-c artifact scatter		Not eligible
44IW0300	20th-c artifact scatter and early 20th-c dwelling ruins		Not eligible
44IW0301	Late 19th- to 20th-c artifact scatter		Not eligible
44IW0302	Native American artifact scatter, possibly Middle Woodland or Late Woodland period		Not eligible
44SK0515	Late 19th- to 20th-c artifact scatter	Not eligible	Not eligible
44SK0516	Drainage ditch	Not eligible	Not eligible
44SK0517	Late 19th- to 20th-c artifact scatter	Not eligible	Not eligible
44SK0518	Late 19th- to 20th-c artifact scatter	Not eligible	Not eligible
44SK0519	19th- and 20th-c artifact scatter	Not eligible	Not eligible
44SK0562	Late 19th- to mid-20th-c artifact scatter		Not eligible
44SK0566	19th- to 20th-c artifact scatter		Not eligible
44SK0571	Mid-19th- to mid-20th-c artifact scatter and farmstead ruins (VDHR No. 133-5199)		Not eligible
44SK0572	Native American artifact location (indeterminate projectile point fragment); mid-19th- to early 20th-c artifact scatter		Not eligible
44SK0573	Native American artifact location (indeterminate projectile point fragment); early to mid-20th-c artifact scatter		Not eligible
44SK0574	Native American artifact location (lithic debitage); mid- to late 19th-c artifact scatter		Not eligible
44SK0575	Mid-19th- to early 20th-c artifact scatter		Not eligible
44SK0576	Late 19th- to mid-20th-c artifact scatter		Not eligible
44SK0578	Late 19th- to mid-20th-c artifact scatter		Not eligible
44SK0580	**Native American artifact location (Middle Archaic period projectile point; lithic debitage); early 19th- to mid-20th-c artifact scatter**		**Potentially eligible based on historic-period component**

*IW = Isle of Wight; SK = City of Suffolk. Note: potentially eligible sites are shaded grey.

3.8.4 Mitigation

The Programmatic Agreement (PA) among FHWA, VDOT, and the SHPO was signed in September 2007. The PA sets forth guidance and directives designed to address and mitigate, if necessary, impacts of future actions on significant archaeological sites and remains in effect through September 2012. Prior to the PA's expiration date, the Agreement was amended in 2012 to:

1) add new stipulations to address future design changes (Stipulation X);
2) to authorize the Public Private Transportation Act (PPTA) Concessionaire to act on the VDOT's behalf to fulfill any VDOT's obligations under the Agreement;
3) to coordinate with appropriate Virginia Indian tribes in replacement of the Virginia Council on Indians in previous stipulations of the Agreement; and,
4) to amend the duration of the Agreement until August 27, 2017.

In November 2015, the agencies executed a second amendment to the PA. Amendment No. 2 acknowledges that, as a result of the Draft SEIS prepared in 2014, VDOT, in close coordination with FHWA, identified the present FHWA/VDOT Preferred Alternative for the Route 460 project. It also recognizes that, prior to completing the Draft SEIS, VDOT, in consultation with the SHPO and other consulting parties, completed efforts to identify buildings, structures, and non-archaeological sites, districts, and objects listed on or eligible for listing on the NRHP within the APE of the FHWA/VDOT Preferred Alternative. Although Amendment No. 2 acknowledges that VDOT has not yet completed the efforts necessary to identify archaeological historic properties that might be affected by the FHWA/VDOT Preferred Alternative, it notes that existing PA Stipulation X established a process that VDOT will follow to complete the identification of any archaeological properties potentially affected by future design changes, assess the effects of the FHWA/VDOT Preferred Alternative on those properties, and identify and implement appropriate treatment actions to address any adverse effects.

As the design of the FHWA/VDOT Preferred Alternative is refined further, VDOT will re-examine the three archaeological sites potentially eligible for the NRHP to determine whether they are still located within the LOD for the FHWA/VDOT Preferred Alternative. If the sites will be directly impacted by project construction, in consultation with the SHPO and other parties, VDOT will follow the process outlined in Stipulation X of the Section 106 PA to conduct evaluation studies to conclusively establish their NRHP-eligibility, assess project effects on any sites determined to be eligible for the NRHP, and determine whether avoidance or minimization of any adverse effects is feasible and prudent. If adverse effects cannot be avoided, VDOT will follow the process described in Stipulation X to develop and implement appropriate treatment plans to mitigate the adverse effects. Extant information about the three sites indicates they would be chiefly important for their information potential, and VDOT will assess the effects of the FHWA/VDOT Preferred Alternative to determine whether avoidance or minimization of any adverse effects is prudent and feasible, and develop and implement a treatment plan to address any adverse effects that cannot be avoided.

3.9 VISUAL QUALITY

Aesthetic and visual resources are perceived human and natural landscape features, including land, water, vegetation, and man-made elements that contribute to the overall quality and the public enjoyment of the environment. Impacts to aesthetic and visual resources are generally defined by the degree of change in visual resources and viewer response to those changes, resulting in an overall effect on the character and quality of the viewed environment. The purpose of this section is to identify visual and aesthetic stimuli throughout the study area and assess the potential effects resulting from the implementation of the

FHWA/VDOT Preferred Alternative. Additional details on the methodology for assessing changes to visual resources are provided in the ***Aesthetics and Visual Quality Technical Memorandum*** (VDOT, 2014p).

3.9.1 Regulatory Context and Methodology

NEPA requires federal agencies to take into consideration the effects of proposed Federal Actions on the human and natural environment. The CEQ's implementing regulations for NEPA identify aesthetics as one of the elements or factors in the human environment that must be considered in determining the effects of a particular action (40 CFR §1508.8). Further, Title 23 USC §109(h) and FHWA Technical Advisory T 6640.8A cites "aesthetic values" and "visual impacts", respectively, as important considerations in the implementation of NEPA.

An assessment of the aesthetic and visual environment existing within the project study area and an analysis of potential visual impacts resulting from the FHWA/VDOT Preferred Alternative have been conducted closely following the methodology outlined in FHWA's *Visual Impact Assessment for Highway Projects* (1988). In the development of the framework for the visual quality analysis for this environmental study, reference also was given to the principles and concepts set forth in the USACE's *Visual Resources Assessment Procedure* (Smardon, et al., 1988). These guidance documents both outline a process in which visual quality and potential impacts to aesthetic resources are determined through the selection of representative viewpoints, the determination of visual quality with and without planned alternatives, and the consideration of public perception. Visual issues pertinent to determining effects on historic resources under the NHPA and resources governed by Section 4(f) of the DOT Act of 1966 also have been considered.

The visible area along the FHWA/VDOT Preferred Alternative alignment was determined through a viewshed delineation performed using aerial photography and landcover data from the ArcGIS software package. The inventory of visual resources within the FHWA/VDOT Preferred Alternative viewshed and assessment of potential changes to visual resources associated with the FHWA/VDOT Preferred Alternative were determined through a review and analysis of existing aerial photography, satellite imagery, USGS topographic mapping, local planning documentation, county comprehensive plans, and Google Earth software. A supplemental windshield survey and field visit were conducted in May 2014 to verify the aesthetic features and visual resources that characterize the Route 460 project setting.

3.9.2 Affected Environment

A preliminary identification of important visual resources throughout the project study area is important for establishing a baseline understanding of the visual environment to be used in the analysis of potential project impacts. This initial inventory includes existing landform features, scenic roadways, historic structures and districts, regionally or locally important visual or scenic resources, recreation areas or similar facilities (i.e., parks, trails, and wildlife and waterfowl refuges), and properties oriented towards views of the aforementioned visual resources. While there are visual resources throughout the entire project study area that establish the overall project setting, this visual quality analysis primarily focuses on aesthetic resources located in areas with potential views of the FHWA/VDOT Preferred Alternative and/or areas viewers could potentially see from the FHWA/VDOT Preferred Alternative alignment as they travel through the landscape (i.e., the project viewshed).

The visual environment of the study area for the Route 460 project generally can be defined by the terraced landscape sloping towards the coast, characteristic of the Coastal Plain Physiographic Province in which the study area is situated. Sloughs, wetlands, and other water features within the study area occasionally

contribute to visible depressions in the landscape. Reservoirs located in the eastern edge of the study area provide interesting vistas, recreational opportunities, and wildlife habitat. The landcover overlying the relatively level topography is primarily comprised of forested areas, farmland, and open space that are definitive of the overall rural character of the region. The farmland consists mostly of peanut, cotton, corn, and soybean fields and offers long expansive views of the relatively flat landscape with trees, homes, grain silos, and other farming structures visible along the horizon. Meanwhile the forested areas contain primarily oak, maple, and loblolly pine, as well as a variety of cypress and tupelo and other plant species characteristic of low-lying swamps. These forest lands generally are thickly vegetated and in many cases have trees that are similar in age, typical of timber farming and logging operations. Forested areas offer limited views along existing roadways as vegetation typically is within close proximity to the clear zone or right-of-way and in the foreground of the view. Sparsely interspersed throughout the study area are rural single-family and farm units located along primary and secondary roads. Residential development is concentrated around the commercial and industrial built-up areas along the transportation corridors of Route 10 and existing Route 460 and become more rural in nature as they radiate away from these hamlets and towns. Within the towns, views are limited to the structures in the foreground. As structures and built-up areas dissipate away from the towns, additional visual resources can be seen in the open views offered by rural farmland. Additionally, identified historic sites and scenic roads serve as important viewpoints in the project study area.

To facilitate a focused assessment of visual quality and aesthetic effects along the FHWA/VDOT Preferred Alternative alignment, the viewshed corridor has been separated into visual assessment units (VAUs) as illustrated in **Figure 3.9-1**. The viewshed corridor was considered to be the visible area along the FHWA/VDOT Preferred Alternative alignment. Since the various landcover types influence the extent of the viewshed and visual setting along the FHWA/VDOT Preferred Alternative Alignment, the Inventory Corridor was used as the baseline for establishing the project viewshed. Where the FHWA/VDOT Preferred Alternative passes through farmland and open space areas, the Inventory Corridor was extended beyond this 500-foot buffer to the assumed limits of visibility, usually to the end of the property or nearest forest land. Within the viewshed corridor, landscape types were combined to form definitive units for analysis, or VAUs, which have been generally delineated based on similarities of land use and development patterns, although a variety of landscape types may exist within each unit.

The overall visual character of the identified viewshed corridor, as well as VAUs along the FHWA/VDOT Preferred Alternative alignment, was determined by representative points of assessment (POAs) for visual quality determinations. These POAs generally represent either the common viewing environment of each VAU, the viewpoint where the greatest effect to visual quality from the project is anticipated, or identified visually sensitive areas upon which a human value has been placed for reasons of historic importance, natural beauty, or other reasons. For each POA, visual quality ratings were assigned through a collective evaluation of specific considerations including the *vividness* of landforms, water, vegetation, and manmade development; the absence of encroachment and overall *intactness*; and the blending of manmade and natural elements as part of the overall *unity* of the view. In addition, viewer sensitivity at each POA was determined based on ratings of viewer activity, awareness, local values, and exposure. **Table 3.9-1** summarizes the existing visual quality and viewer sensitivity based on the selected POAs along the FHWA/VDOT Preferred Alternative viewshed corridor. Additional descriptions and mapping of each POA, as well as details regarding the visual resources evaluated, are provided in the ***Aesthetics and Visual Quality Technical Memorandum*** (VDOT, 2014p).

Table 3.9-1: Summary of Existing Visual Quality and Viewer Sensitivity by Point of Assessment

VAU	POA No.	Name/Visual Resource	Visual Quality	Viewer Sensitivity
Zuni-Ivor	18	General Mahone Boulevard	Moderately Low	Moderately High
	16B	Blackwater River	Moderate	Moderate
Zuni	17B	Zuni at Blackwater River	Low	Moderate
	17A	Zuni	Moderately Low	Moderately High
Windsor-Zuni	14	Windsor Boulevard	Moderately High	Moderately High
Windsor	12	Windsor Athletic Association	Moderate	Moderately High
	9	Marantha Bible Church	Moderately Low	Moderately High
	8	Roberts House (William Scott Farmstead)	Moderate	Moderately High
Suffolk-Windsor	5	Pruden Boulevard	Moderately Low	Moderately High
	4	Alvin W. Anderson Property	Moderate	Moderate
Suffolk	3	King's Fork Community House	Moderately High	Moderate
	1A	Nansemond-Suffolk Academy Baseball Field	Moderate	Moderate

3.9.3 Environmental Consequences

In order to assess the potential visual impacts of the FHWA/VDOT Preferred Alternative, the existing conditions within each VAU, determined based on analysis of the selected POAs, were compared to the No Build and FHWA/VDOT Preferred Alternatives and prescribed components associated with each. For the purpose of this analysis, visual changes from existing conditions will be negligible under the No Build Alternative. The level of impact associated with the FHWA/VDOT Preferred Alternative was determined by the degree to which the alternative would change the existing visual quality category (high, moderately high, moderate, moderately low, and low) of a viewed landscape and the visual sensitivity (high, moderate, and low) of people who would view the project alternative in the landscape. Impacts were categorized as follows:

- **High** – An impact to visual quality with a high rating is considered to occur where the existing visual quality category changes by (a) two or more categories (for example, from high to moderate or moderate to low) in an area where people with high or moderate viewing sensitivity would see it; or (b) one category in an area where people with high viewing sensitivity would see it.
- **Moderate** – An impact with moderate intensity is defined as a change in the existing visual quality category by one category (for example, high to moderately high, or moderately low to low) in an area where people with moderate viewer sensitivity would see it.
- **Negligible** – An impact with negligible intensity is defined as (a) a change in the existing visual quality category by one or more visual quality categories in an area where people with low viewer sensitivity would see it; or (b) no change in the existing visual quality categories in an area where people with high, medium, or low viewing sensitivity would see it.

The determined degrees of impact to the visual resources identified within each POA were combined and averaged within each VAU to compare the aesthetic and visual quality impacts associated with the FHWA/VDOT Preferred Alternative. This comparison of visual quality assessments for the VAUs potentially affected by the FHWA/VDOT Preferred Alternative is included in **Table 3.9-2**. As evidenced by the visual changes listed, the build section of the FHWA/VDOT Preferred Alternative would result in the most perceivable changes to the visual environment within their respective viewsheds. Of the six VAUs evaluated for the FHWA/VDOT Preferred Alternative, four include at least one POA that would experience moderate changes in visual quality. However, any changes to the overall visual quality in each VAU is

anticipated to be negligible with the exception of the Suffolk VAU, where the implementation of the FHWA/VDOT Preferred Alternative would result in moderate visual quality changes perceived from multiple community facilities.

In other cases, where improvements are included along existing Route 460 the overall visual quality is generally considered to be moderately low to low. This is primarily due to the discontinuity of the viewsheds, which include disjointed visual elements of overhead powerlines, the existing roadway facility, and a combination of natural elements with manmade residential and commercial encroachments. Where the FHWA/VDOT Preferred Alternative would be constructed on a new location alignment, the natural setting and bucolic scenery may offer beneficial improvements for views from the new roadway. However, for the most part, these alignments traverse areas where there are few highway viewers and as a result viewer sensitivity is not considered to be very high. Therefore, any anticipated noticeable visual changes are expected to be negligible.

Table 3.9-2: Summary of Visual Quality and Viewer Sensitivity by VAU and Degree of Impact by Alternative

VAU	Existing Visual Quality	Existing Viewer Sensitivity	Degree of Impact	
			No Build	Preferred Alternative
Zuni-Ivor	Moderately Low	Moderately High	Negligible	Negligible
Zuni	Low	Moderately High	Negligible	Negligible
Windsor-Zuni	Moderately High	Moderately High	Negligible	Negligible
Windsor	Moderate	Moderately High	Negligible	Negligible
Suffolk-Windsor	Moderately Low	Moderate	Negligible	Negligible
Suffolk	Moderate	Moderate	Negligible	Moderate

3.9.4 Mitigation

As the final design and landscaping plans are advanced for the construction of the FHWA/VDOT Preferred Alternative, efforts will be made to minimize impacts to visual resources. These mitigation measures may include landscaping (i.e. plantings and/or berms) to screen the resource from the proposed roadway or lowering the elevation (depressing) of the roadway so that it would not be visible from the resource. At the Blackwater River bridge and elsewhere in areas that vegetation removal would be required, tree clearing would be limited to the proposed LOD, which represents the smallest feasible footprint considered to be practicable along the FHWA/VDOT Preferred Alternative alignment. To mitigate for viewshed impacts, material selection and aesthetic treatment may be among the considerations for the Blackwater Bridge. If the project moves forward, the goals of the final design analysis for noise walls would be to determine if any warranted highway traffic noise abatement measures are feasible and reasonable, determine the desires of the benefited communities, and incorporate appropriate aesthetic treatments. All mitigation efforts will be coordinated with the appropriate local, state, or federal agencies as necessary.

3.10 ENERGY

For transportation and highway projects, energy use is predominately dependent upon fuel consumption and is generally discussed in terms of direct and indirect use. Direct energy use is associated with the amount of fuel used for vehicle propulsion, which is influenced by factors such as traffic volume, distance traveled, vehicle type, average outdoor air temperature, and the thermal value of the fuel being used on the roadway facility. Traffic congestion can also result in additional fuel consumption for excessive starts and

idling. Indirect energy use is associated with the construction of the roadway and related infrastructure. This one-time, non-recoverable consumption of energy results from the production and shipping of component materials, actual road or bridge construction, and/or any repairs made to the roadway facility once it has been built. The purpose of this section is to document the anticipated direct and indirect energy expenditures that may result from the FHWA/VDOT Preferred Alternative.

3.10.1 Regulatory Context and Methodology

Under the NEPA implementing regulations, CEQ requires that the energy needs of the FHWA/VDOT Preferred Alternative be analyzed and potential energy conservation and mitigation measures be identified (40 CFR §1502.16(e)).

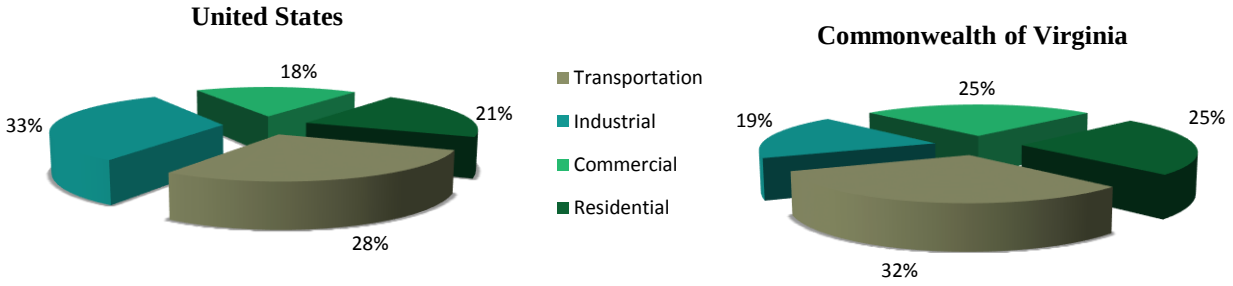
A qualitative assessment of the project's energy impacts was performed by comparing the energy consumption of the No Build Alternative to that of the FHWA/VDOT Preferred Alternative. This qualitative analysis was developed based on consideration of VMT and congestion experienced as indicated by estimated travel time (direct energy use). Additional information on the determination of VMT and travel time and the detailed traffic analysis can be referenced in **Chapter 2.0** of this Final SEIS and the ***Supplemental Traffic and Transportation Technical Report*** (VDOT, 2016h)**.**

3.10.2 Affected Environment

As illustrated in **Figure 3.10–1**, the transportation sector is the largest consumer of energy within Virginia, accounting for nearly one-third of end-use energy consumption in 2012. Within the entire U.S., the transportation sector is responsible for just over one-quarter of energy consumption.

According to the U.S. Department of Energy, which tracks state and national energy consumption and expenditures in the four sectors illustrated in **Figure 3.10–1** (transportation, industrial, commercial, and residential), 99 percent of Virginia's energy consumption within the transportation sector is as a result of petroleum use, primarily motor gasoline (EIA, 2014).

Figure 3.10-1: Total End-Use Energy Consumption by Sector (2012)



Source: U.S. Energy Information Administration [EIA], 2014

Construction (indirect) energy consumption is presently occurring for public and private roadway and development projects along existing Route 460 and throughout the study area, such as the Curtis Contracting Asphalt Plant that is currently being constructed just west of Ivor and the Loafers Oak Road (Route 630) bridge rehabilitation that is underway in Surry County.

3.10.3 Environmental Consequences

3.10.3.1 Direct Energy Consumption

Where VMT is the highest and congestion is greater than other portions of the existing Route 460, fuel consumption (direct energy consumption) is higher due to the fuel required to propel more vehicle miles during longer periods of idling at the delayed intersections.

3.10.3.1.1 No Build Alternative

Under the No Build Alternative daily VMT between one mile west of Zuni and Route 58 is expected to be 363,240 miles. In the No Build scenario, as traffic increases between 2013 and 2040 travel speeds will decrease. The predicted 2040 No Build travel time from one mile west of Zuni to the westbound Route 58 ramp terminals is 25 minutes, with an average speed of 37 mph.

During peak travel periods, drivers could be expected to spend more time idling at delayed intersections, therefore burning more fuel and increasing operational energy consumption over the existing conditions.

3.10.3.1.2 FHWA/VDOT Preferred Alternative

Under the 2040 conditions for the FHWA/VDOT Preferred Alternative, VMT is projected to increase to 506,250, a 39 percent increase over the No Build scenario. The FHWA/VDOT Preferred Alternative travel time from one mile west of Zuni to the ramps to/from Route 58 (on the new highway) is 18 minutes, with an average speed of 52 mph, eliminating idling at intersections for those vehicles using the new limited access roadway. Additionally, travel time on the existing Route 460 would also decrease; travel time would be 22 minutes, with an average speed of 43 mph. This reduction in travel time would also lead to a reduction in idling time at intersections along the existing corridor.

3.10.3.2 Construction Energy

A one-time, non-recoverable indirect energy expenditure would result from the construction of the FHWA/VDOT Preferred Alternative. Energy would be required to extract raw materials, manufacture and fabricate construction materials, transport materials to the study area, and complete construction of the various project components including but not limited to roadway, bridges, and interchanges. Where portions of the FHWA/VDOT Preferred Alternative would be constructed on new alignment, a greater expenditure of construction energy is anticipated. Additional energy usage would be incurred due to maintenance of the constructed roadway facilities.

Accurate construction energy costs for the No Build Alternative cannot be determined given the uncertainty of variables at this level of planning analysis. However, the No Build Alternative is not expected to result in the expenditure of energy with the exception of projects that are currently programmed and funded in the VDOT Six-Year Improvement Plan (SYIP) and Tri-Cities/HRTPO plans. In addition, there would be energy consumption for maintenance of the existing Route 460; however, this consumption would also apply to the FHWA/VDOT Preferred Alternative. This energy consumption is estimated to be minimal compared to construction energy consumed by the FHWA/VDOT Preferred Alternative.

3.10.4 Mitigation Measures

An improved corridor is anticipated to increase the overall energy consumption along the corridor due to increased capacity, although the anticipated improvements to vehicular fuel economy are expected to substantially reduce the anticipated impacts. Over time, older and less fuel-efficient vehicles are expected to be replaced with more fuel efficient vehicles, including hybrid and electric vehicles. To minimize the amount of indirect energy required for the FHWA/VDOT Preferred Alternative, energy conservation

methods that could be implemented during the construction, operation, and maintenance phases include using recycled pavements, reused hardware items such as guardrails and tires, and low energy traffic signals and/or roadway lights; applying BMPs in roadway maintenance; and promoting carpool, vanpool, buses, and bicycle initiatives. During construction, mitigation of indirect energy use may include limiting the idling of machinery and optimizing construction methods to lower overall fuel use.

3.11 SECTION 4(F)

A Draft Section 4(f) Evaluation (VDOT, 2014m) was prepared and circulated in conjunction with the Draft SEIS; however, through the identification of the FHWA/VDOT Preferred Alternative and avoidance and minimization efforts associated with its development (minor roadway shifts, adjustments to stormwater management locations, etc.) the public parks, recreation resources, and historic properties, that were identified in the Draft SEIS and protected by Section 4(f) of the Department of Transportation Act of 1966, will no longer be involved with the project.

Additionally, although three potentially eligible archaeological sites would be impacted by the project, the SHPO concurred that the sites are important chiefly for the information they contain and have minimal value for preservation in place, see **Section 3.8.3.2.2**. Therefore, Section 4(f) does not apply to these three sites.

Since there will be no Section 4(f) resource uses associated with the FHWA/VDOT Preferred Alternative, a Section 4(f) Evaluation is no longer required.

3.12 SHORT-TERM IMPACTS/LONG-TERM BENEFITS

The direct and indirect impacts to the resources aforementioned in previous sections of this chapter (and further indirect effects in **Chapter 4.0**) can often be characterized as having short- or long-term duration. The implementing regulations of NEPA require that consideration be given to "the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity" (40 CFR §1502.16). Short-term effects and uses are commonly associated with the construction phase of the project, while long-term is defined as the life of the roadway facility through maintenance and operation. This section is not intended to repeat the analyses already provided; rather, it documents the tradeoffs between the immediate and long-term gains derived from the implementation of the FHWA/VDOT Preferred Alternative as compared to the short- and long-term losses. Overall, the short-term impacts and use of resources by the FHWA/VDOT Preferred Alternative are not expected to detract from the enhancement of long-term productivity and transportation benefits for the local area, region, and Virginia as a whole.

3.12.1 Short-Term Gains

If the FHWA/VDOT Preferred Alternative is selected for implementation, construction of the associated transportation improvements would create jobs primarily for material suppliers, construction workers, and construction inspectors necessary for the construction of the project. These employment positions may be filled by area residents or individuals who move into the local areas as a result of the anticipated job opportunities. The new local residents and the concentration of workers within the project area would benefit the local economy by increasing sales to such establishments as motels, restaurants, banks, gas stations, grocery stores, and other commercial and retail establishments within the project area. Increased

sales tax would be derived from the sales at these establishments and from the sales of materials required for the project construction.

3.12.2 Short-Term Losses

Short-term impacts associated with the construction of the FHWA/VDOT Preferred Alternative may result from travelers taking alternate routes to avoid the construction areas or as a result of required detours. Maintenance of traffic would be required for the FHWA/VDOT Preferred Alternative, as traffic would be redirected while improvements along existing Route 460 are implemented. However, detours may be required where any improvements are made to the existing roadway infrastructure within the study area. The use of these alternate routes may increase fossil fuel consumption as a result of longer trips on less direct routes and may discourage patronage of local businesses resulting in lowered sales and sales tax revenues. The use of alternate routes may also disrupt the travel habits of local residents since they may be required to travel on more heavily traveled roadways, which may experience increasing congestion and delays due to the increase in traffic during the construction period. Short-term impacts to air quality may result from these reduced travel speeds and increased traffic levels. There would also be modifications to access of individual properties primarily in the construction zones so as to accommodate truck traffic necessary to provide the construction materials and heavy equipment to the site.

During construction of the FHWA/VDOT Preferred Alternative, short-term impacts would also include temporary impacts to streams and wetlands, including the removal of existing vegetation as a result of clearing and grubbing as well as earth moving and grading activities. As a result, a temporary increase in soil erosion may be expected along with a localized degradation of air quality due to fugitive construction dust emissions. This erosion would be minimized through the use of erosion and sediment control practices. A temporary increase in noise and vibration levels may also occur from construction activities including heavy equipment and vehicle operation, and potential pile driving as required for retaining walls and bridges. As the project design advances, VDOT will consider requiring the contractor to employ control measures to minimize the potential for vibration impacts during construction. There would also be a need for local water resources for construction activities such as the mixing of aggregates, road wetting, fugitive dust control, and landscaping. Temporary impacts to water quality, including those associated with construction activities, and may be regulated under local and state regulations and laws. Locations of staging areas for equipment would be selected to avoid impacting surface waters and wetlands. Water quality may be temporarily impacted by stormwater runoff, erosion, and sedimentation during roadway construction while the project areas are cleared and graded.

3.12.3 Long-Term Gains

Upon completion of construction of the FHWA/VDOT Preferred Alternative, several long-term benefits would result, enduring the lifespan of the proposed facility. These benefits are associated with the Purpose and Need of this study, as set forth in **Chapter 1.0** of this Final SEIS. The FHWA/VDOT Preferred Alternative would offer varying degrees of primary long-term benefits, including increased safety with roadway access controls and reduced travel time delays, improved mobility and evacuation capabilities with increased roadway capacity and avoidance of flood prone areas, and enhanced accommodations for increasing freight traffic within the improved portion of Route 460. Other anticipated long-term benefits offered by the FHWA/VDOT Preferred Alternative would include improved strategic military connectivity and support of local economic development plans.

The FHWA/VDOT Preferred Alternative would be designed in accordance with updated American Association of State Highway and Transportation Officials (AASHTO) design standards, thus providing

increased safety and improved mobility throughout the improved portion of the corridor. Access control would provide an additional increase in safety, a reduction in travel time delays, and improved mobility through the improved portion of the corridor. The build section of the FHWA/VDOT Preferred Alternative on new alignment, would be constructed to avoid flood-prone areas, while the build section of the FHWA/VDOT Preferred Alternative along the existing alignment would incorporate infrastructure improvements to decrease the frequency of flooding.

Benefits of decreased travel times as mentioned previously would result in quicker commutes and emergency response times, improved military connectivity, and the more efficient movement of freight, as well as decreased use of gasoline. Roadway improvements would also draw traffic from neighborhoods, thereby increasing safety and decreasing air emissions within these communities.

3.12.4 Long-Term Losses

The construction of the FHWA/VDOT Preferred Alternative would require the conversion of property from residential, commercial, and agricultural use to transportation use. Real estate taxes paid on these properties would be eliminated and in some instances the loss of commercial structures may result in the loss of jobs and sales revenue. Cohesive tracts of agricultural land may be divided to allow for construction of the project, resulting in farm fragmentation. These monetary losses could be off-set by potential increased property values in areas surrounding the interchange locations and possible attraction of new development and businesses to these improved interchange areas.

Implementation of the FHWA/VDOT Preferred Alternative would also result in the long-term loss of habitat and natural resources. The new location segments of the build section of the FHWA/VDOT Preferred Alternative would require conversion of forest land, open space, wetlands, and other natural resource into permanent transportation use. As a result, habitat loss and fragmentation may result in the loss of some wildlife resources.

3.13 IRREVERSIBLE AND IRRETRIEVABLE RESOURCES

Implementation of the FHWA/VDOT Preferred Alternative would require the commitment of a range of natural, physical, human, and fiscal resources. Under the implementing regulations for NEPA, any expenditure of these resources that would be considered irreversible or irretrievable must be included for consideration in the discussion of potential environmental effects of the alternative (40 CFR §1502.16). Irreversible impacts are those that cause, through direct or indirect effects, use or consumption of resources in such a way that they cannot be restored or returned to their original condition, regardless of the mitigation efforts in place. An irretrievable impact or commitment of resources refers primarily to the use of nonrenewable resources. In accordance with the requirements of NEPA, this section describes the irreversible and irretrievable resource losses associated with the FHWA/VDOT Preferred Alternative under study and evaluates these resource commitments to ensure that consumption is justified.

The commitment of land for the construction of the FHWA/VDOT Preferred Alternative would render the land unusable for any other use. Although the existing land uses within the required right-of-way could be relocated to another location, the land itself would be irreversibly dedicated to transportation use. As a result, the loss of real estate and land would cause a decline in tax revenues to counties and communities along the alternative corridor. Even though the structures required for the FHWA/VDOT Preferred Alternative may be replaced with structures of equal or greater value in other locations, these structures themselves would be irreversibly removed from the tax base. However, due to the relative sizes of the

taxing entities, the losses incurred would not have long-term adverse effects to the respective tax bases. The properties surrounding the interchange locations of the FHWA/VDOT Preferred Alternative may increase in value and would remain taxable land. The taxes collected from these properties would compensate somewhat for the taxes lost as a result of the FHWA/VDOT Preferred Alternative.

Under the FHWA/VDOT Preferred Alternative, approximately 507 acres of land variously designated as agricultural, residential, commercial/industrial, public, and recreation/open space would be permanently altered. Segments on new location and those that incorporate bypasses would result in greater right-of-way acquisitions and therefore more irreversible consumption of land. As part of this permanent land alteration, an estimated 265 acres of prime farmland, 56 acres of farmland of state-wide importance, 6,874 linear feet of streams, and 39.77 acres of wetlands (four of which are bridge conversions) have the potential to be affected. Although farmland properties could be developed elsewhere, these individual acres would be lost from production.

Likewise, while stream and wetland mitigation and banking could account for some of these losses, these individual distinct ecosystems could be irreversibly impacted. Wetlands and ponds in the LOD would be irretrievably lost. Some streams in the LOD would be routed through culverts, thus irreversibly impacting the hydrology and habitat they provide. Construction of the FHWA/VDOT Preferred Alternative would permanently cross some wildlife corridors and remove some habitat for plants and animals.

Gasoline and diesel fuels to power construction equipment and vehicles would be irretrievably expended during the construction of the FHWA/VDOT Preferred Alternative. In addition, labor and highway construction materials would be required. Anticipated construction materials would include, but are not limited to, aggregates, asphalt, bituminous pavement, cement, gravel, and sand. The fuels, electricity, and labor required to manufacture, transport, and apply these materials would be irretrievably lost. However, these construction materials are readily available and their use would not have an adverse effect upon the continued availability of these resources.

The construction of the FHWA/VDOT Preferred Alternative would require a substantial expenditure of fiscal resources (an estimated $448 million) to pay for the labor and materials, which would also be an irreversible and irretrievable commitment of monetary resources.

CHAPTER 4.0 | INDIRECT EFFECTS & CUMULATIVE IMPACTS

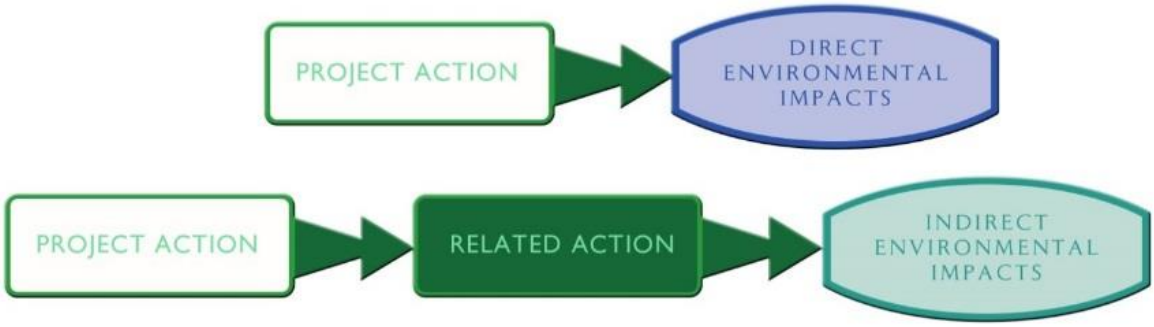
Chapter 4.0 INDIRECT EFFECTS AND CUMULATIVE IMPACTS

4.1 REGULATORY CONTEXT AND METHODOLOGY

The National Environmental Protection Act (NEPA) legislation does not mention indirect or cumulative impacts; however, the Council on Environmental Quality (CEQ) regulations for implementing NEPA address federal agency responsibilities applicable to indirect and cumulative impacts considerations, analysis, and documentation (40 CFR § 1508.25) in the content requirements for the environmental consequences section of an Environmental Impact Statement (EIS) (40 CFR § 1502.16) (Federal Highway Administration (FHWA), 2014). Indirect effects and cumulative impacts were evaluated following 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 guidance: Questions and Answers Regarding the Consideration of Indirect and Cumulative Impacts in the NEPA Process (2014); CEQ's "Considering Cumulative Effects under the National Environmental Policy Act" (1997) and CEQ's "Guidance on the Consideration of Past Actions in Cumulative Effects Analysis" (2005); and the Transportation Research Board's (TRB) National Cooperative Highway Research Program (NCHRP) Project 25-25 Task 11: Indirect and Cumulative Impact Analysis – *A review and synthesis of the requirements for indirect and cumulative impact analysis and mitigation under major environmental laws and regulations* (TRB, 2006).

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(a)). One particularly applicable category of indirect effects are those which result from induced growth and subsequent changes in the pattern of land use. Other indirect effects may include physical, biological, or socioeconomic alteration of the behavior and functioning of the affected environment that are a result of and/or lead to changes in "population density or growth rate, and related effects on air and water and other natural systems, including ecosystems" (40 CFR 1508(a)). These actions are those that may or may not occur without the implementation of the proposed project, as illustrated in **Figure 4.1-1**

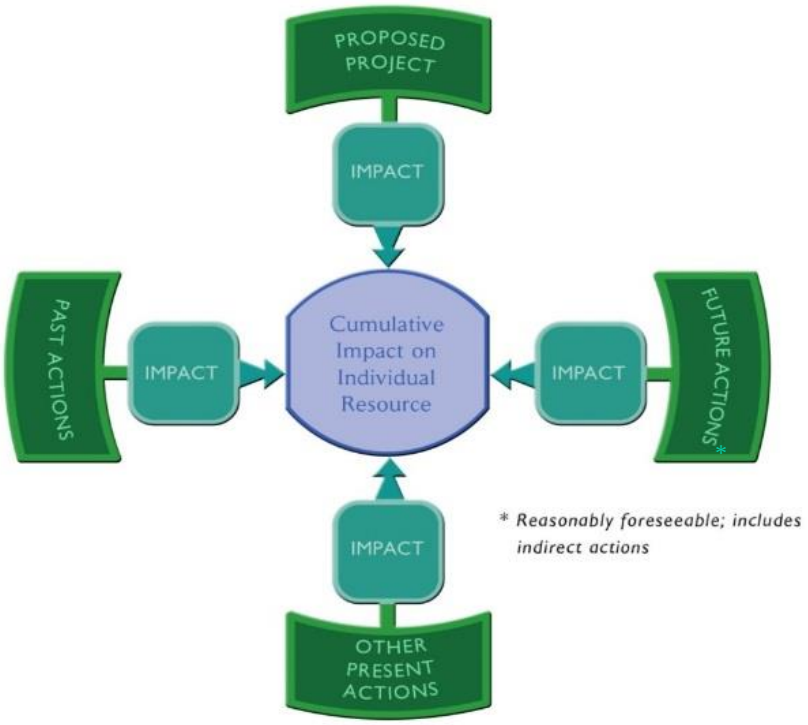
Figure 4.1-1: Direct vs. Indirect Environmental Impacts



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 impacts can result from individually minor but collectively significant actions taking place over a period of time" (40 CFR § 1508.7). Cumulative impacts 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 (Environmental Protection Agency (EPA), 1999), as illustrated in **Figure 4.1-2**.

Figure 4.1-2: Cumulative Impacts



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

Because indirect effects and cumulative impacts may be influenced by actions including those taken by others outside of the immediate study area, assumptions must be made to estimate the result of these actions. The CEQ regulation cited above states that the analysis must include all the indirect effects that are known, and make a good faith effort to explain the impacts that are not known but which are "reasonably foreseeable." NEPA does not define what constitutes "reasonably foreseeable actions." Court decisions on this topic indicate that indirect effects analyses should consider impacts that are sufficiently "likely" to occur (FHWA, 2014). CEQ has provided guidance on how to define reasonably foreseeable actions based upon court opinions. CEQ makes it clear that actions that are probable should be considered while actions that are merely possible, conceptual, or speculative in nature are not reasonably foreseeable and need not be considered in the context of cumulative impacts (CEQ, 1981, FHWA, 2015).

This direction on identifying reasonably foreseeable actions is taken into account in both the analyses described in the following sections. Specific methodologies on how these analyses were conducted are presented for indirect effects in **Section 4.2.1** and cumulative impacts in **Section 4.3.1**.

4.2 INDIRECT EFFECTS ANALYSIS

4.2.1 Methodology

This section presents an analysis of the potential indirect effects related to the FHWA/VDOT Preferred Alternative described in **Chapter 2**, **Section 2.4**. For the purposes of this analysis and for this Supplemental EIS (SEIS), the methodology followed for analyzing indirect effects are prescribed in the TRB NCHRP Report 466: *Desk Reference for Estimating the Indirect Effect of Proposed Transportation Projects* (TRB, 2002). In the NCHRP Report 466, TRB states that indirect effects can occur in three broad categories:

1) Encroachment-Alteration Impacts – Alteration of the behavior and functioning of the affected environment caused by project encroachment (physical, biological, socioeconomics) on the environment;
2) Induced Growth Impacts – Project-influenced development effects (land use); and,
3) 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).

Two types of indirect effects particularly relevant to transportation projects are induced growth and those effects to socioeconomic and natural resources that could occur as a result of induced growth.

To identify areas that may be impacted by induced growth, the North Carolina Department of Transportation's (NCDOT) Guidance for Assessing Indirect and Cumulative Impacts for Transportation Projects in North Carolina was used (NCDOT, 2001). The NCDOT guidance document recommends that such development is most often found up to one mile around a freeway interchange and two to five miles along feeder roads. The NCDOT guidance also provides additional direction for identifying factors that influence the nature and magnitude of anticipated induced growth. These conditions include:

- Extent and maturity of existing transportation infrastructure;
- Land availability and price;
- State of the regional economy;
- Area vacancy rates;
- Location attractiveness;
- Local political/regulatory conditions; and,
- Land use controls.

For the purposes of this analysis, the term "indirect effects" refers to the three categories of impacts: encroachment-alteration, induced growth, and impacts related to induced growth. When the term "induced growth" is used in this report, it is specifically referring to the one-mile radius around the three new interchanges/intersection of the FHWA/VDOT Preferred Alternative that may support such development and two to five miles along the feeder roads. These areas are discussed in **Step 6** of this analysis.

Based on these principles, the indirect effects analysis focuses on the potential for ecological and socioeconomic impacts that could occur as a result of the proposed alternatives outside of the area of direct impact, as well as the potential impacts that could result from induced land development or redevelopment

in those areas available for such changes. The stepwise process TRB recommends in NCHRP Report 466 for assessing indirect effects has been used as the structure for the analysis, and considers the following steps:

1) Scoping
2) Identify Study Area Direction and Goals
3) Inventory Notable Features in the Study Area
4) Identify Impact-Causing Activities of the Proposed Alternatives
5) Identify Indirect Effects for Analysis
6) Analyze Indirect Effects and Evaluate Analysis Results
7) Assess Consequences and Develop Mitigation

To complete these steps, the required analyses rely on planning judgment. The NCHRP 25-25 program, Task 22, *Forecasting Indirect Land Use Effects on Transportation Projects*, documents means of applying planning judgment to indirect effects and cumulative impact analyses (TRB, 2007). The direction provided in the TRB document is the basis for the indirect effects analyses on socioeconomics and land use, as well as historic properties and recreational resources. The indirect effects analysis of wetlands is built upon the wetlands functional assessment used for this study, as described in **Section 3.4.3.2.1**. The analysis of indirect effects to wetlands and other natural resources, such as streams and wildlife habitat, is also based on an understanding of the project design, the natural resources in the study area, professional experience and past scientific studies of the effects of similar projects.

4.2.2 STEP 1: SCOPING

Scoping has been underway for this study periodically since 2003. As part of the 2005 Draft EIS (DEIS), two scoping meetings were held in August 2003. These meetings were attended by 231 people. Following these meetings, two Citizen Information Meetings were held in February 2004, with a total attendance of 378. Development of the 2005 DEIS also included interviews with local officials. The 2005 DEIS, which included indirect effect and cumulative impact analyses, was made available for public review and comment in June 2005.

The Final EIS (FEIS) was approved by FHWA June 2008 for public review, and following the public review of the FEIS, FHWA issued a Record of Decision (ROD) dated September 2008. Following the publication of the ROD and prior to this SEIS, VDOT initiated procurement activities for the Route 460 project under the Public Private Transportation Act of 1995. This effort included briefings with local governments and neighborhood groups.

FHWA and USACE filed Notices of Intent (NOI) to prepare an SEIS in December 2013. Approximately 58 comments were received by FHWA and USACE on the NOIs. Specific comments addressing indirect effect and cumulative impact were received from EPA, U.S. Fish and Wildlife Service (USFWS), and Virginia Department of Forestry. The 2014 Draft SEIS, which included indirect effect and cumulative impact analyses, was made available for public review and comment in September 2014. Specific comments addressing indirect effects and cumulative impacts were received from EPA, the Chesapeake Bay Foundation, and the Southern Environmental Law Center, as well as several residents.

In addition to the outreach efforts associated with the 2005 DEIS and 2008 FEIS, scoping activities were conducted as part of this SEIS to assist in the analysis of indirect effects. This effort included meetings with localities within the project study area as presented in **Table 4.2-1**.

Table 4.2-1 Locality Coordination

Locality	Locality Representative	Meeting Date
Isle of Wight County	County Planning Staff	March, 2014
Town of Ivor	Elected Official (Mayor)	July, 2014
Prince George County	County Planning Staff	April, 2014
Southampton County	County Community Development Staff	April, 2014
City of Suffolk	City Planning Staff	April, 2014
Surry County	County Director	April, 2014
Sussex County	County Planning Staff	March, 2014
Town of Wakefield	Planning Commission	April, 2014
Town of Windsor	Town Planning Staff	April, 2014

These meetings included discussions related to indirect effects and cumulative impacts and identified any updates to the planning documents discussed under **Step 2** and highlighted the limited level of development that has occurred and/or is anticipated to occur in much of the project corridor.

As part of this scoping effort, a number of local and regional planning documents were reviewed. These include each local government's comprehensive and/or capital improvement plans, the *Hampton Roads 2034 Long Range Transportation Plan*, and the *Tri-Cities Area Year 2035 Transportation Plan*. With the exception of Surry County, which was not impacted by the alternative selected in the FHWA ROD, each locality's comprehensive plan that has been updated since approval of the FEIS assumes construction of the Build Alternative previously approved by the Commonwealth Transportation Board (CTB). Similarly, the *Hampton Roads 2034 Long Range Transportation Plan* (HRTPO, 2012a) and the *Tri-Cities Area Year 2035 Transportation Plan* (Tri-Cities Area MPO 2012) include the previous CTB-approved Build. The direction and goals set by these planning documents are described below in **Step 2**.

4.2.3 STEP 2: IDENTIFY STUDY AREA DIRECTION AND GOALS

The second step in the indirect effects analysis focuses on assembling information regarding general directions and goals within the study area established for this Final SEIS, as presented in **Chapter 3.0, Figure 3.1-1**.

4.2.3.1 Study Areas

The project study area, along with input from the scoping process outlined above, was used to inform the identification of resource-specific study areas for this indirect effects analysis. Specific indirect effect study areas were developed for each or the following resource topics:

- **Socioeconomic and Land Use:** This study area was established to analyze indirect effects to socioeconomics and land use, including environmental justice populations. This study area includes all of the census blocks that are fully or partially within the project study area as illustrated in **Figure 4.2-1**.
- **Natural Resources:** This study area was established to analyze indirect effects to wildlife; threatened and endangered species; floodplains; state wild and scenic rivers; and waters, wetlands and water quality. The study area for natural resources includes the four hydrologic unit code

(HUC)-8 subbasins that are fully or partially within the project study area. The United States is divided by the United States Geological Survey into successively smaller hydrologic units. Each hydrologic unit is identified by a unique HUC consisting of two to twelve digits based on the levels of classification in the hydrologic unit system. The HUC-8, represented by 8 digits, is referred to as a subbasin, and are depicted **Figure 4.2-2**.

- **Historic Properties:** The study area established to analyze indirect effects on above-ground architectural resources is consistent with the project study area as illustrated in **Figure 4.2-3**.
- **Recreational Resources:** The study area established to analyze indirect effects to recreational resources is consistent with the project study area as illustrated in **Figure 4.2-4**.

4.2.3.2 Direction and Goals

The direction and goals considered for the analysis are independent of the transportation alternatives being evaluated in this Final SEIS and include social, economic, and/or growth-related issues. Evidence indicates that transportation investments result in land use changes only in the presence of other factors. These factors include supportive local land use policies, local development incentives, availability of developable land, access to utilities, and a good investment climate (TRB, 2002).

An understanding of local goals combined with a thorough knowledge of demographic, economic, and social trends is essential in understanding the potential for project-influenced changes. It is also important to understand the regional goals for a consideration of potential indirect effects to the natural environment and whether potential effects are in line with local goals as a determinant of impact significance and an indicator of effects that merit further analysis. The following sections describe the existing and planned land use and population/employment trends in the socioeconomic study area, in concert with statewide water quality goals, in order to provide insight to the direction and goals for the study area.

Demographics

As discussed in the ***Socioeconomic and Land Use Technical Report*** (VDOT, 2014n) and Chapter 3 of this Final SEIS, there are over 52,000 residents within the project study area. Nearly 60 percent of the study area residents live within Isle of Wight and Prince George Counties. The City of Suffolk has the largest population of the jurisdictions within the study area at 84,585 (U.S. Census Bureau, 2010); however, only a relatively small portion of Suffolk (the Kings Fork area) is located within the study area limits. Thus, Suffolk residents account for approximately 19 percent of the study area population (U.S. Census Bureau, 2010). Prince George County, at the western terminus of the study area, has a population of 35,725; however, only approximately 32 percent of the Prince George County residents are included within the study area population (U.S. Census Bureau, 2010).

These current population figures are the result of decades-long population trends that have been occurring in the region. Isle of Wight County and the City of Suffolk have grown at a faster rate than the Commonwealth of Virginia (Virginia) over the past four decades, while Southampton County experienced a population decline. The larger communities in the study area, such as Waverly, Wakefield, and Windsor, have declined in population and employment due to the loss of agricultural and timber jobs. Smaller communities, such as Disputanta, Ivor, and Zuni, have had a similar decline and continue to remain almost entirely residential. The King's Fork area in the City of Suffolk experienced a substantial increase in residential development in the late 1990s, consistent with the overall growth in the City of Suffolk (VDOT, 2005a).

With almost 17,000 residents, persons between the ages of 45 and 64 comprise the largest percentage (32 percent) of the study area population. The proportion of persons between the ages of 45 and 64 is slightly higher than that of Virginia, which is approximately 27 percent. Persons under the age of 18 are the second largest group, representing approximately 22 percent of the study area. Age distribution within each jurisdiction of the study area is similar to the overall distribution for Virginia as a whole. This indicates that there are no unique concentrations of children or elderly in any particular jurisdiction (VDOT, 2014n).

White is the largest racial group for Isle of Wight, Prince George, Southampton, and Surry Counties, as well as for the City of Suffolk. Black/African American is the largest racial group in Sussex County. Hispanic or Latino persons comprise three percent of the study area population, and Asians one percent (VDOT, 2014n).

Land Use Patterns and Local Plans

Historic Land Use

A review of historical resources and aerial photography, maintained in VDOT's Location and Design aerial survey repository, was performed to assess land use trends in the vicinity of the study area over a relatively long period of time. Aerial photographs were selected from 1937 and 1954 because they are known to represent the highest quality aerial imagery from the years prior to 1970. This aerial imagery is included in **Appendix F – Historic Aerial Photography.** Google Earth imagery from 1994 and 2014 was also reviewed to gauge more recent changes in land use and development. Historic aerial photographs that would represent the landscape prior to the construction of Route 460, which was completed in 1928, are not available; however, the aerial photography from 1937 provides a glimpse into the development patterns that would have already been underway due to the presence of railroads and the newly constructed Route 460.

The historical timeframe of this land use analysis is approximately four hundred years to the present, beginning with Euro-American occupation in southeastern Virginia, which has altered the landscape and with it the ecosytem that exists there. All of the old-growth forests encountered by the early colonists were removed through historic timbering and land development. These forests were replaced by a patchwork of fields, forests, scrub, and pasture. In the mid-1700s, the population of eastern Virginia expanded to the south and west, a growth that was fueled by farmers seeking better environments for their tobacco crops. Agriculture expanded and diversified through the 18th and 19th centuries, leading to the continued conversion of forest land to crop land.

Development in the region was further enhanced through the construction of the railroad. The Norfolk and Petersburg Railroad, which is nearly coterminous with the present Route 460 from New Bohemia to Windsor, was completed in 1858. The towns along the Norfolk and Petersburg Railroad were established at depot stations. Thus the early development of the towns of Disputanta, Waverly, Wakefield, Ivor, and Windsor was spurred by the presence of the railroad. Following the Norfolk and Petersburg Railroad's destruction during the Civil War, the railroad was rebuilt and new railroads were laid, connecting the City of Norfolk to the Mississippi Valley.

Construction of the railroad also spurred the lumber industry, which led to more land clearing, the growth of saw mills, and increased demands for goods and services. During the late 19th century, small railways began to operate in the vicinity of the study area. These railways were built to move lumber from the forests to the mill yards. Large lumber operations existed in the study area to take advantage of the demand for

timber and many towns in and around the study area owed their success to the railroad, peanut farming, and the lumber industry. The construction of Route 460, funded largely through a Work Projects Administration grant, in 1928, contributed to the continued growth in the early 20th century. Historic VDOT aerial photography from 1937 confirms that the lumber industry had dramatically altered the previously forested landscape; the photographs depict an environment that is a patchwork of farms surrounded by scrub and wetlands with little forest cover and substantial amounts of open space.

Agriculture was the continuing focus of many counties in the region; in the 1940s, over 1,200 farms were in operation and peanuts, corn, potatoes, tobacco, cattle, hogs, and chickens were listed as common products. On the other hand, a comparison of aerial photography from 1937 to 1954 indicates that the lumber industry was in decline; images from 1954 indicate that agricultural tracts remained mostly intact, while forest cover was reestablished on much of the open space. One exception to this decline is in the Waverly area of Sussex County, where growth continued following World War II, tied in part to local lumber companies and a fiberboard plant in 1956. From 1937 to 1954, several instances can be observed where the acreage of farm tracts appeared to decrease slightly, particularly in the western half of the study area from Petersburg to Windsor. In general the boundaries of tracts also became more defined, which may be a result of technological advances in farm equipment. In contrast, in the eastern half of the study area, from Windsor to Suffolk, agricultural areas appear to grow and become more connected with new cultivated areas filling in where there was previously open space. Aerial images also indicate that the presence of wetlands and waterways decreased from 1937 to 1954, possibly due to land reclamation efforts to create new farmlands in the vicinity of the City of Suffolk.

After World War II, the expansion of industry led to the construction of businesses and homes in and around the towns in the study area. Aerial photography from 1937 indicates that residential and commercial development prior to 1937 closely aligned with Route 460 and the Norfolk and Petersburg (Norfolk Southern) rail line; likewise, aerials from 1954 indicate any additional residential and commercial development occurred close to the existing town centers. Some instances of expansion of residential development north and south of Route 460 can be observed along major thoroughfares; this is particularly observed along roadways branching north and south of Windsor and south toward Suffolk. In the rest of the region, agriculture continued as the predominant land use.

Historical resources indicate that throughout the mid-20th century commercial forestry was still a leading industry along with the continued importance of agriculture. Agriculture in the region declined in the 1990s, with some crop farms shifting to beef cattle farming.

Review of more recent aerial photography shows some development activities between 1994 and 2014. In the western half of the study area, expanding low density residential development has been observed in New Bohemia, Disputanta, and Wakefield, as well as a new golf course west of Disputanta, Sussex I and Sussex II State Prisons, and a landfill between Disputanta and Waverly. Waverly's town center expanded and medium density housing was constructed on converted farmland. Southampton County experienced some land clearing for the expansion of residential development of single family homes, particularly along roadways spreading from Ivor and Zuni, such as Routes 460, 614, 616, 618, 622, 635, 638, 644, 645, and 649; some additional commercial development occurred on Route 460 in Ivor and Zuni as well.

Moving eastward, the Town of Windsor and the outskirts of Suffolk underwent the most noticeable changes with significant infill and more intensive land development. These growth trends are consistent with population figures discussed in the **Demographics** section above that indicate population growth in Isle of

Wight County and the City of Suffolk's King's Fork area. The conversion of farmland to large subdivisions can be observed north of Windsor off of Route 640 and in the northwest quadrant of Suffolk off of Route 634. Expanded commercial and industrial development in Windsor from 1994 to 2014 included a new storage facility and rehabilitation center; two new shopping centers; a bank; a new commerce park (Shirley T. Holland Intermodal Park), which includes the new Green Mountain Keurig manufacturing center, Cost Plus World Market Virginia Distribution Center, and a Safco Products Company's distribution facility; and the expansion of the Commonwealth Gin (cotton company). Other improvements include a new middle school and substantial improvements to the high school.

From 1994 to 2014, expanded agricultural operations northwest of Suffolk are observed by the presence of large greenhouses and new orchard operations at the Pitchkettle Road Farm. A new clay extraction operation on Route 460 north of the intersection with Old Myrtle Road was established during this period. Commercial development, typically through the conversion of farmland or clearing of trees, can be observed along Route 460 and in the King's Fork area, including several shopping centers, a funeral home, a large storage facility, hotels, and banks. Improvements to institutional and recreational resources are evidenced by new or improved facilities at the Suffolk Youth Athletics Association, the YMCA, Nansemond Suffolk Academy, Rivers Bend Academy, King's Fork High School, and King's Fork Middle School. A new 168-bed, full service hospital (Sentara Obici Hospital) was also constructed on Godwin Boulevard (Route 10) approximately one mile from Route 460.

The review of historic documentation and aerial photographs clearly illustrates that more intensive development and infill have occurred in the eastern half of the study area, particularly in Windsor and Suffolk. West of Windsor, however, the presence of Route 460 has not resulted in conversion of agricultural land or forested land to more intensive land uses, such as suburban-style shopping centers, office parks, or residential subdivisions. Additional factors in the City of Suffolk, and by proximity, in the Town of Windsor, such as development-friendly policies and access to other major transportation infrastructure (highways, rail, and ports) and a growing population, likely contributed more to growth trends and land use changes in Windsor and Suffolk than the presence of Route 460.

Current Land Use Plans

Land use information was compiled from U.S. Census data, U.S. Geological Society land coverage, historic aerial photographs, and local comprehensive plans. General descriptions of the development in the study area are based on compiled land use information and field visits. At the northwest end is Prince George County, near the cities of Hopewell, Petersburg, and Richmond. Isle of Wight County and the City of Suffolk are part of the Hampton Roads metropolitan area, lying at the southeast end of the study area. Four incorporated towns and three unincorporated towns also are within the study area. The majority of the land is devoted to agriculture, with some commercial and industrial development along the main highways. Land use planning is an ongoing and continuous activity of local government. The land use and development goals for the localities are guided by the principles set forth in the respective comprehensive planning documents for each locality within the project study area. Using the land use plans for each locality, a Consolidated Land Use Map for the study area was developed (**Figure 4.2-5**) that breaks down the land use as follows:

- Residential
- Commercial/Industrial
- Agricultural/Rural

- Conservation Areas/Natural Resources
- Other (includes areas that are mixed use or are not classified as one of the above categories)

A detailed description of each plan can be found in the ***Socioeconomic and Land Use Technical Report*** (VDOT, 2014n). The updated plans for the City of Suffolk and Prince George County are discussed in Chapter 3 of this Final SEIS. Meetings held as part of this SEIS with the local jurisdictions identified above in **Step 1** indicated that most of the localities have included the construction of the alternative selected by FHWA in 2008 (Draft SEIS Alternative 1) in their planning efforts. These planning efforts, as they relate to land use and transportation, are described below.

Locality Utility Planning

A key factor in dictating future growth is the placement of utilities. Currently there are 11 public utility providers in the study area.[1] Although service is not provided consistently throughout the study area, the comprehensive plans described in the section below identify plans for utility expansion. The location of some of these future utility developments is based on the previously approved Route 460 alignment. Changes in the alignment as proposed could result in changes to future utility plans.

Prince George County 2014 Comprehensive Plan Update, Prince George County

Adopted on December 9, 2014, the Prince George County comprehensive plan seeks to preserve existing agricultural and environmental resources while effectively accommodating development and pressure for growth from nearby Petersburg, Hopewell, and Richmond. The plan indicates that the county will continue to monitor on-going developments related to the Route 460 project, especially for the western terminus area and the proposed interchange at Route 156 in the vicinity of the J.E.J. Moore Middle School; however, the plan references the Draft SEIS Alternative 1 alignment.

As identified on Prince George County's *2014 Comprehensive Plan Future Land Use Map*, the eastern portion of the County seeks to remain agricultural; future residential development of this land is not encouraged. Residential land is encouraged to be concentrated on the north and northwest sections of the county, east of Hopewell and Petersburg. Land east of the I-295/Route 460 interchange is planned for industrial use; including plans for a Virginia Enterprise Zone, providing special incentives for future development. Surrounding the Disputanta community, land is zoned for neighborhood commercial use. Neighborhood commercial refers to the locality designation for small-scale retail and service establishments located in and around residential neighborhoods intended to serve the local residential population without disrupting the residential neighborhood fabric of the surrounding area.

2004-2005 Comprehensive Plan Update, Sussex County

Adopted in October 2005, this plan documents a desire to maintain the rural character of Sussex County, concentrating commercial and industrial development along the existing Route 460, the route prescribed in the Modified CBA-1 alignment selected by CTB and approved by FHWA in 2008, and the Interstate 95 (I-95)/Route 301 corridors.

In general, Sussex County's future land use plan identifies six land use types. The agricultural land use designation, which is the largest land use, is restricted to farming, conservation, and passive recreation.

[1] City of Norfolk, City of Virginia Beach, City of Suffolk, Western Tidewater Water Authority, Isle of Wight County, Town of Windsor, Town of Ivor, Town of Wakefield, Town of Waverly, Prince George County, Sussex Service Authority

Areas designated for residential use have been limited to areas within incorporated towns. Future commercial and industrial development is anticipated with the extension of public water and sewer utilities along existing Route 460 from the Coppahaunk Swamp area, southwest through Wakefield, and continuing to the Southampton County line. Additionally commercial growth is expected along the western side of existing Route 460 and at the intersection of State Route 602/existing Route 460. Prime industrial sites are to be located where they can be served by major transportation facilities, such as existing Route 460 and as such, land along both sides of existing Route 460 is designated for future industrial growth, from the intersection of State Route 602/Route 460 to the Town of Waverly and again from the intersection of State Route 604 (Owens Grove Road)/Route 460 to the Town of Wakefield,

Surry County Comprehensive Plan Update, Surry County

In addition to the *Surry County Land Development Plan*, this comprehensive plan controls and directs growth to adhere to the community's goals of achieving balanced land use, protecting productive agricultural and timber land, supporting and instituting community facility and service programs, and fostering a favorable climate for economic development. The County's supplemental Zoning Ordinance (January, 2013) identifies the specific land uses allowed for portions of the jurisdiction. Interviews by VDOT representatives with Surry County staff in April 2014, followed by a letter from the County Administrator, indicated that the County seeks to focus development around the towns and along existing major roads such as Route 10 (Surry County, 2014).

According to the Surry County Comprehensive Plan Update, future development will allow the growth of commercial, industrial, and residential zones to broaden the tax base and increase local employment opportunities, as long as such growth occurs in a way that preserves the agricultural and forestal land uses. Intensive land uses will be confined to areas where the efficiency of transportation systems, utility service, and community facilities will be maximized. Surry County has available improved industrial development sites on Route 10 with access to Routes 31 and 40. Outside of the towns of Surry, Dendron, and Bacon's Castle, Surry County is primarily designated for agriculture and forestry.

Vision 2025: The Southampton Comprehensive Plan, Southampton County

Adopted June 2015, Southampton's comprehensive plan identifies the predominant activity centers within the county and primarily directs residential, industrial, and business growth opportunities to the areas of Ivor, Courtland, and Boykins-Branchville-Newsoms.

Southampton County's primary goals regarding future development include maintaining the agricultural land base that helps influence the rural quality of life, providing quality educational services, expanding economic opportunities, and preserving the natural environment. The incorporated town of Ivor, located within the study area, is expected to serve as a hub for future activities in the study area portion of Southampton County. In this area land adjacent to the Route 460 corridor is primarily designated for future single-family residential use, with the exception of the western-most portion, which has been designated as industrial land. Small pockets of land designated as industrial stretch from the main western-most industrial land portion along the narrow strip of Route 460 east into, and almost completely through, the Town of Ivor. Within Ivor, land use is designated as industrial, open space, commercial, residential, and institutional with a majority of the land designated as open space. East of Ivor, land is designated as commercial, low density residential, and institutional.

Comprehensive Plan, Isle of Wight County

Updated in 2008, Isle of Wight County's comprehensive plan informs decisions regarding the character of the county, establishing preservation policies for agricultural and rural areas and encouraging growth within three separate Development Service Districts (DSDs) at Smithfield, Windsor, and Camptown (east of Franklin). Each of these locations generally correspond with the location of the major county transportation corridors and existing or planned future Hampton Roads Sanitation District sewer and water service areas. Areas designated DSDs generally have served and are expected to continue to serve as the principal residential, commercial, and employment centers of the county. These areas comprise the most suitable locations for future growth and development. Growth in and around these areas should serve to inhibit sprawl of development into other county areas, and concentrate future residential growth in areas where residents can be economically provided with utilities, services, and employment (Isle of Wight Planning Commission, 2008). To provide for an increasing population, while also protecting the rural integrity of the county, Isle of Wight County has developed a "constrained growth" strategy.

Comprehensive Plan for 2035, City of Suffolk

Adopted in 2015, this plan identifies the land use goals of the City of Suffolk, establishing zoning allowances that concentrate growth to the urban core surrounding the intersection of Route 13 and Route 32. Suburban land use designations are shown along the existing Route 460 corridor in the project study area.

The City of Suffolk's 2035 Comprehensive Plan is based on six overall plan themes, which include: balanced growth and development; vibrant core areas; preserved and enhanced character; enhanced economic diversity and vitality; environmental protection; and responsible regionalism. Suffolk has designated two areas as Suburban/Urban Growth Areas: one in the north and the other in the center of the City. The northern growth area is focused around major transportation routes and the central growth area is focused around the historic city core. The primary role of these growth areas is to accommodate development and provide a focus for future development, limiting sprawl pressures in the southern areas of the City. Rural agricultural conservation districts are located predominantly in the south and northwest quadrants of the City to maintain significant areas of the City for continued agricultural use. The City of Suffolk Plan notes that improvements to Route 460 are being evaluated and may include construction of a new facility in Suffolk.

Future Land Use Plans

Based on a review of the available comprehensive plans and locality land use designations for each community within the study area, planned areas for future development were identified. Along existing Route 460 where the FHWA/VDOT Preferred Alternative is proposed to be implemented, two growth areas have been designated, as illustrated in **Figure 4.2-6**.

The Isle of Wight County Comprehensive Plan (County of Isle of Wight, 2008) identified the Windsor DSD, where development is encouraged. Included within this area are planned industrial developments, comprised of the three phases (the first of which, located between Route 460 and Route 636, is completed) of the Shirley T. Holland Intermodal Park and the Norfolk Southern Property. The 2008 Isle of Wight County Comprehensive Plan stated the following: "The Windsor DSD is also targeted for future growth. Within much of this district, sewer and water facilities have been extended to accommodate growth, [and]…sewer availability together with adequate transportation service capacity via State Route 460 suggest some level of development activity can be expected in this area. Areas along the [existing] Route 460 corridor and Norfolk and Southern rail line have strong potential for future industrial development.

The Shirley T. Holland Commerce Park, located east of the Town, has been established as one such location for business development."

The City of Suffolk also identified an area at the eastern end of the corridor where development is encouraged – the Central Growth Area.

Portions of the areas designated for potential future growth have historically been developed, as described in preceding discussions in **Section 4.2.3**. In order to identify where additional development could potentially occur, based on the areas identified for development, these locations have been compared to existing land cover data showing current development. As shown in **Table 4.2-2**, of the 10,399 acres within the Windsor DSD, approximately 9,386 acres are available for potential future development. Similarly, of the 6,546 acres of the portion of Suffolk's Central Growth Area within the baseline area, approximately 4,819 acres are available for potential future development. Future development that may occur within these designated areas would be required to obtain any applicable federal, state, and local approvals, prior to proceeding.

Table 4.2-2: Land Acreage within Designated Growth Area

Designated Growth Area	Total Land Acreage Within the Designated Growth Area	Developed Land	Land Available for Development
Windsor DSD	10,399 acres	1,013 acres	9,386 acres
Suffolk's Central Growth Area	6,546 acres	1,727 acres	4,819 acres
Total	16,945 acres	2,740 acres	14,205 acres

Virginia's Goals for Water Quality in the Study Area

Virginia Department of Environmental Quality (VDEQ) has responsibility for monitoring water quality in the state's waters, identifying impairments and sources of impairments, and developing and implementing Total Maximum Daily Load (TMDL) reports for those impaired waters (VDEQ 2014d). TMDLs are the allowable loadings or loading strategies for waterbodies classified as water quality limited. A TMDL Report is a special study to determine the amount of a pollutant that the impaired water can assimilate and still meet water quality standards. Additionally, the TMDL report will identify all sources of pollution contributing to the violation of water quality standards and calculate the pollutant amount entering the stream from each source and calculate reductions in pollutant loads needed for attainment of Water Quality Standards. The TMDL process is a mechanism for integrating the estimates of point and nonpoint source loads contributing to the impairment of the waterbody.

The goal of the efforts driven by TMDL reporting is to restore watersheds and their aquatic ecosystems to support economic and recreational activities and human health, and provide healthy habitats for fish, plants, and wildlife. VDEQ uses Water Quality Management Plans (WQMPs), required by section 303(e) of the Clean Water Act, as the link between the water quality assessment requirements and water quality based controls. These plans recommend control measures for the water quality problems identified and characterized in the 305(b) report (VDEQ 2014d). The desired outputs are calculations of the reductions of nitrogen, phosphorus, sediment, bacteria, and toxins (where applicable) from point and nonpoint sources as necessary to improve water quality. Control measures recommended in the plans are implemented through the Virginia Pollutant Discharge Elimination System (VPDES) for point sources and through the application of Best Management Practices (BMPs) for nonpoint sources. WQMPs establish the strategy

for returning impaired waters to meeting water quality standards and for preventing the degradation of high quality waters.

There are TMDLs currently developed for some of the study area's impaired waterbodies, and other TMDLs are currently under development for a number of the others; however, many of the impairments are caused by natural causes for which TMDLs are not required, such as animal waste (from birds or other wildlife) or low dissolved oxygen (from high water temperatures or high biological oxygen demand). Overall, as TMDLs are developed and implemented in some of the study area watersheds, it is expected that water quality will improve in those watersheds. TMDLs for the project area are discussed in **Section 4.2.7.2**.

Direction and Goals - Conclusion

Overall land use within the study area is primarily rural in nature and existing development is concentrated along Route 460. Based on review of the comprehensive plans described above, the direction and goals for land use within the study area are balanced between maintaining and preserving existing agricultural and forested land uses with an emphasis on retaining a rural character, limiting sprawl, and preserving the natural environment. At the same time, local goals and plans encourage economic opportunities and revitalization of core areas that are already developed.

4.2.4 STEP 3: INVENTORY NOTABLE FEATURES IN THE STUDY AREA

Notable features are the specific features that are sensitive and/or unique and may be less able to bear impacts from a transportation project. Notable features for this study that were considered to be particularly relevant for the analysis of impacts from a transportation project include socioeconomics and land use, including environmental justice; natural resources including natural communities, wildlife, and biodiversity, threatened and endangered species, floodplains, state wild and scenic rivers, waters, wetlands, and water quality; historical properties; and recreational resources. The resources associated with each notable feature category are the same as those analyzed in Chapter 3. The following sections discuss the notable features that have been identified as part of this study.

4.2.4.1 Socioeconomics and Land Use

The Route 460 study area lies between two urban areas, although the majority of the study area is rural (see **Figure 4.2-5**). Residential land uses are found within and surrounding the towns or developed areas. In general, there is more widespread development near the project termini and in the vicinity of the towns located along the existing Route 460 corridor. Seven communities are located along Route 460 – Disputanta, Waverly, Wakefield, Ivor, Zuni, Windsor, and the City of Suffolk. Along Route 460 motorists are able to access residences and business on either side of the road. Further removed from the Route 460 corridor, farm equipment and vehicles utilize rural roads and private drives to reach portions of adjacent agricultural property.

As noted in the ***Socioeconomic and Land Use Technical Report*** (VDOT, 2014n) and **Chapter 3** of this SEIS, minority populations have been identified within 685 census blocks within the study area (see **Figure 4.2-7**). None of the census block groups within or adjacent to the study area have a median household income below the United States Department of Health and Human Services poverty threshold. Thus, no low-income populations have been identified within the socioeconomic indirect effects and cumulative impact study area. The land uses and the socioeconomics of the study area are identified as notable features since the development of vacant land, or conversion of the built environment to more intensive uses, is often a consequence of highway projects.

4.2.4.2 Natural Resources

Waters, Wetlands and Water Quality

Subbasins form the basis of the natural resources analysis in the SEIS and are considered notable features for their value as habitat and water supply, as well as for their capacity to recover and adapt when water quality may be already impaired. Two major river basins are located in the indirect effect study area, the James and the Chowan/Dismal Swamp. The eastern and northwestern portions of the study area are contained within the James River Basin. Portions of the study area lie within the James River Basin in the Lower James Hydrologic Unit (HUC 02080206) and Hampton Roads Hydrologic Unit (HUC 02080208). The central and southwestern portions of the study area are contained within the Albemarle-Chowan Basin. These portions of the study area fall within the Nottoway River Hydrologic Unit (HUC 03010201) and the Blackwater River Hydrologic Unit (HUC 03010202). These four 8-digit hydrologic units make up the natural resource study area considered for the analysis of indirect effects and cumulative impacts. The natural resource study area for indirect effects and cumulative impacts contains a large number of named and unnamed perennial and intermittent streams. Of these, the Blackwater River is the most prominent and longest stream course. The major surface water impoundments of Lake Burnt Mills, Lake Prince, Western Branch Reservoir, Lake Cohoon, and Lake Meade are located in the easternmost portion of the study area. These are all water supply reservoirs. Water flows from the proposed Route 460 improvements to the reservoirs, which are downstream of the project.

Wetlands belong principally to the Palustrine system based upon National Wetland Inventory (NWI) mapping. These are non-tidal wetlands and have been broadly classified within the study area into three major categories: Palustrine Emergent Wetlands (PEM), Palustrine Scrub-Shrub Wetlands (PSS), and Palustrine Forested (PFO). It is estimated that 4,662 acres of PEM wetlands, 8,794 acres of PSS wetlands, and 191,319 acres of PFO wetlands exist within the study area; the boundaries of the area and general locations of which are illustrated in **Figure 4.2-2**.

For the area in the vicinity of the build section of the FHWA/VDOT Preferred Alternative wetlands were delineated and were assessed for their functional value. These wetlands can generally be divided into three subclasses based on geomorphic setting, water sources, and hydrodynamics: bottomland hardwood forests, bald cypress/tupelo swamps, and wet flatwoods. Following is a brief description of each wetland subclass.

Bottomland Hardwood Forest

Bottomland hardwood forests within the study area can generally be described as hardwood dominated forests located in floodplains and river terraces. These communities may be classified under the Cowardin wetland classification system as palustrine forested with non-tidal wetland regimes that vary from semi-permanently flooded, to intermittently exposed, permanently flooded, saturated, intermittently flooded, or temporarily flooded (Cowardin et al., 1979). Further classification describes these systems in a geomorphic context as low-gradient alluvial wetlands (Brinson, 1993). The Natural Communities of Virginia: Classification of Ecological Community Groups (Fleming et al., 2001) categorizes such wetlands as Coastal Plain/Piedmont bottomland/floodplain forests represented by wetlands not dominated by bald cypress (*Taxodium distichum*) or tupelos (*Nyssa* spp.).

Wetland hydrodynamics are dominated by unidirectional flow where flow velocities correspond with low-gradient landforms. Singular or multiple inflow points can be present while outlets are generally unobstructed, and typically convey surface hydrology to downstream resources. Lateral migration is present in periods when groundwater discharge or precipitation events exceed soil permeability.

Chemically reduced soil matrices generally display strong redoximorphic features including concentrations, depletions, and other features indicating chemical reduction and oxidation of iron and manganese compounds.

The canopy, scrub shrub, herbaceous, and vine stratums of the bottomland hardwood forests are composed of numerous species. For a full description of the vegetation composition and the characteristics of other terrestrial resources, see **Chapter 3.0, Section 3.4.**

Bald Cypress/Tupelo Swamps

Bald cypress/tupelo swamps within the study area are associated with inundated forested areas typically located along watercourses. These communities may be classified under the Cowardin wetland classification system as palustrine forested with non-tidal wetland regimes that vary from semi-permanently flooded, to intermittently exposed, or permanently flooded (Cowardin et al., 1979). Further classification describes these systems in a geomorphic context as low-gradient alluvial wetlands (Brinson, 1993). The Natural Communities of Virginia: Classification of Ecological Community Groups (Fleming et al., 2001) categorizes such wetlands as bald cypress/tupelo swamps represented by wetlands dominated by bald cypress and tupelos. Wetland hydrodynamics are similar to bottomland hardwood forests within the study area.

The canopy and herbaceous stratums of the bald cypress/tupelo swamps are composed of numerous species. For a full description of the vegetation composition and the characteristics of other terrestrial resources, see **Chapter 3.0, Section 3.4.**

Wet Flatwoods

Wet flatwoods communities within the study area were historically mixed hardwood communities that, through anthropogenic disturbance, have been mostly converted to silvicultural and agricultural use. The wet flatwoods communities within the study area consist mostly of crop fields, pastures, loblolly pine plantations, and early to mid-successional pine-hardwood communities. These communities may be classified under the Cowardin wetland classification system as palustrine forested with non-tidal wetland regimes that vary from saturated, intermittently flooded, to temporarily flooded (Cowardin et al., 1979). Further classification describes these systems in a geomorphic context as low-gradient non-alluvial wetlands (Brinson, 1993). The Natural Communities of Virginia: Classification of Ecological Community Groups (Fleming et al., 2001) categorizes such wetlands as Non-Riverine Flatwoods and Swamps.

Wetland hydrodynamics are generally fed by precipitation with water loss through evapotranspiration, with some retention of floodwaters within depressions. Wet flatwoods generally lack inlets, while outlets, when present, are generally intermittent or restricted. Lateral migration is present in periods when groundwater discharge/precipitation events exceed soil permeability, although this duration is decreased in higher slope gradients. Chemically reduced soil matrices with strong redoximorphic features provide evidence that there is seasonal vertical fluctuation of the water table.

The vegetation within wet flatwoods varies depending upon whether the communities are under active or historic silviculture, how recently it has been logged, dominance of pine, and to what degree the understory has been manipulated. For a full description of the vegetation composition and the characteristics of other terrestrial resources, see **Chapter 3.0, Section 3.4.**

Wetland Functions

Wetland functions are self-sustaining properties of a wetland ecosystem that exist in the absence of society without regard to subjective human values (USACE, 1999). Wetlands within the study area serve a variety of functions that benefit the wetland and the wetland's watershed. These include, but are not limited to, habitat for fish, wildlife, and plants; improving water quality and hydrology; flood protection; protecting shorelines and stream banks from erosion; economic benefit; and recreation, education, and research (EPA, 2016). A description of the functional assessments performed on the wetlands being directly impacted, as well as the resulting information regarding the functions served, is described in **Chapter 3.0, Section 3.4.**

Surface Waters

Some surface waters in the study area fail to meet water quality standards and are designated as "impaired waters" under Section 303(d) of the Clean Water Act. **Chapter 3.0, Section 3.4** lists streams and other surface waters within the study area presently included on the Virginia 303(d) Priority List of Impaired Waters. Types of impairment are largely due to bacteria, including E. coli, mercury in fish tissue, benthics, and dissolved oxygen. The major suspected sources of the impairments are nonpoint sources, including sediment laden runoff, wildlife, agriculture, livestock grazing or feeding operations, atmospheric deposition, natural conditions, municipal point source discharges, unspecified domestic waste, and unknown sources.

These issues are discussed in greater detail in the ***Natural Resources Technical Report*** (VDOT, 2014i) and the ***Supplemental Natural Resources Technical Report*** (VDOT, 2016f).

Floodplains

Based on the Federal Emergency Management Agency's (FEMA) Flood Insurance Rate Maps (FIRM), 100-year floodplains are located within the study area and are considered to be notable features due to their value in natural flood mitigation. FEMA-regulated floodways within the study area occur along the Blackwater River, Bailey Creek, Blackwater Swamp, Chappell Creek, Manchester Run, Powell Creek, Walls Run, and Wards Creek. These floodways have experienced a relatively low level of development compared to other floodplains in more developed parts of Hampton Roads and Richmond. It is estimated that 405,764 acres of 100-year floodplains and 25,123 acres of 500-year floodplains exist within the indirect effect and cumulative impact study area. These figures were derived by estimating the area of total floodplain within the indirect effect and cumulative impact natural resources study area using GIS.

State Wild and Scenic Rivers

No federally designated Wild and Scenic Rivers are present within Virginia. However, a portion of the Blackwater River in Isle of Wight and Southampton Counties and the Cities of Franklin and Suffolk, from Proctor's Bridge at Route 621 to its confluence with the Nottoway River at the North Carolina line, a distance of approximately 56 miles, was designated as a component of the Virginia Scenic Rivers System in 2010 (Code of Virginia § 10.1-418.6). DCR's evaluation involved a map survey, a related literature review and a field study to validate existing land use information and rank the river according to the relative uniqueness or quality. The DCR recommended designation of this segment of river due to its interesting views and aesthetic features including islands, and earthen bluffs, as well as its meandering alignment adjacent to variations in terrain and vegetation with few man-made features (DCR, 2009a).

Natural Communities, Wildlife, and Biodiversity

Portions of the study area have experienced noticeable alterations over the past several hundred years due primarily to human activity. Growth and development along the railroad and Route 460 and other major

thoroughfares have encroached on the various terrestrial and wetland wildlife habitats found in the study area; however, some remain relatively unaltered, particularly in wetter areas (e.g., swamps) and forests, and are identified as notable features for their valued environmental importance in support of the region's diverse ecosystems.

Three main terrestrial forest types have been identified in the study area: 1) deciduous forest, 2) evergreen forest, and 3) mixed evergreen/deciduous forest (NOAA, 2010a). Terrestrial forest types comprise approximately 51 percent of the study area (or 242,414 acres out of the 477,058-acre study area). Of this forested total, 25 percent (59,983 acres) is deciduous forest, 36 percent (88,475 acres) is evergreen forest, and 39 percent (93,956 acres) is mixed evergreen/deciduous forest.

Approximately 126,276 acres of agricultural lands are located in the study area. Wildlife habitat associated with agricultural lands is comparatively limited due to the lack of plant diversity and the relatively high frequency of disturbance (i.e., plowing, planting, fertilizing, grazing, and routine maintenance). Despite these factors, agricultural lands are used by wildlife on a limited basis, with the species composition often depending on the type of crop being cultivated, the time of year, and the methods of harvesting.

The boundary between active agricultural fields and adjacent habitats often creates "edge" habitat or edges. Edges are areas where two habitat types meet, such as an agricultural field and a forest. Edges are unique because they combine some of the characteristics of two or more habitats. Edges are inhabited by some of the animals and plants that are characteristic of each adjacent habitat, plus species that are specially adapted to live in edges.

Approximately 63,361 acres of brush and old fields are located within the study area. Abandoned pastures and agricultural fields can provide excellent wildlife habitat. These areas contain an interspersion of plant communities, which is beneficial to many species.

The habitat diversity within the Route 460 study area varies greatly. It includes a patchwork of riparian corridors, farm fields, abandoned fields, pastureland, and various forest types. This variety in habitats contributes to a relatively rich assemblage of plants and animals in the study area. Biodiversity tends to be greater in areas with larger landscape diversity and edge habitat

There are four areas within the study area that have been designated as Natural Area Preserves because they contain rare and unique communities, which provide habitat for rare species – Dendron Swamp, Blackwater Ecological Preserve, Antioch Pines, and Blackwater Sandhills (DCR, 2014a). Established in the late 1980's, the Virginia Natural Area Preserve System protects designated properties with legally binding restrictions on future activities on those properties. Other rare or unique terrestrial communities that occur within the study area are presented in **Chapter 3.0, Table 3.4-6**. Several of these rare and unique communities are located along identified wildlife corridors. These wildlife corridors, shown in **Chapter 3.0, Figure 3.4-12**, provide linkages between isolated areas of natural habitat allowing for wildlife migration.

The study area contains a variety of aquatic habitats including Coastal Plain streams, stream swamp systems, ponds, and rivers. These varied aquatic habitats contain a wide diversity of fish species. Based on a review of the Virginia Department of Game and Inland Fisheries' (DGIF) Fish and Wildlife Information Service (VAFWIS) (DGIF, 2014a), 99 species are known or have the potential to occur in the study area (see the ***Supplemental Natural Resources Technical Report*** (2016f)). Members of the sunfish

(*Lepomis* spp.), darter (*Percina* spp. and *Etheostoma* spp.), dace *(Rhinichthys* spp. and *Clinostomus* spp.), minnow (*Pimephales* spp. and *Hybognathus* spp.), and shiner (*Notropis* spp., *Notemigonus* spp., *Cyprinella* spp., and *Luxilus* spp.) families have been recorded. Game species such as largemouth bass (*Micropterus salmoides*), smallmouth bass (*Micropterus dolomieu*), and bluegill (*Lepomis macrochirus*) have been documented (DGIF 2014a). Other recreationally important fish species found in the study area include channel catfish (*Ictalurus punctatus*), bowfin (*Amia calva*), yellow perch (*Perca flavescens*), and chain pickerel (*Esox niger*). All fisheries in the study area are warm water fisheries.

Benthic macroinvertebrates are common inhabitants of streams and ponds within the study area. These organisms usually inhabit bottom substrates for at least part of their life cycle. Macroinvertebrates commonly found include arthropods, annelids, crustaceans, and mollusks.

Waterways, water bodies, wetlands, and riparian zones within the study area provide suitable habitat for a number of migratory bird species, reptiles, amphibians, and mammals that utilize aquatic habitats, and can provide a travel corridor within and between watersheds. A detailed analysis of aquatic habitats and the species that use them can be found in **Chapter 3.0, Section 3.4.**

Threatened and Endangered Species

The habitats described above are especially important for threatened and endangered species. These species and their habitat are considered to be notable features due to their uniqueness and sensitivity to environmental changes. Four databases were queried to identify the location or potential location of the federal- or state-listed species. The databases include the Department of Conservation and Recreation (DCR) Natural Heritage Database (NHD), the VAFWIS and Wildlife Environmental Review Map Service (WERMS), and the USFWS Information, Planning, and Conservation (IPaC) database. Queries performed through the DCR – NHD database are based upon 12 digit HUCs which intersect the study area. The remaining databases use the study area boundary to determine which federal- or state-listed species are located within the area. Following is a description of the identified federal threatened or endangered species, followed by a list of the identified state threatened or endangered species.

The red-cockaded woodpecker (*Picoides borealis*) has been on the Federal Endangered Species List since 1973. It is a very rare permanent resident south of the Chesapeake Bay and the James and Appomattox Rivers. Historically this species has been recorded in Southampton and Sussex Counties and the City of Suffolk, with nesting verified only in Sussex County (DGIF, 2014). In Virginia, this species is currently found only within the Piney Grove Preserve in Sussex County within the study area (CCB, 2013).

The Roanoke logperch (*Percina rex*) is a freshwater fish species that has been listed as endangered by both the USFWS and Virginia since 1989. The Roanoke logperch is endemic to the Roanoke River and Chowan River drainage basins, where it is encountered in relatively small numbers. Populations located to date are separated from one another by long segments of rivers or by large impoundments (DGIF, 2014a). DGIF states that there is a potential for the Roanoke logperch to occur in Sussex, Southampton, and Prince George Counties.

The northern long-eared bat (NLEB) (*Myotis septentrionalis*) was listed as a threatened species by the USFWS in 2015. Suitable summer habitat exists throughout the study area and consists of a wide variety of forested/wooded habitats where they roost, forage, and travel and may also include some adjacent and interspersed non-forested habitats such as emergent wetlands and adjacent edges of agricultural fields, old fields, and pastures. NLEBs also have been occasionally found roosting in structures like barns and sheds

(particularly when suitable tree roosts are unavailable). NLEBs typically occupy their summer habitat from mid-May through mid-August each year and the species may arrive or leave some time before or after this period (USFWS, 2014b).

Sensitive Joint Vetch was listed as federally threatened in 1992. This species is found in New Jersey, Maryland, Virginia, and North Carolina, and is thought to be extirpated from Pennsylvania and Delaware. Sensitive Joint Vetch grows on brackish tidal river shores and estuarine-river marsh borders with peaty, sandy, or gravelly substrates. Habitat alteration (e.g. development, changes in natural disturbance regime) is the primary threat to this species. Areas of suitable habitat are located in the northern portion of the study area along the majority tributaries of the James River, like the Pagan River.

The Atlantic sturgeon is an anadromous species that migrates from the ocean into coastal estuaries and rivers to spawn. In the Chesapeake Bay, Atlantic sturgeon historically spawned in all of its major tributaries. Presently, spawning populations have been drastically reduced due to overfishing, pollution, dam construction, and habitat degradation (Bilkovic, et al., 2009). The James and York Rivers in Virginia are the two rivers comprising the Chesapeake Bay Distinct Population Segment where Atlantic sturgeon reproduction has been confirmed (Balazik, et al., 2012). Juveniles may spend several years in fresh water of some large rivers, or they may move downstream to brackish waters when the temperature drops in the fall (DGIF, 2014a). The Atlantic sturgeon was identified as a federal species of concern in 1988 and the Chesapeake Distinct Population Segment was federally listed as endangered in 2012.

State endangered species believed to occur within the study area include the Rafinesque's eastern big-eared bat (*Corynorhinus rafinesquii macrotis*), little brown bat (*Myotis lucifungus*), tri-colored bat (*Perimyotis subflavus*), black rail (*Laterallus jamaicensis)*, eastern tiger salamander (*Ambystoma tigrinum*), eastern chicken turtle (*Deirochelys reticularia*), canebreak rattlesnake (*Crotalus horridus*), and blackbanded sunfish (*Enneacanthus chaetodon*).

State threatened species believed to occur within the study area include the New Jersey rush (*Juncus caesariensis*), Henslow's sparrow (*Ammodramus henslowii*), barking tree frog (*Hyla gratiosa*), Mabee's salamander (*Ambystoma mabeei*), and Peregrine falcon (*Falco peregrinus).*

Although bald eagles (*Haliaeetus leucocephalus*) are no longer federally or state listed, bald eagles currently are protected under the Bald and Golden Eagle Protection Act. The bald eagle is a fairly common summer and winter visitor in the Chesapeake Bay region and nearby counties. The bald eagle forages along coastal areas, rivers, and large bodies of water. Nesting sites are commonly located in large forested areas adjacent to marshes, on farmland, or in seed tree cut-over areas. The DGIF database lists the bald eagle as occurring within the City of Suffolk and Isle of Wight, Southampton, Sussex, Surry, and Prince George Counties (DGIF, 2014a). Bald eagle nests have been recorded within the study area (CCB, 2014).

4.2.4.3 Historic Properties

Historic properties are considered notable features for their value to the area's historical and cultural foundations, and the state and nation's heritage. The National Historic Preservation Act of 1966 (NHPA) [16 U.S.C. §470] defines a historic property as any "prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places (NRHP), including artifacts, records, and material remains related to such a property or resource." For the purpose of this analysis historic properties are archeological sites and architectural resources eligible for listing or listed in the NRHP. The 91 historic properties within the study area are shown and listed on **Figure 4.2-3**.

4.2.4.4 Recreational Resources

Recreational resources are considered notable features since they provide a variety of social benefits ranging from public recreation, meditation, and exercise to exercise and sports areas for students. For the purposes of this study, outdoor recreational resources include all private and public recreation areas, including school playgrounds and ballfields. Sixty-one recreational properties were identified within the study area. These properties are shown and listed on **Figure 4.2-4**.

4.2.5 STEP 4: IDENTIFY IMPACT CAUSING ACTIVITIES OF THE PREFFERED ALTERNATIVE

The objective of this step is to identify direct impacts which could have indirect effects that may conflict with the regional direction and goals discussed in **Step 2** and/or impact the notable features identified in **Step 3**. The NCHRP Report 466 includes groups of actions associated with transportation projects that are known to trigger indirect effects. Some examples of these impact-causing activities include: alteration of drainage, channelization, noise and vibration, cut and fill, barriers, excavation, erosion and sediment control, landscaping, and alteration of travel time/cost.

The direct impacts to notable features within the Limit of Disturbance (LOD) of the FHWA/VDOT Preferred Alternative, which includes both temporary and permanent impacts, including stormwater management facilities and construction access, are documented in **Table 4.2-3**.

Table 4.2-3: Direct Impacts within the Limit of Disturbance of the FHWA/VDOT Preferred Alternative

Notable Feature	Direct Impact
Residential Relocations (No.)	21
Business Relocations (No.)	6
Farm Relocation (No.)	1
Non-Profit Relocation (No.)	1
Forested Habitat/Wildlife Corridors (Acres/No.)	162.7/3
Regional Biodiversity (Acres of Conservation Lands)	5.32
Threatened and Endangered Species or potential habitat (No.)**	6
Floodplains (Acres)	11
State Wild and Scenic Rivers (Linear Feet)	500
Streams (No. of Crossings)	53
Stream Impacts (linear feet)	6,874
Stream Impacts – Pipe Replacement (linear feet)	789
Jurisdictional Ditch (linear feet)	9,339
Permanent Impacts to Vegetated Wetlands (cut/fill, bridge conversion, right-of-way clearing, and secondary) (Acres)	39.77
Open Water (Acres)	3.93
Temporary Impacts to Vegetated Wetlands / Open Water (Acres)	1.31/0.12
Listed or Eligible Historic Properties (Architectural (No.)/Potentially Eligible Archaeological Resources (No.)	0/3
Recreational Resources (No.)	1

*** There is habitat present which appears to meet the species' requirements and the study area is within the known range of the species for the following species: northern long-eared bat, barking tree frog, Mabee's salamander, little brown bat, tri-colored bat and bald eagle.*

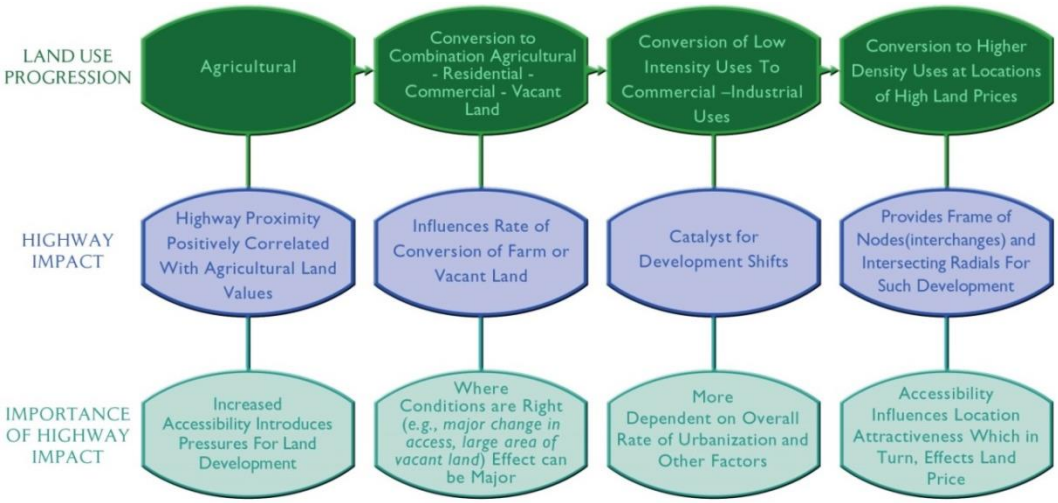
4.2.6 STEP 5: IDENTIFY INDIRECT EFFECTS FOR ANALYSIS

Step 4 identified project-related activities that would directly impact notable features within the FHWA/VDOT Preferred Alternative's LOD. The objective of **Step 5** is to discuss the potential for these impact-causing activities to have indirect effects on notable features.

Indirect effects that may result from the direct effects as presented in **Table 4.2-3** could include increases in traffic on feeder roads connecting to the new roadway as well as decreases in traffic on roadways that are bypassed or become closed to through traffic as a result of the FHWA/VDOT Preferred Alternative improvements. Other indirect effects may include land owners choosing to relocate due to the proximity of the improvements, or businesses choosing to relocate due to reductions in local traffic on existing Route 460. Other indirect effects could be the perceived safety and altered behavior of pedestrians along an improved roadway or the alteration of the downstream flow regime of a wetland area resulting from the installation of a new culvert. As defined in **Section 4.2.3.1**, the study area for indirect effects is the project study area.

In addition, there may be project-influenced development effects in the form of changes to land use (induced growth) which in turn result in effects related to the changes in land use. In general, with regard to induced growth, transportation improvements often reduce time and cost of travel, as well as provide new access to properties and enhance the attractiveness of surrounding land to developers and consumers. Development of vacant land or conversion of the built environment to more intensive uses are often consequences of highway projects. Important characteristics for induced growth are included in **Figure 4.2-8**. These characteristics 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. In the case of this study, an existing transportation corridor has existed for more than 80 years and the study area remains at a land use progression of "Agricultural" and "Conversion to Agricultural - Residential- Commercial-Vacant Land." The existence of Route 460 by itself, and the uncontrolled access it provides, has not resulted in progression to any of the more intensive land uses; one objective of this analysis, however, is to assess the extent to which the FHWA/VDOT Preferred Alternative will result in such a progression.

Figure 4.2-8: Highway Investment on Typical Progress of Urbanization



Source: Guidance for Assessing Indirect and Cumulative Impacts of Transportation Projects in North Carolina, Vol. II: Practitioners Handbook, Louis Berger Group, 2001

Given this general understanding of the land use development progression that has occurred in the study area, three interchange/intersection locations were identified as having the potential for induced growth associated with the FHWA/VDOT Preferred Alternative – Route 460 intersection (west of Windsor), Route 460 interchange (east of Windsor), and Route 58 interchange. It is in the vicinity of these three interchanges/ intersection locations that induced growth areas were defined for further analysis. These locations were identified as areas of potential induced growth given their current state of development and proximity to population centers. At each location, the induced growth area encompasses the area within one-mile radius of the given interchange/intersection, plus additional area along roadways that lead to the interchanges intersection, or feeder roads. Given the limited land use progression that has occurred in the presence of factors favorable for induced growth as discussed above, a conservative two-mile distance for induced growth along feeder roads is being used for this analysis. Along the feeder roads leading to each interchange/intersection for a distance of two miles, a 1,000-foot buffer was applied to the edge of pavement and extended for a distance of two miles. The Induced Growth Areas are illustrated in **Figure 4.2–9**.

The 1,000-foot buffer off each side of the edge of pavement was used because it represents a conservative estimate of the distance over which the influence of the project could be felt. The limits of this analysis are not meant to suggest that induced growth would not occur outside of this area, but that future growth beyond the two-mile distance may not be an indirect result of the implementation of the FHWA/VDOT Preferred Alternative.

It should be noted that induced growth is not anticipated west of Yellow Hammer Road (Route 645), because the improvements in this area do not include the construction of additional lanes and are relatively minor in scope. As a result, the improvements are not expected to be a catalyst for induced growth or accelerate existing or planned growth. Any growth that does occur is expected to occur along the existing corridor in planned development areas or previously developed areas.

The process for identifying indirect effects for analysis was to locate notable features within the resource-specific indirect study areas. Also, additional consideration was taken for notable features within the induced growth areas to consider how direct impacts may lead to indirect effects at a future time. Following is an assessment of each notable feature category, concluding with a statement as to whether the impact-causing activities are likely to have indirect effects that must be analyzed in **Step 6: Analyze Indirect Effects and Evaluate Analysis Results**.

4.2.6.1 Socioeconomics and Land Use

The FHWA/VDOT Preferred Alternative would pass through residential, commercial, and agricultural portions of the study area, resulting in property impacts, noise impacts, and visual effects, as well as community impacts such as disruption and fragmentation, which in turn may lead to land use changes. These direct impacts could have indirect effects from encroachment-alteration, induced growth, and impacts related to induced growth.

Within the broader indirect effects study area, direct impacts that result in changes to land use and development patterns is most likely to occur within the induced growth areas as presented in **Table 4.2-4**. Based on the existing development that has been identified within the designated growth areas along existing Route 460, illustrated in **Figure 4.2-10**, any induced development is most likely to occur on approximately 3,752 acres of land available where development has been designated within the Windsor DSD and Suffolk's Central Growth Area.

Some additional development and associated indirect effects will likely continue along existing Route 460, where existing development would be bypassed by the FHWA/VDOT Preferred Alternative, such as in Windsor; however, the pace of growth along the existing Route 460 corridor may slow with the implementation of the FHWA/VDOT Preferred Alternative, as development shifts to the induced growth areas. Analysis of land use has been advanced to **Step 6**.

Table 4.2-4: Land Use within Induced Growth Areas*

Interchange/ Intersection Location	Land Use Type[1]	Land Use Acreage
Route 460 Intersection (west of Windsor)	Designated Agricultural	2,964
	Designated Commercial/Industrial	158
	Designated Residential	846
	Designated Natural Resources/Conservation	0
	Designated Other[2]	63
	Existing Developed Land within Designated Growth Area[3,4]	92
	Land Available for Development within Designated Growth Area[4]	1,031
Route 460 Interchange (east of Windsor)	Designated Agricultural	1,970
	Designated Commercial/Industrial	420
	Designated Residential	1,103
	Designated Natural Resources/Conservation	0
	Designated Other[2]	236
	Existing Developed Land within Designated Growth Area[3,4]	216
	Land Available for Development within Designated Growth Area[4]	1,393
Route 58 Interchange	Designated Agricultural	2,846
	Designated Commercial/Industrial	232
	Designated Residential	845
	Designated Natural Resources/Conservation	662
	Designated Other[2]	131
	Existing Developed Land within Designated Growth Area[3,4]	597
	Land Available for Development within Designated Growth Area[4]	1,328

[1] Designated land use types are based on locality definitions and are not indicative of the type of land use presently occurring.
[2] Other includes areas that are mixed use or are not classified as agricultural, commercial/industrial, or residential.
[3] Based on the National Oceanic and Atmospheric Administration's nationwide land cover dataset and includes residential, commercial, and industrial development.
[4] Induced growth is most likely to occur in the induced growth areas shown in Figures 4.2-9 and 4.2-10, both inside those designated growth areas and outside those designated growth areas.

Twenty-one percent of the census blocks within the broader indirect effects study area are identified as having higher percentages of minority populations (**Figure 4.2-7**). These census blocks are generally dispersed throughout the indirect effects study area. Indirect effects to land use and socioeconomics would primarily occur along or adjacent to the eastern portion of existing Route 460 corridor and the FHWA/VDOT Preferred Alternative alignment; therefore it is not anticipated that the indirect effects would be disproportionately borne by minority populations that are dispersed throughout the indirect effects study area. Likewise, 15 percent of the census blocks within the area identified for potential induced growth are identified as having high percentages of minority populations. The effects of induced growth are assumed to be dispersed throughout the identified induced growth area; therefore, it is not anticipated that these impacts would be disproportionately borne by these populations. Because the anticipated indirect effects would not be disproportionately borne by minority populations, environmental justice is not advanced to

Step 6 in this analysis as a separate resource type. Instead, impacts to minority populations are considered as part of the overall population under Socioeconomics.

4.2.6.2 Natural Resources

Waters, Wetlands, and Water Quality

The FHWA/VDOT Preferred Alternative directly and indirectly impacts wetlands and other Waters of the U.S. Indirect effects resulting from project construction include changes in water quality (and therefore potentially changes to impaired waters and TMDLs), changes in hydrologic regime, changes in light regime, habitat fragmentation, increased noise, and introduction of invasive species. These indirect effects may be realized within the indirect effects and induced growth study areas.

The induced growth area has 173,712 linear feet of streams, as approximated with National Hydrography Dataset data. Wetland acreage was determined to be 1,520 acres using NWI mapping, and approximately 3,865 acres using aerial photointerpretation and best professional judgment. The area of potential induced growth illustrated in **Figure 4.2-11** would potentially impact waters, wetlands, and water quality. Because indirect effects are anticipated, waters, wetlands, and water quality have been advanced to **Step 6** in this analysis.

Floodplains

The FHWA/VDOT Preferred Alternative involves direct impact to floodplains, predominantly related to road crossings, such as displacement due to filling and reduction in flood storage capacity. Indirect effects caused by the FHWA/VDOT Preferred Alternative include alteration of drainage patterns, water quality degradation, changes in flood flow elevations, and associated effects on floral and faunal communities. These indirect effects may be realized within the indirect effects study area and induced growth study area. Because indirect effects from the FHWA/VDOT Preferred Alternative on floodplains are anticipated, this resource is advanced to **Step 6**.

State Wild and Scenic Rivers

Virginia Scenic Rivers Program's intent is to identify, designate, and help protect rivers and streams that possess outstanding scenic, recreational, historic, and natural characteristics of statewide significance (DCR, 2009a). A portion of the Blackwater River, which is a designated state scenic river, occurs within the indirect effects study area. Bridging of this river could result in a direct impact to the qualities and features that qualify it for the Scenic River Program. These direct impacts would come in the form of building a new bridge over the river and noise associated with traffic, which could lead to indirect effects to the river and the characteristics that make it uniquely scenic. Given the potential for these types of impacts, this resource is advanced to **Step 6.**

Natural Communities, Wildlife, and Biodiversity

The indirect effects study area includes a variety of wildlife, wildlife habitat, and movement corridors. Direct impacts, listed previously in **Table 4.2-3** could result in fragmentation, changes in regime (e.g. light, hydrology), introduction of invasive species by opening up forest areas, and other impacts that could affect wildlife beyond the spatial and temporal boundaries used to analyze direct impacts. Increased traffic volume resulting from project completion and induced growth could result in indirect effects to wildlife outside of the area of direct impact. These indirect effects include but are not limited to habitat fragmentation, increased pollution from traffic accidents and oil spills, animal-vehicle collisions, and introduction of invasive species on equipment and vehicles traveling from other locations. These indirect

effects may be realized within the indirect effects study area and induced growth study area. Given the nature of this area and the potential for indirect effects, wildlife is included in the analysis of natural resources in **Step 6** of this analysis.

Threatened and Endangered Species

Four federally-listed species, several state-listed species, and one (the bald eagle) under the protection of the Bald and Golden Eagle Protection Act have been known to occur or have potential habitat within the indirect effects study area. One federally-listed species, two state-listed species, and the bald eagle have also been known to occur or have potential habitat within the induced growth area, as determined by threatened and endangered species database searches. Construction of the proposed project may indirectly affect threatened and endangered species by altering landscape habitat. Such alterations may include increased noise, degradation of water quality, and fragmentation of habitat corridors. These indirect effects may be realized within both the indirect effects study area and the induced growth study area. Given the likelihood of land use changes within the indirect effects induced growth study areas that could have indirect effects on the species' habitat, this resource is advanced to **Step 6**.

4.2.6.3 Historic Properties

The induced growth areas contain six architectural resources that are NRHP-listed or eligible for listing: Hobbs Property (Helen Johnson Hobbs Store and Motel), Henry Saunders House, Langford Farm, Rountree Farm, Mt. Zion Cemetery, and the Norfolk and Petersburg Railway (Norfolk and Western Railway (see **Figure 4.2-12**). Development within the induced growth areas could affect these resources.

Land use changes within the larger indirect effects study area could potentially cause impacts to historic resources either by taking the resource or compromising the view from the resource. Additionally, changes in traffic and associated noise could indirectly affect historic resources within the indirect study area.

FHWA, USACE, and VDOT have coordinated with the Virginia Department of Historic Resources (VDHR) regarding all direct, indirect, and cumulative impacts related to historic properties in the study area. Because indirect effects are anticipated, this resource is advanced to **Step 6**.

4.2.6.4 Recreational Resources

There are eight recreational resources that are located within the induced growth areas of the FHWA/VDOT Preferred Alternative – Central County Park, Lake Prince, Kings Fork Athletic Complex, Nansemond-Suffolk Academy, Indian Point Farm, Elephants Fork Elementary School, Lake Cohoon, and Lake Meade. Development within the induced growth areas could affect these resources (see **Figure 4.2-13**).

Changes in traffic within the larger indirect effects study area could increase noise levels at adjacent recreational resources; while changes in land use could affect demand at the recreational resources. Because indirect effects on recreational resources are anticipated, this subject is advanced to **Step 6**.

4.2.6.5 Summary

The comparison of notable features to impact causing activities determined that the following resources may experience indirect effects evaluated in this analysis:

- Socioeconomics and Land Use
- Natural Resources

- Historic Properties
- Recreational Resources

4.2.7 STEP 6: ANALYZE INDIRECT EFFECTS AND EVALUATE ANALYSIS RESULTS

This step of the analysis evaluates the potential indirect effects that may occur as a result of the FHWA/VDOT Preferred Alternative under consideration in the Final SEIS.

Under the No Build Alternative, there would be no change to the existing Route 460. A decline in growth may occur in the study area if safety problems, flooding, or transportation design deficiencies are not addressed. However, as a result of the background growth rate, traffic volume forecasts in the ***Supplemental Traffic and Transportation Technical Report*** (VDOT, 2016h) indicate that under the No Build scenario, traffic volumes on Route 460 will increase throughout the 50-mile project study area from Petersburg to Suffolk. Anticipated increases range from 14 to 21 percent by the year 2021 and from 56 to 92 percent by the year 2040. The increased volumes on the unaltered Route 460 roadway can be anticipated to cause increased accidents, increased noise, and decreased air quality.

4.2.7.1 Socioeconomics and Land Use

The FHWA/VDOT Preferred Alternative consists of 16 miles of improvements and another 36 miles of No Build status quo conditions; indirect effects described in **Step 6** below are not anticipated for the 36-mile No Build segment of the FHWA/VDOT Preferred Alternative. In this 36-mile section, there would be no change to the existing Route 460.

The FHWA/VDOT Preferred Alternative, between west of Windsor and Route 58 would introduce a new roadway element into the area that would lead to increased noise levels, fragmentation of existing properties, moderate visual impacts, and short-term construction impacts, such as noise and dust. The region would have a new, limited access roadway that would connect to more developed areas east of the study area. The introduction of a limited access four lane roadway would fragment several large tract parcels that may interfere with certain farming operations, lead nearby property owners to opt to move away, or attract new landowners to the corridor. Because a portion of the FHWA/VDOT Preferred Alternative is similar to the alternative that was approved by FHWA in 2008, it is possible that some of these effects have already occurred to a degree; however, specific examples are not apparent.

The implementation of the FHWA/VDOT Preferred Alternative could lead some regional travelers who normally pass through Windsor to travel on the new route to avoid stoplights and associated delays. This decrease in traffic through Windsor could result in a loss of business for local restaurants, gas stations, and shops. Alternatively, reduction of traffic, including trucks, through Windsor could make the businesses along Route 460 more accessible and desirable to current and potential residents. Studies on the impact of bypasses on rural towns and communities support the potential for such effects; however, these studies also indicate that the changes caused by bypasses in the rural environment are minimal (Rogers, Marshment, 2000; TRB, 2014). The ***Supplemental Traffic and Transportation Technical Report*** (VDOT, 2016h) reports that at the east of Windsor study location, the total average daily traffic (ADT) of existing Route 460 in 2040 (13,300) is less than the existing ADT (14,900 in 2013), indicating a decrease in traffic volume of about 11 percent traveling through downtown Windsor. In contrast, the new Route 460 in 2040 is modeled to have an ADT of 21,600. While the combined ADT on the existing Route 460 and new Route 460 in 2040 (34,900) would be more than double the existing ADT (14,900), the majority of the traffic, about 62 percent of ADT (21,600), would use the bypass. The potential diversion of traffic onto the bypass may have impacts on the town of Windsor, some positive and some negative. The bypass may slow

economic development along the existing Route 460 corridor where traffic has been an issue. On the other hand, improved traffic conditions may make Windsor an appealing, affordable alternative for families and small businesses, and the increase in traffic through the rest of the corridor may provide other economic benefits, such as increased business at gas stations and restaurants.

Property owners along the existing corridor are accustomed to the size of Route 460, its proximity to their property, unrestricted access for movements in any direction, and the vehicle noise that reaches their property. Between west of Zuni and west of Windsor, the upgraded Route 460 would have managed access with new medians, turn lanes, and sidewalks. These changes to certain local movements may change local travel patterns to some degree. Bringing this section of the road up to current standards will improve safety and will better accommodate truck traffic, resulting in real or perceived changes to existing noise levels that landowners not directly impacted by property takings would experience. Additionally, the availability of sidewalks through Zuni should improve opportunity for and safety of local pedestrian movements.

Local movements also could be affected because the major area where Route 460 floods in Zuni would be addressed, improving accessibility within/through the town. The incorporation of the new bridge and raised roadway necessary to address flooding from the Blackwater River at Zuni would lead to some effects on the town. The raised roadway would affect the far western end of Zuni, including the Tabernacle of Praise Full Gospel Baptist Church and access to Zuni Circle; however driveways and side streets would be modified to maintain access. The new bridge would introduce a visual element that may or may not affect location decisions by residents.

As the new alignment would be limited access, encroachment-alteration indirect effects and induced development would be focused along the existing Route 460 alignment between west of Zuni and west of Windsor, as well as at the intersections/interchanges associated with the new bypasses.

The improvements along the existing alignment of Route 460 between west of Zuni and west of Windsor would result in the relocation of seven residences, three businesses, and a post office. In some cases, the project may impact land of some properties which may reduce the size of a parcel; in other cases a complete property take may occur. Replacement development could occur along the corridor behind houses and businesses projected to be displaced, which would represent an indirect effect. However, because there is an existing four-lane roadway on the same alignment, any such development in this section of the study area would result in encroachment-alteration indirect effects and not indirect effects from induced growth. Any replacement development that would occur could contribute to economic development goals established by local governments and would be in compliance with local comprehensive plans, since such development would be adjacent to existing developed areas. Depending on the type and level of replacement development and whether the value of real estate increases, property tax revenue, along with other revenue sources, could increase for the respective localities. In addition, increases in job opportunities would be expected due to short-term construction and long-term operation and maintenance of new development. Conversely, whole and partial property takings and relocations could reduce the tax base and/or result in businesses permanently leaving the Route 460 corridor.

The interchanges/intersection may induce growth because of their proximity to existing built-up areas. Residents of Windsor and Suffolk may be inclined to patronize any new development at the interchanges/intersection, such as fast food restaurants and gas stations, which they may access by the feeder roads between the towns and the bypass interchanges/intersection. Thus, the land around the interchanges/intersection has a greater potential customer-base and is more likely to undergo development.

Growth around the interchanges/intersection could help the respective localities advance their economic development goals. Property and real estate tax, along with other revenue sources would be expected to increase for the respective localities. In addition, increases in job opportunities could be expected due to short-term construction and long-term operation and maintenance of new developments.

Table 4.2-4 lists the existing land uses associated with the areas surrounding the interchanges/intersection where induced growth could occur for the FHWA/VDOT Preferred Alternative. The land use designations listed can be an indicator of the type of growth that may occur in these areas; for instance, the combined land area that is currently agricultural (8,170 acres) would be more likely to be converted to residential, industrial, or commercial, rather than remain agricultural, under the conditions of induced growth. Local comprehensive plans and land use and zoning maps are regularly updated to account for market pressures and changing community needs.

The majority of the potential induced growth area in Isle of Wight County is located within the Windsor DSD. The land use plan for the Windsor DSD identifies a range of land uses for the area identified by the analysis as a potential induced growth area, including Conservation Development, Planned Industrial, Suburban Estate, and Business and Employment.

The area identified by this analysis as a potential induced growth area in the City of Suffolk is also located where development is encouraged – the Central Growth Area. This potential induced growth area in Suffolk is a suburban use district and inner-ring suburban use district, with small portions extending east into the Core Support Use District, and west into the Rural Agriculture Use District (which is outside of the Central Growth Area).

As noted in the Isle of Wight and Suffolk comprehensive plans (County of Isle of Wight, 2008; City of Suffolk, 2015), development around road networks or other designated development areas accommodates growth and limits the likelihood that sprawl would lead to unwanted development throughout a region. As a result of the implementation of the FHWA/VDOT Preferred Alternative, induced development may occur on the available land in the induced growth areas shown in **Figure 4.2-9**. As previously mentioned, future development that may occur as a result of the indirect effects and induced growth associated with the FHWA/VDOT Preferred Alternative, would be required to obtain any applicable federal, state, and local approvals, prior to proceeding.

As there would be no change to the existing Route 460 west of Zuni, no induced growth is anticipated for the corridor between Petersburg and west of Zuni as a result of the FHWA/VDOT Preferred Alternative. On the other hand, increased traffic converging from the region to the Route 460 corridor may, over time, have indirect effects such as increased noise, increased accidents, decreased air quality, and increased development of supporting services for the corridor, such as gas stations.

4.2.7.2 Natural Resources

Waters, wetlands, and water quality; floodplains; state wild and scenic rivers; natural communities, wildlife, and biodiversity; and threatened and endangered species were considered notable natural resources within the study area and are carried forward for analysis in this step. Direct effects would occur through physical alteration or destruction of habitat by the roadway and its associated right-of-way. Each direct impact can cause additional indirect effects as discussed below.

One of the most important indirect effects associated with habitat alteration/destruction is habitat fragmentation. Habitat fragmentation can have wide-ranging implications, and may result in creation of

more edge habitat, barriers to wildlife movement, reduction in patch size, loss of interior or area-sensitive species, disruption of wildlife foraging patterns, increased opportunity for invasive species establishment, and generally reduced biological diversity. The study area's riparian corridors are generally the least disturbed within the natural landscape of the study area. Indirect effects to the riparian corridors may occur through restriction of movements by wildlife into and out of them as a result of fragmentation of the wildlife corridors, as well as more locally restricted movements of wildlife into and out of these protected areas.

The primary indirect effect associated with the introduction of pollutants from roadway runoff is the degradation of nearby terrestrial and aquatic habitat from increased deposition of sediments or contamination from chemical pollutants in the form of heavy metals, inorganic salts, asbestos, and petroleum products and their byproducts. 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. Potential effects to impaired waters and possible mitigation are presented in **Chapter 3.0, Sections 3.4.3.2.1** and **3.4.4.1.1** and discussed in detail in the ***Natural Resources Technical Report*** (VDOT, 2014i) and the ***Supplemental Natural Resources Technical Report*** (VDOT, 2016f).

According to studies, rural roads have lower levels of stormwater pollutants than urban roads. Similarly, roads with lower ADT have lower levels of stormwater pollutants than roads with higher ADT. Based on previous studies, rural roads with less than 30,000 ADT volumes do not produce the level of pollutants required to measurably affect surrounding water quality (Driscoll et al, 1990). As discussed in the ***Supplemental Traffic and Transportation Technical Report*** (VDOT, 2016h), neither the existing Route 460, nor the new Route 460, is projected to exceed this 30,000 ADT threshold through 2040. A recent study found that there is very little long-term impact to water quality from stormwater runoff from bridges in either rural or urban areas, and minimal short-term impacts to water quality (Wagner et al., 2011). It should be noted that the Wagner study investigated the effects of runoff from bridges only, and not from fill/culvert crossings of streams. A number of other studies have found that there are numerous factors besides ADT that could potentially influence the pollutant levels within stormwater runoff, including rainfall volume, rainfall frequency, and surrounding land use (VDOT 2014z). Because of the numerous variables, a meaningful projection of the extent of pollutant loads from any alternative cannot be made without extensive analysis. In lieu of this analysis, the best predictor of the relative degree of impacts to water quality from the alternatives is the extent of direct impacts to streams, i.e., the number of streams crossed.

The disruption or alteration of natural processes leads to the indirect effect of changing hydrologic flow dynamics through the local natural communities and sometimes altering these dynamics at the ecosystem level such that the ability of the system to maintain itself is altered. Preserving the 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, marsh and swampland. Some of the potential effects that may occur as a result of changes to natural processes in the wetlands of the study area include changes to floodwater storage capacity and retention times, vegetative community composition and structure, nutrient cycling, and aquatic life movement. For example, an increase in sunlight in riparian areas due to a new roadway 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 effects described in the preceding paragraph could result from the FHWA/VDOT Preferred Alternative.

Hydrologic modifications from wildlife activity are relatively commonplace in these systems, such as tree removal and dam construction caused by beavers, and consequently, these low gradient small stream swamp systems are adapted to these natural hydrologic modifications. However, these systems may not be able to fully adapt to hydrologic modifications that result as an indirect effect of construction of the FHWA/VDOT Preferred Alternative. While the changes that occur to the parameters identified above generally tend to be localized around the disturbance sites, and because the systems are adapted to some naturally caused regular changes in hydrologic flow it is difficult to predict the effect that FHWA/VDOT Preferred Alternative changes in the hydrologic regime may have on the system when added to natural effects.

Indirect effects to wetland functions may be realized as a result of the proposed Project, such as providing habitat for wildlife and maintaining characteristic plant communities. To assess indirect effects to wetland functions along the FHWA/VDOT Preferred Alternative accurately, modifications of two published hydrogeomorphic functional assessment methodologies were used to evaluate existing and post-construction functions. Both methodologies, fully outlined in **Chapter 3**, were modified to reflect regional ecological conditions and due to time constraints and the extent of data that had already been collected in the impact areas.

Functional assessment values were established for wetland types exhibiting a variety of conditions within the area. Reference standard wetlands were selected and scored in order to calibrate atypical, typical, and optimal conditions of potentially affected wetlands. Lower scoring systems are generally located in the top of watersheds; while higher scoring wetlands (bottomlands) were lower in the watershed. Features located in the top of watersheds are typically more degraded by anthropogenic activities including farming, ditching, channelization of streams, and fill. Ease of fill and successful alteration outcomes (as compared to large swamps) are the primary causes of degradation. Wetlands (bottomlands) lower in the watershed, typically those considered high scoring, have generally not been drastically altered because their hydrologic conditions make them difficult to access and modify. The functional assessments identified the highest functioning wetlands of those being directly impacted.

The small clearing of riparian areas for placement of culverts and eventual maintenance of the area within the right-of-way (approximately ten feet on each side of road) would expose those lengths of the stream to temperature increases.

Wetland Impacts

Direct impacts to wetlands fall into four categories:

- cut/fill – where no functions remain after construction;
- permanent right-of-way (ROW) conversion - where a partial loss of function is realized, mainly due to cleared vegetation;
- bridge conversion, where a partial loss of function is realized, mainly due to cleared vegetation; and,
- altered hydrology or hydrologic isolation causing a partial loss of function.

Direct impacts from cut/fill would result in loss of all wetland functions within the immediate footprint of the impact. The wetland functions most affected by right-of-way conversion, bridge conversion, and hydrologic alteration are cycle nutrients, export organic carbon, maintain characteristic plant community, and provide habitat for wildlife for bottomland hardwood wetlands and cypress/tupelo wetlands and habitat, maintain characteristic plant community, and carbon cycling processes for wet flatwoods. 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.

Indirect effects are those effects on wetlands surrounding the directly impacted areas, as well as up and down stream. Indirect effects to wetlands caused by roadway construction may include blocking water flow, increasing or decreasing water volume, dust from construction activities, habitat fragmentation, noise, vibration associated with construction, shading, forming mudwaves, introduction of invasive species, and disturbance due to temporary construction staging.

A fill roadway directly impacts wetlands through placement of fill, but also can have the indirect effect of changing hydrology both upstream and downstream of the culverts. If adequate drainage structures are not selected during roadway construction, the habitat functional value of wetlands may be reduced by changing the plant community associated with the area. More frequent backflooding above the fill roadway may be experienced, which can have the indirect effect of changing the vegetative community, shifting it to more flood tolerant vegetative species, converting a wetland into an unvegetated open water area, or converting adjacent uplands into wetlands. The roadway and culverts may also reduce flooding downstream and may restrict water flow into formerly braided channel stream swamp systems downstream, resulting in less frequent inundation and changes in flow patterns. This can result in a shift toward less flood tolerant vegetative communities downstream of the roadway, and may convert a wetland into an upland by altering the hydrologic regime. Impeding water flow at the major stream/wetland crossings through placement of fill material without adequate drainage structures could reduce the habitat functional value of the wetlands by changing the plant community associated with the area.

These types of changes will also affect certain functions. If culverts are incorrectly sized or installed, or maintained, bottomland hardwood wetland Hydrogeomorphic (HGM) model variables $V_{SURFCON}$, V_{FREQ}, and V_{WTD}, which impact the wetland functions of "export organic carbon", "temporarily store surface water", "retain particulates", "remove and sequester elements and compounds", and "maintain characteristic plant community", may be reduced outside of the area of direct effect. These impacts to wetland functions are particularly important to high quality wetland systems that contain bald cypress, water tupelo, and overcup oak, which require specific hydrologic regimes.

The mineral flat HGM model variable V_{DRAIN}, which impacts the wetland function "maintain characteristic water regime", may also be reduced in the indirect effects study area. These hydrology modifications could lead to backwater flooding, which could cause vegetation changes due to prolonged inundation. In the bottomland hardwood HGM, an increase in flooding could cause tree death (model variables V_{TBA}, V_{TDEN}), leading to an increase in the model variables V_{SNAG}, V_{WD}, and V_{LOG}, thus changing the wetland functions of "cycle nutrients", "provide habitat for wildlife", "export organic carbon", and "maintain characteristic plant community", which would be noticed in the area of indirect effect. The mineral flat HGM would experience a change in the model variables V_{WD}, V_{FOOD}, $V_{DENSITY}$, and V_{REGEN}, which are incorporated in the "habitat", "carbon cycling processes", and "maintain characteristic plant community" functional capacity indexes (FCI). Additionally, if flooding changes plant communities, the bottomland hardwood HGM variable

V_{COMP} (wetland functions "provide habitat for wildlife" and "maintain characteristic plant community") and mineral flat HGM variables V_{FQAI} and $V_{INVASIVES}$ (wetland functions "carbon cycling processes" and "maintain characteristic plant community") may be noticed in the area of indirect effects. An increase in flooding is particularly detrimental to high value swamp systems, which require fluctuating water regimes for seedling germination and plant survival.

Direct impacts to wetlands will also result in habitat fragmentation, both in the areas of direct and indirect effects. The bottomland hardwood HGM variables V_{TRACT}, V_{CORE}, and $V_{CONNECT}$, which are incorporated into the provide habitat for wildlife FCI, would be reduced due to the construction of the proposed project. In the mineral flat HGM, habitat fragmentation would be noticed in the $V_{NATURAL}$ model variable, which is incorporated in the maintain characteristic water regime and habitat FCIs.

The FHWA/VDOT Preferred Alternative has seven crossings of larger named swamp systems, and several crossings of smaller unnamed systems. The indirect effects associated with any given stream swamp crossing will, to some extent, depend on other natural disruptions to hydrologic flow characteristics both upstream and downstream, as well as other manmade modifications to the system's hydrology, such as railroad or road crossings, mill pond dams, irrigation pond dams, etc. Indirect effects could also be associated with petroleum from vehicles, and salt or chemicals due to road maintenance.

Photointerpretation and NWI mapping was used to estimate wetlands within the induced growth areas. Approximately 3,865 acres of wetlands are located in the induced growth area of the FHWA/VDOT Preferred Alternative. Most of the areas that are undeveloped and are not actively used for agriculture are wetlands, typically part of large wetland systems associated with Lake Meade and the Nansemond River.

Surface Waters Impacts

The primary direct impact of highway construction on surface water is associated with the number and nature of the surface water crossings. All of the crossings would consist of bridges or culverts. Perpendicular crossings cause less direct impact than parallel or diagonal crossings because of their shorter length in the waterway. Stream crossings by bridges tend to have less direct impact than culvert crossings. Cofferdams used in bridge construction and lack of scour protection around culverts increase surface water impacts.

Indirect effects that may be expected from construction include temporary increases in downstream sedimentation and turbidity. These adverse effects could temporarily reduce downstream water quality and potentially impact fisheries and macrobenthic populations. Following construction, traffic could indirectly impact water quality through spills and vehicular deposition of pollutants such as heavy metals, asbestos, and petroleum products and their byproducts. Additionally, treatment of streets and roadways during icing or snow events, although not currently common in the study area, could result in the deposition of salt or sand on the roadways. These materials are deposited between precipitation events onto the roadway surfaces, the median areas, and adjoining right-of-way, and are later washed into the surface waters by wind, rain, and snow or ice melt. If these pollutants are allowed to run off untreated into impaired waterways, the indirect effects to both the water quality and the aquatic biota can be magnified to the point that they result in changes to the public water supply and the aquatic community structure and composition.

Aquatic biology impacts will occur as a result of roadway construction, maintenance, and usage. These impacts may result from the placement of fill that causes alterations to hydrology, changes in water quality, and changes to aquatic habitat, or they may occur as a result of degradation of aquatic habitat from runoff

of highway pollutants. Construction of bridges and culverts into and around water bodies may change the water velocity, depth, and erosion and sedimentation rates, which in turn could impact downstream habitat. Similarly, if pipes are not maintained, obstructions can develop, limiting movement of organisms. These activities also may impede the normal movement of aquatic biota, and could isolate or separate populations of some species.

Within the area of potential induced growth for the FHWA/VDOT Preferred Alternative there are approximately 173,712 linear feet of intermittent and perennial streams that may be impacted. Indirect effects from induced growth can include filling and relocation of streams for development, impoundment of streams to create recreational ponds or lakes and irrigation ponds for agriculture, water withdrawal for water-dependent activities, and utility infrastructure improvements.

Floodplains Impacts

Potential direct impacts to floodplains can include displacement due to filling/causeways and reduction in flood storage capacity, leading to indirect effects such as alteration of drainage patterns, water quality degradation, changes in flood flow elevations, and associated effects on floral and faunal communities. Additionally, development within induced growth areas has the potential to affect 1,000 acres of 100-year floodplains, as determined with FEMA mapping; there are no floodways within the induced growth areas.

State Wild and Scenic Rivers

The Blackwater River is the only State Wild and Scenic River within the FHWA/VDOT Preferred Alternative indirect effect study area. Indirect effects to this feature would be similar to the indirect effects discussed above in Surface Water Impacts. Additional indirect effects to the aesthetic quality of the river, one of the reasons for designating this river as a State Wild and Scenic River, include noise and viewshed alterations at locations in close proximity to the project location. The induced growth area does not contain a State Wild and Scenic River, and therefore no indirect effects to this resource will occur within the identified induced growth areas.

Wildlife/Regional Biodiversity Impacts

The construction of the FHWA/VDOT Preferred Alternative can lead to the direct loss, fragmentation, and/or degradation of habitat and in turn potentially impact wildlife and regional biodiversity. Additional potential impacts may also include impacts to animal foraging behavior and displacement of wildlife, alteration of topography, noise and visual disturbance, and introduction of invasive species (EPA, 1994). This section primarily addresses terrestrial wildlife habitats including upland habitats, wildlife corridors, and biodiversity-ranked sites. Aquatic wildlife habitat is addressed in the sections on surface waters and wetlands. There is overlap between terrestrial and aquatic habitats with regard to wildlife corridors and biodiversity-ranked sites, as all of the wildlife corridors identified in the study area are riparian corridors which may include both wetland and upland habitat, and some of the biodiversity-ranked sites are wetland habitats.

The types of activities associated with construction of the FHWA/VDOT Preferred Alternative that may potentially impact wildlife and regional biodiversity include vegetation removal, earth moving in the form of cut and fill, and direct construction impacts to sensitive habitats. In addition to the physical destruction of habitat and soil erosion, other forms of pollution may degrade habitat. Upon completion of construction, roadway operation and maintenance may result in continued impacts to wildlife that may impact regional biodiversity. These may include physical barriers to wildlife movements, vehicle wildlife collisions, introduction of invasive plant species that change the character of habitat, and degradation of aquatic

habitats due to contaminated runoff and fuel or chemical spills associated with vehicular accidents. Maintenance activities that may cause impacts include vegetation management (including physical and chemical vegetation controls) and salting and sanding roads during winter storms. These activities can result in an increase in runoff pollution.

Fragmentation of forested ecosystems may also contribute to indirect effects on wildlife species, reducing the habitat value of the area for species that require large contiguous tracts of forested habitat. Some of the potential negative effects of fragmentation include reduction in total habitat area available, increase in edge habitat, lower diversity due to smaller woods patches, potential isolation of populations, increased vulnerability of species moving between fragmented patches, increased vulnerability to external competition and predation, and potential decreased flow of genetic material through the landscape.

Roadway noise may also result in direct and/or indirect effects to wildlife, although these impacts are very difficult to quantify. It has been suggested that roadway noise can have possible adverse effects (altered habitat utilization, strained communication, and heightened metabolic rates) on wildlife, especially avian communities[2].

Other direct impacts may include some takes (killing) of individuals of smaller, less mobile wildlife species within the right-of-way during construction. Following construction, indirect take of wildlife can be expected as a result of wildlife-vehicle collisions.

Development within the induced growth areas could cause indirect effects to wildlife/regional biodiversity by potentially affecting approximately 3,979 acres of forested habitat (both wetland and upland), as determined by National Oceanic and Atmospheric Administration Coastal Change Analysis Program data. Detailed information on the natural communities, other terrestrial wildlife habitat, wildlife corridors, and biodiversity-ranked sites that may be affected is provided in the ***Supplemental Natural Resources Technical Report*** (VDOT, 2016f).

Threatened and Endangered Species Impacts

Direct loss of individuals of listed species known from the study area is not anticipated to occur as a result of the project. However, habitat (including roosting or foraging habitat) loss within the project footprint could result in indirect effects to these species. Like other wildlife, indirect effects could occur due to reduction in total habitat area available, lowered diversity due to habitat fragmentation, potential isolation of populations, increased vulnerability of species moving between fragmented patches, impacts to conservation areas, increased vulnerability to external competition and predation, and potential decreased flow of genetic material through the landscape. Additionally, indirect effects associated with the increase in edge habitat could be positive or negative, depending upon the species' desired habitat. The species potentially subject to these indirect effects are NLEB, barking tree frog, Mabee's salamander, and the bald eagle. These species and their habitat requirements are discussed in detail in the ***Supplemental Natural Resources Technical Report*** (VDOT, 2016f). Following is a description of the potential indirect effects to each species:

[2] McClure CJW, Ware HE, Carlisle J, Kaltenecker G, and Barber JR. 2013 An experimental investigation into the effects of traffic noise on distributions of birds: avoiding the phantom road. Proc R Soc B 280: 20132290. http://dx.doi.org/10.1098/rspb.2013.2290

- While, the FHWA/VDOT Preferred Alternative does not contain suitable winter hibernacula or habitat for the NLEB, suitable summer roosting and foraging habitat exists throughout the FHWA/VDOT Preferred Alternative. Indirect effects of the project would be a reduction in suitable summer roosting and foraging habitat due to removal of trees. An increase in ambient noise levels adjacent to the road would also reduce the area of potential habitat due to the bat's sensitivity to higher noise levels. A positive indirect effect would be the addition of summer roosting habitat for the NLEB in the form of bridge structures.
- Mabee's salamander has very specific habitat, favoring ephemeral ponds; the project has been shifted to avoid potential habitat identified within the Inventory Corridor. Indirect effects of the project could be a reduction in water quality/quantity due to runoff from the new roadway.
- The barking tree frog is typically located in sandy areas near shallow fish-free pools in pine savannas and in lowland woods and swamps. Indirect effects of the project would be potential reduction in water quality/quantity due to runoff from the new roadway and a loss of potential habitat due to the construction of the road. In addition, an increase in the ambient noise levels adjacent to the road would reduce the area of potential habitat due to the frog's sensitivity to higher noise levels.
- Bald eagles favor tall structures with open views. Indirect effects of the project would be a reduction in nesting habitat due to tree removal. Additionally, the increase in ambient noise levels adjacent to the road would reduce the area of potential habitat due to their sensitivity to higher noise levels.

Threatened and Endangered species database searches for the induced growth areas indicated that the five species described above, as well as two additional species [red-cockaded woodpecker (federally and state endangered) and canebrake rattlesnake (state endangered)] may be present or may have habitat elements present within the induced growth areas. Induced growth could reduce habitat, cause habitat fragmentation, increase road mortality, and alter hydrology in adjacent areas, all due to urbanization.

4.2.7.3 Historic Properties

For this analysis, data on historic properties are based on existing records included in VDHR databases. Architectural resources in the indirect effects study area may be impacted in the future by increased traffic approaching the new roadway. Visitors to these resources may experience increased noise and reduced air quality. The indirect effects of noise and air quality are not anticipated to be substantial enough to alter the use of these architectural resources.

Within the areas identified for induced development, the six historic properties illustrated in **Figure 4.2-12** could be affected. Should that development use federal funds or require federal approvals, it would be subject to the requirements of Section 106 of the National Historic Preservation Act (NHPA) at that time.

4.2.7.4 Recreational Resources

It is possible that Lake Meade would be impacted by indirect effects as a result of increased noise levels and visual impacts. A portion of Lake Meade is crossed by Route 58 and one of the exit ramps from the FHWA/VDOT Preferred Alternative would end at the northern edge of this crossing. Users of the lake may be able to see the exit ramp. In addition, increased traffic on this portion of Route 58 may lead to increased noise on the lake at this location. These indirect effects of noises and aesthetic detriments are not anticipated to deter residents from using the lake for recreational purposes, particularly in the main recreational areas, which are located away from Route 58.

Additionally, the proposed alignment would bisect the Nansemond Suffolk Academy's (NSA) athletic fields. As a result, the FHWA/VDOT Preferred Alternative alignment will alter access between the remaining recreational facilities at the NSA campus and increased traffic is predicted to impact the recreational use of the fields due to increased noise. VDOT has coordinated extensively with NSA to shift the alignment to avoid the playing fields to the greatest extent feasible, in an effort to minimize the direct and indirect effects to the recreational resource.

Additional recreational resources in the indirect effects study area may also be impacted in the future by resulting increased traffic approaching the new roadway. Users of the recreational resources may experience increased noise and reduced air quality. These indirect effects are not anticipated to be significant enough to deter residents from using these recreational resources.

The eight recreational resources that are located within the induced growth areas associated with the FHWA/VDOT Preferred Alternative (see **Figure 4.2-13**) could experience effects from noise, viewshed changes, or possibly encroachment. It is possible that induced growth would increase the utilization of the recreational resources. For instance, the proposed Route 58 south exit ramp would be located adjacent to a portion of Lake Meade's banks. Although there are currently no locations for launching watercrafts on this portion of the lake, potential induced growth may lead to increased use of the lake for recreational purposes and the construction of additional recreational amenities, such as boat launches. On the other hand, the low rate of growth in the study area, the high number of available properties, and the value that rural localities place on their limited recreational resources should help to ensure that these resources are not impacted in the future.

4.2.8 STEP 7: ASSESS CONSEQUENCES AND DEVELOP MITIGATION

4.2.8.1 Socioeconomics and Land Use

The analysis included in **Step 6** identified a variety of potential indirect effects. While planning judgment allows for that identification, there is not enough available information to fully assess the consequences of direct impacts, which includes indirect effects that are difficult to quantify. For example, although it is known that the changes to socioeconomic resources could result in some individuals and businesses voluntarily leaving the Route 460 corridor while also attracting others to the region, it is unclear which landowners or businesses would fall into these two different categories. Without information of this nature, it is difficult to assess the consequences of the indirect effects or identify measures to mitigate those effects.

Regarding induced growth, as discussed above in **Section 4.2.7.1**, the three interchanges/intersection identified as areas with potential for induced growth to occur are all generally located within designated growth areas. Isle of Wight County and the City of Suffolk have comprehensive plans in place to guide development to these areas (County of Isle of Wight, 2008; City of Suffolk, 2015).

4.2.8.2 Natural Resources

Potential consequences have been estimated based on the extent of direct impacts to the resources outlined above in Steps 4 and 6 as well as the identification of potential indirect effects on these resources both inside and outside of the induced growth areas. Methods to mitigate impacts to these natural resources are described below.

Wetland Mitigation

Mitigation for wetland impacts is generally thought of in terms of three types of actions: avoidance, minimization, and compensation. Avoiding and minimizing direct effects will also serve to reduce indirect

effects. The FHWA/VDOT Preferred Alternative alignment was developed by balancing potential wetland impacts with impacts to other resources, such as residences and businesses, as well as cost. Thus, the primary avoidance measure was shifts out of wetlands where practicable. Modifications to the roadway design were also made as a result of the wetland functional assessment discussed in **Chapter 3**, to shift impacts to the upper portion of the watershed, away from the higher quality wetlands.

Impacts to wetlands will be minimized through a number of measures. The most effective impact minimization effort is shifting a roadway out of wetlands, which was incorporated wherever practicable. Construction of bridges over sensitive wetland areas and streams also serves as an effective avoidance and minimization strategy. Wetlands under a bridge experience a certain amount of impact due to placement of footers, piers or pilings, shading, or temporary construction measures. Hydrologic flow patterns and velocities can be altered to some extent by bridges, which can lead to minor alterations in the adjacent wetland communities; however, the overall impact to wetlands and flow patterns upstream and downstream will be substantially reduced by bridging and maintaining an appropriate hydraulic opening. In areas where bridging is not implemented, adequately sized culverts serve as an effective avoidance and minimization strategy to maintain hydraulic connectivity to wetlands upstream and downstream. Direct wetland impacts have also been reduced through design measures that reduce the footprint of the roadway.

Staging areas will not be located in wetlands and borrow material will not be excavated from wetlands. Additionally, temporary causeways will not be used for bridge construction. These measures will reduce potential for indirect effects. Implementation of strict erosion and sediment control measures during construction will minimize permanent and temporary impacts to wetlands, and thereby indirect effects as well. Additionally, various control measures will be incorporated into the roadway design and maintenance plans to reduce impacts to wetland hydrology and water quality, including stormwater BMPs as a means of mitigating expected impacts to water quality. BMPs also slow the release of stormwater, reducing erosion of wetlands.

While induced development has the potential to impact these wetlands, future development would be required to attain the necessary permits, which would require the implementation of avoidance and minimization measures for potential impacts.

Surface Waters Mitigation

Under the regulatory frame work of the VPDES and Virginia Erosion and Sediment Control and Stormwater Control laws, VDOT will employ stormwater management control features, including use of BMPs during construction and post construction, to minimize temporary and permanent, and direct and indirect effects to surface waters. These BMPs have been proven to be an effective means of capturing and treating highway runoff to remove heavy metals and nutrients. Properly managed BMP's can intercept runoff and store nonpoint pollutants like sediment, nutrients, and certain heavy metals without being degraded. Vegetation also can slow runoff and dissipate its energy and regulates stream temperature by providing streamside shading. In the event of a spill, VDOT will support first responders and emergency management efforts, as necessary, to reduce direct and indirect effects to surface waters.

Although the indirect effects associated with a roadway construction project are generally considered negative effects, a potential positive indirect effect for the 16 miles of improved roadway would be the implementation of water quality BMPs that meet current guidelines. Modern stormwater measures, such as stormwater management ponds, sediment basins, vegetative controls, and other measures would be implemented to capture runoff from Route 460 improvements on both the improved and new alignment

that currently flow into the watershed unabated. These measures would reduce or detain discharge volumes and remove many pollutants, thereby reducing long-term impacts to water quality. Surface runoff from bridges would be collected and treated in stormwater management facilities rather than running directly off the bridges into underlying waters to prevent degradation of surface drinking water supplies.

During construction, VDOT will adhere to standard erosion and sediment control and stormwater measures and the associated required monitoring protocols, as outlined in Chapter 10 of VDOT's Drainage Manual (VDOT, 2012). Examples of control measures that may be considered include sediment traps, sediment basins, and silt fences. Such measures would minimize the indirect effects associated with sediment transport during construction.

Design and construction techniques which reduce water quality impacts and protect aquatic species, as described in the Virginia Stormwater Management BMP Clearinghouse, will be incorporated into the project. Techniques include stabilization of slopes, channels, swales, and embankments after construction activities are completed; minimization of excavation; installation of turbidity barriers around the area of construction; and prohibiting species specific activities during any required time of year restrictions.

VDOT's practice is generally to maintain both water quality and quantity post-development equal to or better than pre-development, as described in the current guidance, Minimum Requirements for the Engineering, Plan Preparation and Implementation of Post Development Stormwater Management Plans (Instructional and Informational Memorandum Number: IIM-LD-195.8, VDOT – Location and Design Division). One of the mitigation measures used to achieve this goal is the implementation of a monitoring program to measure pollutant concentrations at several outfall locations before, during, and after construction. If pollutant levels exceed established thresholds, actions would be taken to mitigate impacts and the affected public would be notified as required. Additional details on the post-construction stormwater management plan would be developed during the design stage of the project. Nevertheless, the plan would be developed in accordance with the most up-to-date federal and state regulations and it is not anticipated that the indirect effects would extend very far downstream from the crossings.

Direct impacts to fish and macroinvertebrates will be avoided or minimized through various project design considerations, such as bridging, without the use of causeways, countersinking of culverts, and minimizing the roadway footprint and median; reducing such direct impacts should also reduce the potential for indirect effects. Bridging without causeways protects the natural stream bottom, minimizing what otherwise could be substantial upstream and downstream effects to hydrologic conditions, and accommodating aquatic organisms. Properly sized culverts will also maintain wetland hydrology upstream and downstream of the crossing. To prevent bottom scour, banks surrounding culverts will be stabilized using riprap. Implementation of roadside ditches through wetlands will be avoided, where practicable, to avoid any drainage impacts to adjacent wetlands. Temporary construction impacts to fish and macroinvertebrates will be minimized through appropriate use of temporary stream crossing structures and strict adherence to erosion and sedimentation controls.

Development in any induced growth areas will be subject to the same erosion and sediment control as described above for the indirect effects study area.

Floodplain Mitigation

The designation of the LOD of the FHWA/VDOT Preferred Alternative was focused on avoiding and minimizing floodplain encroachment to ensure that the FHWA/VDOT Preferred Alternative meets the requirements of EO 11998 and FHWA policy as set forth in 23 CFR 650.

Similar to the bridging of wetlands and streams to minimize impacts, most 100-year floodplains (including 100-year floodplain crossings on the new alignment portion of the FHWA/VDOT Preferred Alternative) were bridged to reduce the indirect effects on floodplains.

The design of the roadway was based on hydraulic and hydrology evaluations to ensure that increases in flood risk to regulated floodplains and impacts to floodplain values would not result from construction. Near-perpendicular crossings of the floodplain will be spanned by bridges or culverts per design criteria outlined in VDOT's highway construction specifications and in keeping with any Federal or state regulatory requirements. Bridge crossings will be constructed using the minimum number of piers to ensure structural stability within floodways. Fill placed within floodplains for bridge abutments will be minimized. All bridges would be constructed without the use of causeways, which will minimize degradation to floodplains. By minimizing direct effects to floodplains through these measures, there should be very little to no indirect effects.

During final design, a detailed hydraulic survey and hydrology study would evaluate the effect of the proposed roadway improvements on stormwater discharge. The hydraulic study will ensure that no substantial increase in downstream flooding will occur. Design modifications to eliminate or minimize encroachments to the extent practicable are required by EO 11988. It should be noted that while the acreage of floodplains within the induced growth areas are much greater than the direct impacts, any development that would occur in these induced growth areas would be subject to the same regulations.

State Wild and Scenic Rivers

The Blackwater River is the only State Wild and Scenic River within the FHWA/VDOT Preferred Alternative indirect effect study area. Mitigation for indirect effects to this feature would be similar to the indirect effects mitigation discussed above in Surface Water Mitigation. Although the degree of impact associated with visual and noise would be negligible, mitigation of these effects was considered. To mitigate for viewshed impacts, material selection and aesthetic treatment may be among the considerations for the Blackwater Bridge. The applicability of noise mitigation was considered; however, the visual impact associated with any potential noise walls would outweigh the reduction in sound levels experienced by users of the river.

Wildlife/Regional Biodiversity Mitigation

The impacts to wildlife expected as a result of the project will be minimized through use of design measures, such as bridging, countersinking culverts, and reducing the roadway footprint and median width. Using bridges for crossings of streams and associated riparian corridors serves to minimize habitat impacts by allowing the natural hydrologic processes to remain largely intact while also providing wildlife crossings. Additionally, culverts would be designed to maintain low-flow channels to minimize aquatic passage obstruction.

Forests with a mid-story shrub layer have been shown to dampen traffic noise substantially, with the dampening effect increasing with distance from the roadway in a near exponential fashion. Potential noise impacts will be minimized by limiting damage to forest stands along the roadway, which also serves to

reduce habitat losses. In addition, temporary impacts will be reduced through proper location and minimization of staging areas and construction access roads in valuable habitats. Development in any induced growth areas will be subject to regulations and standards designed to minimize impacts to aquatic resources.

Threatened and Endangered Species Mitigation

The potential impacts to threatened or endangered species resulting from the project have been avoided and minimized by conducting presence/absence surveys, identifying potential habitat, and incorporating design measures such as bridging, countersinking culverts, and reducing the roadway footprint and median width. In addition, temporary impacts will be further reduced through proper location and minimization of staging areas, construction access roads, and modifying construction techniques in valuable habitats.

VDOT has completed due diligence studies and coordinated with DGIF, DCR, and USFWS. On March 29, 2016, VDOT provided a letter to DGIF outlining species conclusions, avoidance and minimization measures, and proposed conservation measures. In an email dated April 20, 2016, DGIF provided concurrence with VDOT's survey results and proposed conservation measures.

On March 29, 2016 VDOT provided a letter to USFWS outlining species conclusions, avoidance and minimization measures, and proposed conservation measures. In an email dated April 12, 2016, USFWS recommended that VDOT re-coordinate the project under the northern long-eared bat final 4(d) rule which was promulgated on February 16, 2016. VDOT re-coordinated the project using the USFWS' online IPaC database. Re-coordination through IPaC resulted in findings of "no effect" for red-cockaded woodpecker, "may affect, not likely to adversely affect" for northern long-eared bat, "no effect" for critical habitat, and "no Eagle Act permit required." On April 24, 2016 VDOT transmitted an April 20, 2016 Self-Certification Letter and Project Review Package to USFWS.

USFWS typically does not respond to Self-Certification Letters since the certification letter is USFWS' official response. However, if USFWS has additional questions or does not concur with project determinations, USFWS will contact VDOT during the 30-day review period. Because USFWS did not respond to VDOT's Self-Certification Letter within the 30-day review period, the Self-Certification Letter and the Project Review Package, complete the review of this project in accordance with the Endangered Species Act of 1973 (16 U.S.C. . 1531-1544, 87 Stat. 884), as amended, and the Bald and Golden Eagle Protection Act (16 U.S.C. 668—6680, 54 Stat. 250), as amended.

As a result of the implementation of the aforementioned conservation measures, coordination, and due diligence, no further action or coordination with USFWS, DGIF, or DCR is required.

Historic Resources Mitigation

While historic resources could experience increased noise and traffic, the effects would not be substantial. Therefore, no mitigation is proposed.

Recreational Resource Mitigation

The NSA fields will be impacted by noise. Noise barriers were considered for both sides of the roadway that would pass between the fields, and both were determined to be feasible and reasonable and are recommended. These barriers would be re-assessed during the final design noise analysis. No other recreational resources would require mitigation.

4.2.9 SUMMARY

The centerline of the alignment was located to avoid and minimize impacts to important resources, including both socioeconomic and natural resources. Beyond this effort, further mitigation strategies have been included in this NEPA analysis, which have focused on those impacts that are anticipated. Consideration has been given to avoiding, minimizing, and mitigating reasonably foreseeable indirect effects during design, and will be for construction activities. Should future induced growth and development in the vicinity of the FHWA/VDOT Preferred Alternative impact regulated waters and wetlands, each development project would require review, approval, and/or permits. During the review of any proposed development in waters and wetlands, regulatory agencies would require consideration of avoidance and minimization measures and compensatory mitigation to offset impacts to wetlands and streams, and other regulated natural resources.

Because all roadway crossings would utilize structures designed to adequately pass design floods and accommodate passage of aquatic organisms, and the roadway project would incorporate stormwater BMPs to mitigate pollutant runoff, it is not anticipated that the indirect effects to natural resources would be extensive or extend very far up or downstream from the crossings or in adjacent areas.

4.3 CUMULATIVE IMPACTS ANALYSIS

The goal of the cumulative impacts analysis is to assess the incremental impact of the transportation project in combination with past, present, and reasonably foreseeable future actions in order to consider and inform decision-makers on the contribution of a specific project to the overall long-term changes in characteristics and trends of an area's natural and manmade environment. Not all of the resources directly impacted by a project require a cumulative impact analysis. The resources subject to a cumulative impact assessment are determined based on the specifics of the project being evaluated (FHWA, 2014). The methodology and outcome of the cumulative impacts analysis for this project are outlined below.

4.3.1 Methodology

In determining cumulative impacts for this study, the analysis followed the three-part evaluation process outlined in the CEQ's *Considering Cumulative Effects under the National Environmental Policy Act* (CEQ, 1997):

1. Scoping
2. Describe the Affected Environment
3. Determine Environmental Consequences

FHWA and USACE agreed to use the CEQ approach to cumulative impact analysis in order to align with CEQ regulations and guidance and because it is broad enough to cover both agencies' requirements. **Section 4.2.1** of this report describes the process by which indirect effects were analyzed. Much of the methodology described in that section applies to the analysis of cumulative impacts with regard to resource topics and study areas.

The CEQ regulations define a cumulative impact 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 impacts also can be illustrated as "X+Y=Z". In this equation, "X" is the impact of the proposed alternative. These impacts are thoroughly documented in this SEIS and respective technical reports and

summarized in **Table 4.3-6**. "Y" is the collective impact of all the past, present, and reasonably foreseeable future actions, except this project. Finally, "Z" is the total cumulative impact (CEQ, 1997). The X+Y=Z method is used to describe cumulative impacts in this assessment.

The level of data available for historic and current actions prevented meaningful analysis of environmental justice and recreational resources.

4.3.2 Scoping

4.3.2.1 Assessment Goals

Scoping has been underway periodically for this study since 2003. A description of the scoping efforts performed to date is included in **Step 1** of the Indirect Effects analysis. Information obtained through the scoping process was used to establish the geographic and timeframe boundaries for cumulative impacts and to identify past, present, and reasonably foreseeable future actions.

4.3.2.2 Study Area Boundaries and Geographic Scope

The study areas described in **Section 4.2.3** for the analysis of indirect effects also are used in this analysis of cumulative impacts.

4.3.2.3 Timeframe Boundaries

The analysis of cumulative impacts must consider past, present, and reasonably foreseeable future actions. The temporal boundary used to establish the timeframe for this cumulative impacts assessment spans the construction of the Norfolk and Petersburg Railroad in the 1850s to the year 2040, which is the modeled design year for the FHWA/VDOT Preferred Alternative and this SEIS. The construction of the railroad is used as a temporal boundary because it served to shape the current land use and development of the study area. The modeled design year is used as a temporal boundary because it is the future year to which the facility is being designed and represents a reasonable timeframe to foresee future actions. Within this timeframe, qualitative analyses were conducted. Quantitative analyses were also used but are limited based on the availability of data for the study area and variability by resource.

4.3.2.4 Interagency and Public Coordination

Interagency and public coordination has been underway periodically for this study since 2003. A description of the coordination efforts performed to date is included in **Section 4.2.2**. Each local government was interviewed by the study team in early 2014. Questions related to cumulative impacts were included in the interview process. Specifically, localities were asked to provide information about past, present, and future actions.

4.3.2.5 Past, Present, and Reasonably Foreseeable Future Actions

Past Actions

Historic development described in **Section 4.2.3** provides an overview of the historic actions that contributed to cumulative impacts. More recent past actions were identified through the review of localities' planning documents and interviews with local officials. As discussed in **Section 4.2.3**, development in the region has been limited over the last 50 years. In addition to a low rate of development, much of the development in the region occurred before local planning documents were regularly updated to account for these developments. Therefore, there is limited specific information available about past projects and their impacts for consideration in the cumulative impacts analysis.

Past actions focused on the development of the towns, agricultural activities, and forestry. **Table 4.3-1** lists the year that each of the towns within the study area was founded. The impacts associated with the development of these towns, along with other past actions are described in **Section 4.3.4.2**.

Table 4.3-1: History of Towns Established within the Study Area

Towns	Year of Incorporation or Establishment
Zuni	1700
Disputanta	1864
Waverly	1879
Wakefield	1902
Windsor	1902
Ivor	1908

The more prominent recorded past projects identified by local governments since the establishment of the towns are included in **Table 4.3-2**.

Table 4.3-2: Past Projects within the Study Area

Project Name	Location	Project Description	Status
Atlantic Waste Landfill	Sussex	Landfill	Constructed
Sussex County Mega Industrial Park	Sussex	Industrial Park	Partially Constructed
Southpoint Business Park	Prince George	Industrial Park	Constructed
Crosspointe Centre	Prince George	Industrial Park	Constructed
Curtis Contracting Asphalt Plant	Southampton	Asphalt Plant	Constructed
County trash collection site	Southampton	Public Service	Constructed
Crop Production Services	Southampton	Seed/Fertilizer Facility	Constructed
Virginia Regional Commerce Park	Suffolk	Industrial Park	Constructed
Shirley T. Holland Intermodal Park	Isle of Wight	Industrial Park	Constructed
Route 460	Study Area	Transportation	Constructed
Norfolk and Petersburg Railroad	Study Area	Transportation	Constructed

Source: Local Government Interviews

The development of the area over the past 400 years has altered the landscape and the ecosystems. Old growth forests and any associated wetlands were removed for timbering and land development. As described in **Section 4.2.3**, a review of aerial photography from 1937 (the earliest aerial photography available) confirms that the lumber industry had dramatically altered the previously forested landscape; the photographs depict an environment that is a patchwork of farms surrounded by scrub and wetlands with little forest cover and substantial amounts of open space.

Aerial images also indicate that the presence of wetlands and waterways decreased from 1937 to 1954, possibly due to land reclamation efforts to create new farmlands in the vicinity of the City of Suffolk. Moving forward to recent aerials, new residential and industrial development show further reductions in wetland vegetation.

One means of documenting impacts from the past is through the permits issued by USACE. USACE maintains a database of permitted impacts in Virginia. The database includes the following information for

the two major subbasins in the study area, where impacts from the FHWA/VDOT Preferred Alternative would occur, from 1999 through 2015 (all data are incomplete but represent the best available information):

Blackwater River subbasin (HUC 03010202)

- Total permits issued: 179
- Total linear feet of stream impacts authorized: 3091
- Total acres of fill authorized (mostly wetlands): 95.92

Hampton Roads subbasin (HUC 02080208)

- Total permits issued: 3,142
- Total linear feet of stream impacts authorized: 53,551
- Total acres of fill authorized (mostly wetlands): 146.6

Present and Reasonably Foreseeable Actions

In addition to the past actions described above, there are a number of development activities and actions that are occurring and/or are planned to occur that could contribute to cumulative impacts on resources affected by the proposed project as described below.

In addition to the FHWA/VDOT Preferred Alternative under consideration in this Final SEIS, there are numerous, smaller VDOT actions planned within the study area. These can be found in VDOT's Six-Year Improvement Program (SYIP). The Hampton Roads District of the SYIP identifies seven roadway improvement projects including drainage improvements to Route 460. The Richmond District of the SYIP identifies five projects. The SYIP does not identify any projects located within Sussex or Southampton Counties. In addition, both the Tri-Cities Metropolitan Planning Organization (MPO) and the Hampton Roads Transportation Planning Organization (HRTPO) have produced Constrained Long Range Plans that identify improvements proposed to be funded for construction within the study area over the next 20 years. Projects in these planning documents are treated as reasonably foreseeable actions because future construction funds have been set aside for them in the planning process. One of these planned projects is located within the study area – acceleration lanes on I-295. **Table 4.3-3** lists all of the present and reasonably foreseeable future transportation projects within the study area. For the most part, all of these improvements would occur within an existing, already disturbed corridor and would be expected to contribute minimally to cumulative impacts to the resources being evaluated.

Interviews with local planning officials were conducted as part of the SEIS process and review of local comprehensive plans revealed that there are very few development projects planned within the study area. Much of the local governments' plans include upgrades to existing utilities, community facilities, and other infrastructure. The impacts associated with most of these projects are not expected to be significant. The few projects that are included in local planning documents are shown in **Table 4.3-3**.

As noted above in **Section 4.2.3**, timber harvesting has been a major part of the regional economy. The Virginia Department of Forestry reports that there are 53,360 acres of forest land within the study area. Timber harvesting is expected to continue in the future, though the volume and frequency may decline in response to more sustainable forestry practices. Similarly, despite changes in the regional economy over the last few decades, agricultural practices are expected to continue in the future. This commitment to agriculture is illustrated by the 398,840 acres within the study area that are zoned for agriculture. Like timber harvesting, farming activities may decrease and be altered by sustainable farming practices.

Table 4.3-3: Present and Reasonably Foreseeable Future Transportation Projects within the Study Area

Locality	VDOT UPC	Description
Prince George	100499	Construction of added left turn lane on westbound Route 460 at Enterprise Drive (Route 657).
	82849	Construction of added left turn lanes on northbound Bull Hill Road (Route 630) onto Route 460 in Prince George County.
	105110	Construction of right turn lanes on Courthouse Road (Route 106) at its intersection with Prince George Drive (Route 616).
	104847	Construction of added left turn lane on Route 156.
	Included in Tri-Cities MPO Plan	I-295 northbound acceleration lanes – Southpoint Business Park.
Surry	107529	Improvements to Route 627 by widening, improving the drainage, and straightening the roadway.
Sussex	N/A	No projects listed.
Southampton	N/A	No projects listed.
Isle of Wight	58297	Construction of added left and right turn lanes on Courthouse Highway (Route 258) at its intersection with Scotts Factory Road (Route 620).
	103021	Construct a right turn lane on Turner Drive (Route 644) at the intersection with Benns Church Boulevard (Route 10/32).
Suffolk	104333	Improvements to drainage and stormwater management facilities along Pruden Boulevard (Route 460).
	102994	Intelligent transportation system (ITS) improvements to 11.6 miles of the Suffolk Bypass (Route 58) from the City of Chesapeake to Holland Road.
	100937	Reconstruction with added capacity on Route 58/Holland Road between the Route 58/13/32 bypass to just west of Manning Bridge Road.
	102998	Suffolk Bypass Off-Ramp intersection improvements at Godwin Boulevard. Construct second exclusive right turn lane and traffic signal improvements.
	104332	Improvements to the intersection of Godwin Boulevard (Route 10) and Kings Highway (Route 125).

** Hampton Road Transportation Fund (HRTF) Projects, per HRTPO Resolution 2013-09, October 17, 2013*
Sources: Hampton Roads 2040 Long Range Transportation Plan: Committed and Candidate Transportation Projects, September 2014; Tri-Cities MPO 2035 Long Range Transportation Plan; Virginia Department of Transportation FY 2016 Draft SYIP.

In addition to these planned actions by state and local governments and the continuation of timber and farming practices, it is anticipated that private development on a limited scale would continue in the future. It is difficult to accurately predict future private development, especially in a region where there are limited data available to identify trends or patterns. If the FHWA/VDOT Preferred Alternative is implemented, future private development would most likely occur in the areas of induced growth discussed in **Section 4.2.7**. Potential future private development is likely to occur in the commerce parks listed in **Table 4.3-4**. One such area is the Shirley T. Holland Intermodal Park located in the induced growth study area east of Windsor. As stated in the Isle of Wight County Comprehensive Plan, "sewer availability together with adequate transportation service capacity via State Route 460 suggest some level of development activity can be expected in this area. Areas along the Route 460 corridor and Norfolk and Southern rail line have strong potential for future industrial development. The Shirley T. Holland Intermodal Park, located east of the Town, has been established as one such location for business development" (Isle of Wight County, 2008).

Table 4.3-4: Reasonably Foreseeable Future Projects Sponsored by Local Governments

Project Name	Project Type	Project Description
Old Dominion Cypress Creek Powerstation – Sussex	Facility	Construct a new coal fired power plant
Cabin Point Planned Unit Development – Sussex	Residential	Approved Planned Unit Development
Drumwright Mill – Isle of Wight	Residential	Approved Planned Unit Development
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
Pruden Boulevard Route 460 Fire Station – Suffolk	Facilities	Construct 3 bay fire station
Intermodal Park Phase II and III – Isle of Wight	Facilities	Expand existing Shirley T. Holland industrial park
Pines of Ivor – Southampton	Residential	Subdivision
Cabin Point Industrial Park – Sussex	Facilities	Industrial Park

Sources: County of Prince George FY 2014-2018 Capital Improvements Plan, 2013; Capital Improvements Plan, FY 2014-2023, City of Suffolk, VA; Isle of Wight County Capital Improvement Plan, FY 2014=2018, 2014.

As noted in **Section 4.2.3** of the indirect effects analysis, a key factor in facilitating future development would be the placement of new utilities by local governments. It is unknown to what degree the extensive wetlands in the region may affect some of the planned development.

4.3.3 Describe Affected Environment

The purpose of this section is to characterize the resources within the study area and the stresses affecting these resources, as well as to define a baseline condition for these resources (CEQ, 1997).

4.3.3.1 Characterize the Resources within the Study Area

The condition of resources within the study area was described in **Section 4.2.4**; those descriptions are used for this analysis.

4.3.3.2 Characterize the Stresses Affecting these Resources

The next step in the CEQ process is characterizing the relationship between human activities and the resources. **Table 4.3-5** displays the resource topics that have been or may be affected by the actions listed in **Table 4.3-3** and **Table 4.3-4**.

Most of the stresses placed on these resources in the study area came from past actions not included in the table above. The historic development of the region is most represented by the extensive levels of forestry and farming that have occurred. The landscape first experienced by the European colonists has been transformed into a landscape that scarcely represents the old growth forests that they encountered. More recently, tree plantings and natural regrowth have reshaped the region's forest environment to what it is today. The existing forest resources in the study area continue to be impacted by limited levels of development and ongoing forestry activities. Although timber harvesting in the region has declined, forest loss across the state continues to be an issue. The Virginia Department of Forestry (DOF) reports that statewide it is able to conserve approximately 3,000 acres of forest land for every 16,000 acres that are lost.

Urbanization, development, and associated municipal infrastructure represent the greatest factors in this forestland deficit (DOF, personal communication).

Table 4.3-5: Human Activities with Potential Cumulative impacts on Identified Resources

Project Name	Project Type	Impact Description
Atlantic Waste Landfill	Existing	Socioeconomics and Land Use, Wildlife, Threatened and Endangered Species, Waters, Wetlands, and Water Quality
Sussex County Mega Industrial Park	Existing	Socioeconomics and Land Use, Wildlife, Threatened and Endangered Species, Waters, Wetlands, and Water Quality
Southpoint Business Park	Existing	Socioeconomics and Land Use, Wildlife, Threatened and Endangered Species, Waters, Wetlands, and Water Quality
Crosspointe Centre	Existing	Socioeconomics and Land Use, Wildlife, Threatened and Endangered Species, Waters, Wetlands, and Water Quality
Curtis Contracting Asphalt Plant	Existing	Socioeconomics and Land Use, Wildlife, Threatened and Endangered Species, Waters, Wetlands, and Water Quality
County trash collection site	Existing	Socioeconomics and Land Use, Wildlife, Threatened and Endangered Species, Waters, Wetlands, and Water Quality
Crop Production Services	Existing	Socioeconomics and Land Use, Wildlife, Threatened and Endangered Species, Waters, Wetlands, and Water Quality
Virginia Regional Commerce Park	Existing	Socioeconomics and Land Use, Wildlife, Threatened and Endangered Species, Waters, Wetlands, and Water Quality
Shirley T. Holland Intermodal Park	Existing	Socioeconomics and Land Use, Wildlife, Threatened and Endangered Species, Waters, Wetlands, and Water Quality
Route 460	Existing	Socioeconomics and Land Use, Wildlife, Threatened and Endangered Species, Floodplains, State Wild and Scenic Rivers, Waters, Wetlands, and Water Quality, Historic Properties, Recreational Resources
Norfolk and Petersburg Railroad	Existing	Socioeconomics and Land Use, Wildlife, Threatened and Endangered Species, Floodplains, State Wild and Scenic Rivers, Waters, Wetlands, and Water Quality, Historic Properties, Recreational Resources
Construction of added left turn lane on westbound Route 460 at Enterprise Drive (Route 657).	Planned	Socioeconomics and Land Use, Wildlife, Threatened and Endangered Species, Waters, Wetlands, and Water Quality
Construction of added left turn lanes on northbound Bull Hill Road (Route 630) onto Route 460	Planned	Socioeconomics and Land Use, Wildlife, Threatened and Endangered Species, Waters, Wetlands, and Water Quality, Historic Properties
Construction of right turn lanes on Courthouse Road (Route 106) at its intersection with Prince George Drive (Route 616).	Planned	Socioeconomics and Land Use, Wildlife, Threatened and Endangered Species, Waters, Wetlands, and Water Quality, Historic Properties
Construction of added left turn lane on Route 156.	Planned	Socioeconomics and Land Use, Wildlife, Threatened and Endangered Species, Floodplains, Waters, Wetlands, and Water Quality
I-295 acceleration lane	Planned	Socioeconomics and Land Use, Wildlife, Threatened and Endangered Species, Waters, Wetlands, and Water Quality
Improvements to Route 627 by widening, improving the drainage, and straightening the roadway.	Planned	Socioeconomics and Land Use, Wildlife, Threatened and Endangered Species, Floodplains, Waters, Wetlands, and Water Quality

Project Name	Project Type	Impact Description
Construction of added left and right turn lanes on Courthouse Highway (Route 258) at its intersection with Scotts Factory Road (Route 620).	Planned	Socioeconomics and Land Use, Wildlife, Threatened and Endangered Species, Waters, Wetlands, and Water Quality, Historic Properties
Construct a right turn lane on Turner Drive (Route 644) at the intersection with Benns Church Boulevard (Route 10/32).	Planned	Socioeconomics and Land Use, Wildlife, Threatened and Endangered Species, Waters, Wetlands, and Water Quality
Improvements to drainage and stormwater management facilities along Pruden Boulevard (Route 460).	Planned	Socioeconomics and Land Use, Wildlife, Threatened and Endangered Species, Floodplains, Waters, Wetlands, and Water Quality, Historic Properties
Intelligent transportation system (ITS) improvements to 11.6 miles of the Suffolk Bypass (Route 58) from the City of Chesapeake to Holland Road.	Planned	Socioeconomics and Land Use, Wildlife, Threatened and Endangered Species, Floodplains, Waters, Wetlands, and Water Quality, Recreational Resources
Reconstruction with added capacity on Route 58/Holland Road between the Route 58/13/32 bypass to just west of Manning Bridge	Planned	Socioeconomics and Land Use, Wildlife, Threatened and Endangered Species, Floodplains, Waters, Wetlands, and Water Quality, Historic Properties
Suffolk Bypass Off-Ramp intersection improvements at Godwin Boulevard. Construct second exclusive right turn lane and traffic signal improvements.	Planned	Socioeconomics and Land Use, Wildlife, Threatened and Endangered Species, Waters, Wetlands, and Water Quality, Recreational Resources
Improvements to the intersection of Godwin Boulevard (Route 10) and Kings Highway (Route 125).	Planned	Socioeconomics and Land Use, Wildlife, Threatened and Endangered Species, Floodplains, Waters, Wetlands, and Water Quality, Historic Properties
Old Dominion Cypress Creek Powerstation – Sussex	Planned	Socioeconomics and Land Use, Wildlife, Threatened and Endangered Species, Floodplains, State Wild and Scenic Rivers, Waters, Wetlands, and Water Quality, Historic Properties, Recreational Resources
Cabin Point Planned Unit Development – Sussex	Planned	Socioeconomics and Land Use, Wildlife, Threatened and Endangered Species, Floodplains, Waters, Wetlands, and Water Quality, Historic Properties, Recreational Resources
Drumwright Mill – Isle of Wight	Planned	Socioeconomics and Land Use, Wildlife, Threatened and Endangered Species, Floodplains, Waters, Wetlands, and Water Quality, Historic Properties, Recreational Resources
Water Source Development and Water Treatment Expansion – Suffolk	Planned	Socioeconomics and Land Use, Wildlife, Threatened and Endangered Species, Floodplains, Waters, Wetlands, and Water Quality
Sanitary Sewer System Upgrades – Suffolk	Planned	Socioeconomics and Land Use, Wildlife, Threatened and Endangered Species, Floodplains, Waters, Wetlands, and Water Quality
Pruden Boulevard Route 460 Fire Station – Suffolk	Planned	Socioeconomics and Land Use, Wildlife, Threatened and Endangered Species, Floodplains, Waters, Wetlands, and Water Quality
Intermodal Park Phase II and III – Isle of Wight	Planned	Socioeconomics and Land Use, Wildlife, Threatened and Endangered Species, Waters, Wetlands, and Water Quality

Project Name	Project Type	Impact Description
Pines of Ivor – Southampton	Planned	Socioeconomics and Land Use, Wildlife, Threatened and Endangered Species, Floodplains, Waters, Wetlands and Water Quality, Waters, Wetlands, and Water Quality
Cabin Point Industrial Park – Sussex	Planned	Socioeconomics and Land Use, Wildlife, Threatened and Endangered Species, Waters, Wetlands, and Water Quality

The lack of urbanized areas within the study area suggests that forest loss may not be occurring at this rate; however, the amount of modern day forest loss in the study area is minor compared to the impacts that occurred during European settlement.

Farming has had similar impacts on resources within the study area. Farming activities required land clearing similar to forestry. Once cleared, these lands were manipulated with drainage ditches, ponds, nonnative plantings, and chemicals to maintain these manipulated conditions. These agricultural practices and the associated runoff from agricultural fields have, historically, had a significant impact on the water quality resources. Although there have been reductions in the intensity of farming in the study area, much of the previously developed farmlands are maintained as such today.

These past actions have served as the greatest stresses to the resources in the study area, far exceeding any of the impacts associated with the activities listed in **Table 4.3-2**. The presence of impaired waters and threatened and endangered species within the study area are both indicators that these resources have been greatly impacted by past actions and could be sensitive to future impacts. There are not enough data on resources within the study area to accurately quantify the impacts of those past actions. The socioeconomic trends discussed in **Section 4.2.4,** the historical background provided in **Section 4.2.3**, and the previous discussion of forestry and farming impacts establish overall development trends in the region that affected these resources.

4.3.3.3 Define the Baseline Condition

The final step in describing the affected environment is defining the baseline condition to which the incremental effects of the proposed project will be added. The baseline condition considers how conditions have changed over time and how they are likely to change in the future without the proposed action. For the purposes of this analysis, the environmental baseline includes the current condition of the resources referenced in **Section 4.3.4.1**. The natural, physical, and cultural resources within the study area have been manipulated and impacted by forestry, farming, and all of the other past and present actions discussed above. Furthermore, it is assumed that this baseline would be further impacted by all of the reasonably foreseeable future actions identified in **Section 4.3.3**. All of these past, present, and reasonably foreseeable actions play a role in establishing the environmental baseline.

4.3.4 Determine Environmental Consequences

The purpose of this section is to identify the important cause-and-effect relationships between human activities and resources, determine the magnitude and significance of cumulative impacts, and discuss monitoring of cumulative impacts. In order to conduct this analysis, the resources and actions that will be considered have been defined, as described in **Sections 4.2.3** and **4.3.2**. To conduct the cumulative impacts analysis, the resource topics listed in **Section 4.2.3** were reviewed. In most cases, these resources warranted analysis with regard to cumulative impacts. The level of quantifiable data available for past and present

actions prevented meaningful analysis of environmental justice and recreational resources. Therefore, the cumulative impacts analysis focuses on Socioeconomic Resources and Land Use, Natural Resources, and Historic Properties.

The actions considered for this analysis include the past, present, and reasonably foreseeable future actions listed in **Section 4.3.3**, as well as the historic forestry and farming practices that predate the cumulative impacts study timeframe that began in the 1850s. These actions form the baseline to which the incremental effects of the proposed action will be added to determine the cumulative impacts.

The FHWA/VDOT Preferred Alternative consists of 16 miles of improvements and another 36 miles of No Build status quo conditions. Cumulative impacts are not anticipated for the 36-mile No Build segment of the FHWA/VDOT Preferred Alternative.

4.3.4.1 Identify the Important Cause-and-Effect Relationships

The limited level of data available to document resources in the study area prevents detailed analysis on the cause-and-effect relationships between human activities and resource conditions in the study area. CEQ guidance states that when such data are not available, qualitative evaluation procedures may be used. **Table 4.3-6** is based on an example provided by the CEQ for qualitatively evaluating relative effects. It is presented in the X+Y=Z format discussed in the methodology section of this Chapter (CEQ, 1997).

Table 4.3-6: Relative Cumulative impacts

Resource	Proposed Action/ Alternative (X)		Past Actions (Y)	Present Actions (Y)	Reasonably Foreseeable Future Actions (Y)	Cumulative Impact (Z)
Socioeconomic Resources and Land Use						
Social	No Build	No change in conditions leading to limited growth and/or possible loss of population.	Development of communities and towns based on the location of forestry and agricultural employment, transportation facilities, and improved accessibility within and outside of these developments. Development followed a corridor along the railroad, and later along Route 460. Although historic Environmental Justice data are not available for the study area, an analysis of the region shows that new development was often sited so the low income and minority populations would bear the majority of the impacts, often including displacement, access to job type, and availability of jobs – it is likely that the study area communities experienced similar impacts.	Limited growth and/or possible loss of population due to decreasing employment and small scale investment opportunities. Environmental Justice populations were displaced and relocated due to regional improvements and likely moved to areas where land was cheaper.	Limited growth and/or possible loss of population due to decreasing employment and small scale investment opportunities. Commerce parks and industrial parks under development may increase the availability of jobs in the region and encourage relocation of families to reside along the Route 460 corridor. Environmental Justice populations will be fairly compensated for any displacements and steps will be taken to reasonably minimize impacts to these communities.	Prior to and following the construction of the railroad, residents of the study area have depended on agriculture and forestry. Communities that developed along the railroad continue today, with limited growth in the present or expected in the near future.
	FHWA/VDOT Preferred Alternative	Improved access through the region and the diversion of heavy truck traffic from Windsor's main thoroughfare could attract people, jobs, and investment in the region. Some may voluntarily relocate as a result of the change in the community. Economic development may slow in downtown Windsor compared to other municipalities along Route 460 as a result of the bypass. On the other hand, economic development may improve in Windsor with the reduction in traffic, particularly large trucks, through town, and improved access to Suffolk. Economic development may improve in Zuni with improved roadway for drivers and sidewalks for pedestrians. Environmental Justice populations exist within the study area and will be disproportionately impacted by the project because historically such disproportionate impacts were common in the Commonwealth and in the region.					Prior to and following the construction of the railroad, residents of the study area have depended on agriculture and forestry. Communities that developed along the railroad continue today, with limited growth in the present or expected in the near future. Improvements in accessibility in the region could result in limited population increases and possible shifts in growth patterns, as well as employment opportunities, particularly in designated growth areas, which overlap with induced growth areas. Limited additional effects to communities are expected. Environmental Justice populations may move out of the region.
Community Resources	No Build	No change in community resources or environments.	Development of communities and community resources generally followed a corridor along the railroad, and then Route 460. The character of these communities has remained rooted in forestry and agricultural activities. Vehicular traffic along Route 460 has increased based on regional growth.	Zuni and Windsor are key communities along Route 460, providing businesses and residential areas to create a community. Kings Fork is a community in the rapidly developing City of Suffolk and is not distinguished by undeveloped land surrounding its boundaries creating a more enclosed community like Zuni and Windsor.	Limited change in current community character and resources. Route 460 continues to be a dominating presence in the local communities. New community resources, such as schools or public safety facilities, may be necessary as these resources reach the end of their useful life or to address evolving modern standards, rather than as a result of population growth straining the capacity of the facilities.	The character of the Route 460 corridor has historically been and continues to be strongly influenced by agriculture, forestry, and the presence of the railroad. Cumulative impacts result in limited change in current community character and resources. Route 460 continues to be a dominating presence in the local communities, though unaddressed traffic along the route may deter drivers from using the corridor and utilizing community resources.
	FHWA/VDOT Preferred Alternative	Transportation improvements would occur in downtown Zuni. Some may perceive this change to represent safety and access improvements that would lead to improved community conditions. The inclusion of sidewalks in Zuni will create a more comfortable atmosphere for pedestrians and may improve community perceptions. Others may				The character of the Route 460 corridor has historically been and continues to be strongly influenced by agriculture, forestry, and the presence of the railroad. Cumulative impacts result in limited change in current community character and resources in Zuni and westward,

Resource	Proposed Action/ Alternative (X)		Past Actions (Y)	Present Actions (Y)	Reasonably Foreseeable Future Actions (Y)	Cumulative Impact (Z)
		see the improved road as a greater interference to the rural atmosphere. Transportation improvements that bypass Windsor would divert truck traffic from the downtown, improving traffic conditions and accessibility in the downtown for current residents. This change could serve as a benefit to preserving the small town character, but may also inhibit growth or reduce use of local establishments somewhat in the downtown area.				where Route 460 continues to be a dominating presence in the local communities; additional vehicle traffic on the old Route 460 traveling to or from the improved Route 460 section may increase usage of community resources. East of Zuni where the improved Route 460 departs from the existing Route 460, reduced vehicle traffic will likely lead to greater community cohesion, but may also result in decreased use of some local businesses that are more dependent on through traffic.
Economic	No Build	No change in conditions leading to limited growth and/or investment.	Intensive investment in forestry-and agricultural-based economy formed the basis for economic prosperity; associated development sprung up in response to serve the needs of the workers. Communities that developed in the corridor have their origins in that natural resource-based economy. Recent past actions have had limited impact on the economy and of development in the communities.	Limited growth and investment in the study area, mainly concentrated in Windsor and in the King's Fork area of Suffolk around the Route 58 interchange.	Limited growth and investment in the study area, primarily confined to those locally designated growth areas and commerce parks/industry parks. Commerce parks and industrial parks under development may increase the availability of jobs in the region and encourage relocation of families to reside along the Route 460 corridor.	Continued trend of limited employment and investment growth opportunities in the region, concentrated around Suffolk.
	FHWA/VDOT Preferred Alternative	Some potential for induced growth, particularly around the new interchanges/intersection. This new development could attract jobs and investment in the region at the outskirts of the current economic centers and could spur limited economic revitalization and infill in downtown Zuni. There also would be property takings and limited changes to tax revenue. The bypass of downtown Windsor and King's Fork may slow economic development along the Route 460 corridor where traffic has been an issue; on the other hand, improved traffic conditions may make Windsor and King's Fork an appealing, affordable alternative compared to more congested areas.				Transportation improvements and reduced roadway congestion in the Build section of the FHWA/VDOT Preferred Alternative may attract through traffic and destination traffic to the Route 460 corridor, thereby increasing the potential for increased investment in the provision of associated services and economic development in the region. Any remaining businesses in the forestry and agricultural industries may benefit from improved east-west access to and from the ports. New and developing commerce parks may become more attractive for tenants and employees alike from easier access from residential areas of Suffolk.
Land Use	No Build	No change in existing land use.	Historically, the focus on land use has been to support forestry and farming, with little advancement of other land uses. As the forestry and agricultural based economy has declined, localities have used other land use classifications to stimulate growth and investment in the region such as the inclusion of designated growth areas in comprehensive land use plans and the development of industry/commerce parks.	In the absence of measurable transportation improvements and limited growth in forestry and agriculture markets, localities have continued focus on industrial parks and applying other land use classifications in an effort to stimulate growth and investment in the region,	Limited growth and investment in the study area, primarily confined to those locally designated growth areas and commerce parks/industry parks.	In the absence of an upswing in the forestry and agriculture markets, land use classifications would continue to diversify along the Route 460 corridor and feeder roads to stimulate growth and investment in the region. Intensification of uses would occur predominantly in designated development districts.

Resource	Proposed Action/ Alternative (X)		Past Actions (Y)	Present Actions (Y)	Reasonably Foreseeable Future Actions (Y)	Cumulative Impact (Z)
	FHWA/VDOT Preferred Alternative	Property takings for the road's construction could result in changes to land use. In some cases property owners may voluntarily leave the area; in other cases, growth that capitalizes on existing land uses may occur. Land use changes from induced growth could be viewed as positive or negative. Changes could include expanded growth in designated growth areas. Infill will likely be most pronounced around the interchanges in Windsor and Suffolk. Induced growth may also lead a given locality to update its land use plans.	Subdivisions have also increased in the past two decades in the King's Fork area to address housing needs for the City of Suffolk, as well as in the Windsor area, to the north of Route 460.	particularly in Windsor and Suffolk.		In the absence of an upswing in the forestry and agriculture markets, land use classifications would continue to diversify along the Route 460 corridor and feeder roads to stimulate growth and investment in the region. Intensification of uses would occur predominantly in designated development districts and induced growth areas of the FHWA/VDOT Preferred Alternative. East of Zuni, land uses would likely intensify more quickly around the intersections/ interchanges of the new Route 460, including just to the east and the west of downtown Windsor. Downtown Windsor's designated growth area, on the other hand, may intensify more slowly due to traffic bypassing the downtown on the new Route 460. The greatest intensification of land use would likely occur in the King's Fork area as a result of past development, designated growth areas, proximity to central Suffolk, and the new Route 460 interchange.
Natural Resources						
Waters, Wetlands, and Water Quality	No Build	There would be no new impacts.	Historical land use included conversion (draining through ditches, drain tiles, and other methods) of significant acres of wetlands and direct impacts to streams from forestry and farming activities which cleared and filled wetlands. Past land use activities that pre-date current water quality regulations resulted in significant sediment and nutrient runoff from farming and logging practices. Wetlands, including high value bottomlands and swamps, were likely impounded in many areas, to provide a water source for silvicultural and agricultural uses. This impoundment would likely have reduced the wetland's ability to cycle nutrients, remove and sequester elements and compounds, retain particulates, export organic carbon, maintain	Continued runoff from existing farming activities, along with potential erosion and runoff from forestry practices. Limited development may impact the resource. Public transportation projects would be the only action likely to impact bottomland swamps due to difficulty of construction in these habitats and difficulty of obtaining authorization to impact this resource. New development accompanied by stormwater management facilities to reduce impact to previously disturbed environment.	Continued runoff from existing farming activities, along with potential erosion and runoff from forestry practices. Limited development may impact the resources. Public transportation projects would be the only action likely to impact bottomland swamps due to difficulty of construction in these habitats and difficulty of obtaining authorization to impact this resource. New development accompanied by stormwater management facilities to reduce impact to previously disturbed environment.	Farming and logging practices have already impacted water quality in the area. Continued runoff would likely occur from existing and future farming and logging activities, along with potential erosion. Conversion of wetlands either through draining or impoundment eliminates the functions that they provide (as noted in past actions), which serve to treat the runoff prior to it entering the entering the surface waters. The loss of lower value, previously impacted wetlands under agricultural and silviculture operations, could occur with new residential, commercial, or industrial development.

Resource	Proposed Action/ Alternative (X)		Past Actions (Y)	Present Actions (Y)	Reasonably Foreseeable Future Actions (Y)	Cumulative Impact (Z)
	FHWA/VDOT Preferred Alternative	The FHWA/VDOT Preferred Alternative would impact approximately 39.77 acres of vegetated wetlands (with four of the acres from conversion due to shading by bridges) and 6,874 linear feet of stream. Impacts to high value wetlands would include approximately 12.12 acres of high value wetlands and a reduction in the HGM wetland functions of temporarily store surface water, cycle nutrients, remove and sequester elements and compounds, retain particulates, export organic carbon, maintain water level regime, maintain characteristic plant community and provide habitat for wildlife. The FHWA/VDOT Preferred Alternative could cause some additional impacts related to induced growth. While the project could affect water quality/quantity, it is being designed through applicable guidance dictating minimization of water quality impacts.	water level regime, maintain characteristic plant community and provide habitat for wildlife. Streams were also impounded to create water sources. Anthropogenic changes to the environment, including farming, led to degradation of water bodies (and thus impaired waters).			Farming and logging practices have already impacted water quality in the area. Continued runoff would likely occur from existing and future farming and logging activities, along with potential erosion. Conversion of the wetlands either through draining or impoundment eliminates the functions that they provide (as noted in past actions), which serve to treat the runoff prior to it entering the surface waters. The loss of lower value, previously impacted wetlands under agricultural and silviculture operations, could occur with new residential, commercial, or industrial development. Although the project would impact wetland and streams, the project would mitigate this loss through restoration and preservation of wetlands, as well as purchasing credits through approved mitigation banks, which have already created or restored wetlands. The wetlands that the Project is proposing to restore would be within the same subbasins as those that will be impacted, and will be designed to provide the same functions as those that will be impacted.
Floodplains	No Build	There would be no change to existing floodplain values.	Access to and over waterways for forestry, farming, and transportation facilities resulted in loss of floodplain area and related values. Road crossings of floodplains, such as by Route 460, impacted floodplains by displacement due to filling and reduction in flood storage capacity, alteration of drainage patterns, water quality degradation, changes in flood flow elevations, and associated effects on plant and animal communities. Forests have been removed in floodplains for timber harvesting and agriculture. The sizing of waterway crossings by the railroad has resulted in backwater occurrences during flood events.	Limited impacts to floodplains, due to low levels of growth as well as protection afforded by state and federal floodplain management regulations.	Limited impacts to floodplains, due to low levels of growth as well as protection afforded by state and federal floodplain management regulations.	Floodplains have experienced substantial effects over time with destruction and alteration as well as placing buildings and structures (including the railroad embankment) within floodplains. Continued limited impacts to floodplains, as new access to/over waterways are expected to be limited.
	FHWA/VDOT Preferred Alternative	There would be 6 floodplain crossings and potential downstream impacts. However, the FHWA/VDOT Preferred Alternative has been designed to manage flood events in accordance with state and federal requirements. Development within induced growth areas has the potential to affect 1,000 acres of 100-year floodplains, as determined with FEMA mapping; there are no floodways within the induced growth areas.				Floodplains have experienced substantial effects over time with destruction and alteration as well as placing buildings and structures (including the railroad embankment) within floodplains. Continued impacts to floodplains, due to anticipated low levels of growth in floodplains in the induced growth areas, mitigated by protection by state and federal floodplain management regulations.

Resource	Proposed Action/ Alternative (X)		Past Actions (Y)	Present Actions (Y)	Reasonably Foreseeable Future Actions (Y)	Cumulative Impact (Z)
State Wild and Scenic Rivers	No Build	There would be no change to existing scenic river values.	Impacts to the scenic features that may qualify a river for listing occurred through the removal of forests and the placement of crossing structures. It is unknown whether waterways in the study area other than the Blackwater River might have met criteria for scenic rivers were it not for past actions.	Currently there is limited development adjacent to the river.	Development adjacent to the Blackwater River could occur due to its scenic qualities.	The Blackwater River and other waterways in the study area have experienced substantial effects over time with the placement of crossing structures, as well as through agricultural and silvicultural activities. Future development adjacent to the Blackwater River could occur due to its scenic qualities.
	FHWA/VDOT Preferred Alternative	The project would cross the Blackwater River at the current location of Route 460. The bridge is designed to be higher in elevation in order to minimize flooding and backwater effects to the resource. Since the project would be replacing an existing structure and would not affect the alignment of the river, the scenic nature of the river would be minimally impacted by the new higher bridge. There may be some additional noise effects to river users due to heavier traffic and the higher elevation of the bridge and roadway in the vicinity of the river. In addition, the induced growth area does not contain a State Wild and Scenic River, and therefore no indirect effects to this resource would occur within the identified induce growth areas.				The Blackwater River and other waterways in the study area have experienced substantial effects over time with the placement of crossing structures, as well as through agricultural and silvicultural activities and associated runoff. While the new bridge would not encourage new development, bridging of this river and resulting noise and traffic could result in a direct impact to the qualities and features that qualify it for the Scenic River Program. In addition, development adjacent to the Blackwater River could occur due to its scenic qualities and improved access along Route 460.
Natural Communities, Wildlife, and Biodiversity	No Build	No change to existing resources.	Intensive disruption, fragmentation, and modification of wildlife habitat to support forestry and farming. Runoff from these activities degraded aquatic habitats. Streams were impounded to create water sources, blocking the movement of aquatic organisms and isolating some populations.	Continued, but reduced impact to wildlife habitat from forestry. Ongoing agricultural activities prevent the establishment of normal habitat conditions on agricultural lands for many wildlife species. Runoff from agricultural activities contribute to further degradation of aquatic habitats. Limited levels of industrial, commercial, and residential growth contribute	Continued, but reduced impact to wildlife habitat from forestry. Continued agricultural activities prevent many wildlife species from establishing normal habitat conditions on agricultural lands. Limited levels of industrial, commercial, and residential growth contribute minor impacts to wildlife habitat.	Wildlife has experienced substantial effects over time with the destruction and alteration of habitat. Continued, but reduced impact to wildlife habitat from forestry. Continued agricultural activities prevent many wildlife species from establishing normal habitat conditions on agricultural lands. Limited levels of industrial, commercial, and residential growth contribute minor impacts to wildlife habitat.

Resource	Proposed Action/ Alternative (X)		Past Actions (Y)	Present Actions (Y)	Reasonably Foreseeable Future Actions (Y)	Cumulative Impact (Z)
	FHWA/VDOT Preferred Alternative	The new corridor would remove existing habitat, fragment habitat and movement corridors, and likely lead to some downstream impacts. Impacts may include physical barriers to wildlife movements, vehicle wildlife collisions, introduction of invasive plant species that change the character of habitat, and degradation of aquatic habitats due to contaminated runoff and fuel, chemical spills associated with vehicular accidents, and maintenance activities. Fragmentation of forested ecosystems may reduce the habitat value of the area for species that require large contiguous tracts of forested habitat, reduce the total habitat area available, increase edge habitat, lower diversity due to smaller woods patches, isolate populations, increase vulnerability of species moving between fragmented patches, increase vulnerability to external competition and predation, and decrease flow of genetic material through the landscape.		minor impacts to wildlife habitat.		Wildlife has experienced substantial effects over time with the destruction and alteration of habitat. Continued, but reduced impact to wildlife habitat from forestry and agriculture will continue. Particularly east of Zuni where the new Route 460 diverts from the existing Route 460 on a new roadway through agricultural fields and forests, construction and maintenance activities may lead to further habitat fragmentation and degradation and reduced local biodiversity. Furthermore, as a result of the improved Route 460 roadway and improved access to the area, somewhat greater, though still limited, levels of industrial, commercial, and residential growth may contribute minor disruptions to wildlife habitat.
Threatened and Endangered Species	No Build	No change to existing resources.	Intensive disruption, fragmentation, and modification of species and habitat, including terrestrial and aquatic, as well as takings of individuals, to support forestry and farming.	Continued, but reduced impact to species and habitat from forestry. Maintaining manmade environment to support farming prevents species from reestablishing. Limited levels of industrial, commercial, and residential growth contribute minor disruptions to wildlife habitat. The Endangered Species Act and related regulations protect species from adverse impacts associated with certain actions.	Continued, but reduced impact to species and habitat from forestry. Maintaining manmade environment to support farming prevents species from reestablishing. Limited levels of industrial, commercial, and residential growth contribute minor disruptions to wildlife habitat. The Endangered Species Act and related regulations and required measures resulting from these laws would protect species from adverse impacts associated with certain actions.	Continued, but reduced impact to species and habitat from forestry. Maintaining manmade environment to support farming prevents species from reestablishing. Limited levels of industrial, commercial, and residential growth contribute minor disruptions to wildlife habitat. The Endangered Species Act and related regulations would protect species from adverse impacts associated with certain actions.
	FHWA/VDOT Preferred Alternative	The new corridor would fragment existing habitats and lead to downstream impacts. The Endangered Species Act and related regulations and required measures resulting from these laws would protect species from adverse impacts associated with certain actions.				Continued, but reduced impact to species and habitat from forestry will continue. Maintaining manmade environment to support farming prevents species from reestablishing. Somewhat greater, though still limited, levels of industrial, commercial, and residential growth have contribute minor disruptions to wildlife habitat; however, the potential impacts to threatened or endangered species resulting from the project will be reduced through use of design measures. The Endangered Species Act and related regulations and required measures

Resource	Proposed Action/ Alternative (X)		Past Actions (Y)	Present Actions (Y)	Reasonably Foreseeable Future Actions (Y)	Cumulative Impact (Z)
						resulting from these laws would protect species from adverse impacts associated with certain actions.
Historic Properties						
Historic Properties	No Build	Increased future traffic volume may lead to increased noise and reduced air quality. No new visual impacts are anticipated	Development of the communities and facilities that have become historic properties. Likely undocumented loss of historic properties.	Potentially eligible but unidentified properties may continue to fall into disrepair and/or be demolished by private actions. Other properties may continue to be preserved.	Potentially eligible but unidentified properties may continue to fall into disrepair and/or be demolished by private actions. Other properties may continue to be preserved.	Prior to federal regulations and the establishment of the NRHP, there were likely undocumented losses of historic properties. Historic properties may continue to be directly impacted and/or fall into disrepair. Other properties may continue to be preserved.
	FHWA/VDOT Preferred Alternative	Two resources listed on the National Register of Historic Places (NRHP) and five resources deemed eligible or potentially eligible for the NRHP are located outside of the limits of disturbance, but within the Area of Potential Effect (APE). One eligible resource is located near a new portion of the bypass east of Windsor. Increased future traffic volume may lead to increased noise and reduced air quality. The resource east of Windsor may also be impacted visually by the new Route 460 bypass. VDOT determined that none of these changes will be adverse and in in February 2016, the SHPO concurred with these effect determinations.				Prior to federal regulations and the establishment of the NRHP, there were likely undocumented losses of historic properties. Potentially eligible but unidentified properties may continue to fall into disrepair and/or be demolished by private actions. Other properties may continue to be preserved. A total of seven architectural resources that are listed or deemed eligible or potentially eligible for listing on the NRHP were identified within the APE and may be impacted by infringement effects of future development, including increased traffic volume and noise and reduced air quality. However, none of these effects would be adverse.

Note: The level of data available for historic and current actions prevented meaningful analysis of recreational resources.

4.3.4.2 Determine the Magnitude and Significance of Cumulative Impacts

Following the identification of important cause-and-effect relationships, CEQ guidance recommends a discussion on the magnitude and significance of cumulative impacts. As discussed earlier in this Chapter, population growth and economic development in the study area date back to early European colonization. Through the centuries, much of the population growth and development in the region was based on timber and agriculture. The growth of these natural resource-based industries was supported by the construction of the railroad and Route 460. In recent years, the growth of the natural resource-based economy has slowed and, in some cases, declined, such as in response to the recession and subsequent downturn in lumber demand for housing construction.

Population in the study area counties and in the City of Suffolk have continued to increase; Isle of Wight County, where Windsor is located, and the City of Suffolk have experienced the greatest population gains over the period from 1970 to 2010, with gains of 92.8 percent and 758 percent, respectively. The exception to this trend has been Southampton County, which experienced a 0.1 percent population decrease in the same period. Study area communities have sought to support the population's employment needs and to capitalize on their location in southeast Virginia through the development of industry/commerce parks. Construction of the FHWA/VDOT Preferred Alternative would represent the largest investment in the study area in some time. With the majority of the improvements and, therefore, impacts taking place in Isle of Wight County and the City of Suffolk, the FHWA/VDOT Preferred Alternative would serve to support this population growth and the potential ensuing economic development. The short-term impact of jobs and associated expenditures is expected to benefit the local communities. Once construction is complete, the potential for induced growth or infill development as a result of improved access through the region could represent long-term economic benefits to the community.

As illustrated in , the largest impacts to Waters, Wetlands, and Water Quality occurred as part of the historic forestry and farming activities. These actions resulted in the clearing of forests, wetlands and riparian buffers, ditching and ponding of rivers and swamps, and uncontrolled stormwater runoff. Pesticides, excessive nutrients, and other chemicals were introduced to the region's waters, further degrading the resources before these impacts could be checked through regulations and improved stormwater management techniques; input of chemicals continue from some agricultural activities. Future actions would be developed within the framework of these regulatory and technological controls which should reduce impacts to these resources from these sorts of chemicals. Two specific controls for checking future impacts are USACE and VDEQ water quality permits and TMDL-related requirements established by VDEQ. These controls serve to minimize excessive impacts, identify avoidance and other mitigation measures, and set limits on the amount of pollutants that are allowed to enter receiving bodies of water. The FHWA/VDOT Preferred Alternative would also be subject to these controls to minimize excessive impacts. Ambient conditions upstream, produced as a result of silvicultural activities, wildlife activity, etc., would have greater impact on the parameters measuring stream quality than the effect of the FHWA/VDOT Preferred Alternative. Potential effects to impaired waters and possible mitigation are discussed in detail in the ***Natural Resources Technical Report*** (VDOT, 2014i), the ***Supplemental Natural Resources Technical Report*** (VDOT, 2016f) and summarized in **Chapter 3.0, Section 3.4**.

To compare these previously permitted impacts in two of the study area subbasins (as reported in **Section 4.3.2.5** under Past Actions) and the impacts of the FHWA/VDOT Preferred Alternative in all of the study area subbasins (39.77 acres of wetlands and 6,874 linear feet of stream in the LOD of the FHWA/VDOT

Preferred Alternative) to the total number of wetlands and streams in the study area, an adjustment factor methodology was applied to NWI data across the entire natural resource study area. Based on this adjustment factor there are 212,352 acres of wetlands and 1,516 miles (8,005,991 feet) of streams in the study area. The proposed aquatic resource impacts listed above represent less than 0.02 percent of the total wetlands and less than 0.09 percent of the total streams in the resource study area. Although the study area contains four subbasins, the FHWA/VDOT Preferred Alternative is located in only two subbasins, the Blackwater (HUC 03010202) and Hampton Roads (HUC 02080208), and therefore the Nottoway (HUC 03010201) and Lower James (HUC 02080206) subbasins would not be affected by the proposed project. The subbasins within which the proposed impacts would occur can be subdivided into smaller watersheds (HUC-10) subwatersheds (HUC-12) hydrologic units. The watersheds include the Blackwater River-Rattlesnake Swamp (HUC 0301020203) and Nansemond River (HUC 0208020801); subwatersheds include Blackwater River-Antioch Swamp (HUC 030102020304), Lake Prince (HUC 020802080103), and Cohoon Creek (HUC 020802080102). As demonstrated in **Table 4.3-7**, the acreage of the proposed impacts is small in relation to the total amount of wetlands within the HUC-8 subbasins, HUC-10 watersheds, and HUC-12 subwatersheds.

Table 4.3-7: Wetland Impacts Compared to Wetlands Within Each Impacted Subbasin, Watershed, and Subwatershed

HUC	Wetland Impacts[1]	Wetlands within Each HUC [1,2]	Percent of Wetlands in HUC Impacted by the Preferred Alternative
03010202 (HUC-8)	15 acres	206,399 acres	0.007%
0301020203 (HUC-10)	15 acres	68,664 acres	0.022%
030102020304 (HUC-12)	15 acres	16,195 acres	0.093%
02080208 (HUC-8)	24 acres	318,578 acres	0.008%
0208020801 (HUC-10)	24 acres	121,724 acres	0.020%
020802080102 (HUC-12)	10 acres	13,415 acres	0.075%
020802080103 (HUC-12)	14 acres	8,156 acres	0.172%

[1] Acreage is rounded to the nearest whole number; acreage is not cumulative among HUC-8, HUC-10, and HUC-12.
[2.] The acreage of wetlands in each HUC-8 and HUC-12 was estimated by comparing the delineated wetlands to the NWI wetlands within the LOD and applying the same factor to the NWI wetlands within the HUC-8 and HUC-12.

A portion of the wetlands impacted by the project are considered high functioning bottomland hardwood and cypress/tupelo wetlands, impacts to which could not be offset through purchase of existing mitigation bank credits. In order to offset impacts to these high functioning wetlands, VDOT is developing several "permittee-responsible" off-site mitigation sites to restore high functioning bottomland hardwood and cypress/tupelo wetlands that have been degraded through impoundment.

Species now listed as threatened and endangered were also greatly impacted through forestry and farming actions. Forestry actions removed habitat for many species that are now protected by federal and/or state laws. The continued harvesting of forest resources resulted in regular impacts to these species and their habitats. Similarly, farming activities stripped the region of important habitat and applied different techniques (ditching, clearing, etc.) to maintain this manmade habitat and prevent critical habitats from reestablishing. Since the passage of federal and state regulations to identify and protect rare, threatened, and endangered species, impacts to these species by current and/or future actions have been reduced from what they would have been if allowed to continue unabated. The reduction has come about as a result of

coordination with agencies responsible for protecting aquatic and wildlife species, consideration of alternatives that minimize and avoid impacts, and conservation and mitigation measures. Therefore, future impacts to threatened and endangered species would be controlled and limited through this process. These checks would be in place if the FHWA/VDOT Preferred Alternative were implemented.

Seven historic properties (architectural) are listed or deemed eligible or potentially eligible for listing on the NRHP. Prior to federal regulations and the establishment of the NRHP, there were likely undocumented losses of historic properties. Some historic properties (private and public) may continue to fall into disrepair or be impacted by development in the area.

4.3.4.3 Monitoring

The CEQ guidance paper used to direct this analysis specifically recommends discussing means of monitoring cumulative impacts of a FHWA/VDOT Preferred Alternative (CEQ, 1997). According to CEQ, monitoring of cumulative impacts involves assessing the accuracy of predictions of effects and the success of mitigation. Monitoring is intended to serve as a basis for adaptive management. However, highway agencies who develop and construct roadways typically do not have opportunity for adaptive management of future growth or other activities that contribute to cumulative impacts. Monitoring future cumulative impacts is further complicated when various entities have planning review and control over such future activities, such as the several localities that will be affected by the FHWA/VDOT Preferred Alternative. Monitoring that will be undertaken if the FHWA/VDOT Preferred Alternative is implemented includes monitoring and inspection during construction to insure compliance with regulations and permits, performance monitoring and maintenance of the wetland/stream mitigation bank(s) by the bank managers, and monitoring of any wetland or stream compensation constructed/restored by VDOT.

4.3.5 Cumulative Impact Conclusion

Past and present actions have shaped the current state of socioeconomic, natural, and cultural resources within the study area, and future actions will continue to shape these resources irrespective of this project. Historic forestry and farming activities have had the greatest impact on the region. These actions led to the degradation and/or loss of the natural resources that existed when colonists settled the region and have continued to the present. These actions not only impacted the region but maintained the effects of those impacts to the present day such that the environment has not returned to its original state.

Initially, there was a great deal of growth along the railroad corridor. As the region grew, many of the properties that are now considered historic were constructed. The region's population grew as the natural resource-based economy expanded. In more recent years, the natural resource-based economy has slowed. Virginia's forest products industry has been particularly hard hit, losing over 19,000 jobs state-wide from 2006 to 2011. The severe recession from 2007 to 2009 and the housing market downturn caused rapid contraction in demand for wood products used in housing construction, furniture, and related products. The pulp and paper industry also has been affected by the general state of the economy, and faces reduced demand for its products because of the growth in electronic media. The result of these forces is a smaller forest products industry that is much leaner and more efficient (Weldon Cooper, 2013). The farming industry has faced similar pressure from international competition and from domestic competition from larger farms. These downturns have resulted in a loss of jobs in the region, but also less frequent and intense impacts to the natural environment. However, extensive agricultural activities continue throughout the study area.

While the FHWA/VDOT Preferred Alternative would introduce measurable impacts to natural and socioeconomic resources, impacts to wetlands and streams under the FHWA/VDOT Preferred Alternative would represent less than one percent of the total wetlands and streams that exist in the substantially human-altered environment. The incremental cumulative impacts of the FHWA/VDOT Preferred Alternative to the region's resources would be minimal in relation to past agriculture and forestry activities. Present and reasonably future economic development, agriculture and forestry and are expected to cumulatively impact resources far less than historic actions, as discussed herein.

CHAPTER 5.0 | LIST OF PREPARERS

Chapter 5.0 LIST OF PREPARERS

This Supplemental Environmental Impact Statement was prepared by the U.S. Army Corps of Engineers and the Federal Highway Administration, with the Virginia Department of Transportation serving as the project proponent and the Environmental Protection Agency as a cooperating Agency. Assistance was provided from a team of consulting engineers and scientists led by Whitman, Requardt, and Associates LLP. Key preparers of this document are listed as follows:

U.S. Army Corps of Engineers

Alice W. Allen-Grimes
Environmental Scientist
Education: M.S. Coastal Ecology, B.S. Wildlife Biology
Professional Experience: 30 Years
Role: Project Manager for the U.S. Army Corps of Engineers Regulatory Review

Federal Highway Administration

Edward Sundra
Director of Program Development
Education: B.S. Civil Engineering
Professional Experience: 27 Years
Role: FHWA Project Manager

Virginia Department of Transportation

Angel N. Deem
Location Studies Program Manager
Education: B.S. Biology
Professional Experience: 19 Years
Role: NEPA Project Manager

Caleb Parks
Environmental Planner
Education: B.S. Environmental Policy & Planning
Professional Experience: 4 Years
Role: Deputy NEPA Project Manager, Aesthetic and Visual Quality Technical Analysis

Philip C. Rinehart, P.E.
Project Manager
Education: B.S.E.T. Civil Engineering, B.A. Political Science
Professional Experience: 23 Years
Role: DSEIS Route 460 Project Manager Engineering

Bradley Weidenhammer, P.E.
Hampton Roads District Megaprojects Traffic Engineer
Education: B.S. Civil Engineering
Professional Experience: 12 Years
Professional Experience
Role: DSEIS Deputy Route 460 Project Manager Traffic

Scott Smizik
Location Studies Project Manager
Education: M.S. Energy and Environmental Policy, B.A. Environmental Studies
Professional Experience: 12 Years
Role: DSEIS NEPA Document Writer

James Ponticello
Air Quality Program Manager
Education: M.S. Civil/Environmental Engineering, B.S. Biology, B.S. Chemical Engineering
Professional Experience: 19 Years
Role: Air Quality Technical Lead

Paul Kohler
Noise Abatement Section Manager
Education: B.S. Terrestrial Ecology
Professional Experience: 19 Years
Role: DSEIS Noise Technical Analysis Reviewer

Joshua D. Kozlowski
Noise Abatement Specialist
Education: B.S. Geophysics
Professional Experience: 14.5 Years
Role: Noise Lead, Noise Impact and Abatement Analysis, Noise Monitoring

Lovejoy Muchenje, P.E.
Noise Abatement Engineer
Education: B.S. Mechanical Engineering
Professional Experience: 8 Years
Role: Noise Impact and Abatement Analysis, Report Preparation

Mary Ellen Hodges
Preservation Program District Coordinator,
Education: M.A./B.A. Anthropology
Professional Experience: 36 Years
Role: Cultural Resources Management

William Guiher
Senior Transportation Planner
Education: B.S. Civil Engineering
Professional Experience: 30 Years
Role: Traffic development oversight

Peng Xiao, P.E.
Senior Modeling Systems Analyst
M.S./B.S. Civil Engineering
Professional Experience: 13 Years
Role: Traffic Modeling Oversight

Whitman, Requardt & Associates, LLP

Nicholas Nies
Associate
Education: M.A. Transportation Policy, Operations and Logistics, B.S. Health, Fitness, Park, and Recreation Resource Management
Professional Experience: 15 Years
Role: FSEIS Consultant Team Project Manager for NEPA Document, QA/QC, DSEIS Section 4(f) Technical Lead, NEPA Document Writer

Taylor Sprenkle
Associate
Education: B.S. Biology, M.S. Biology
Professional Experience: 16 Years
Role: Natural Resources Technical Analysis, Joint Permit Application, and Natural Resources Technical Report (NRTR) Lead

Kimberly Glinkin
Associate
Education: M.A. Environmental Studies, B.A. Economics
Professional Experience: 25 Years
Role: FSEIS NEPA Document Lead/Writer, Indirect and Cumulative Effects Analysis, QA/QC

Amanda J. Baxter
Vice President
Education: B.S. Earth Systems Science, Geology
Professional Experience: 17 Years
Role: DSEIS Consultant Team Project Manager for NEPA Document, QA/QC

John Maddox, P.E.
Senior Vice President
Education: B.S. Civil Engineering
Professional Experience: 29 Years
Role: DSEIS Engineering, Section 4(f) Avoidance

Dana Trone, P.E., P.T.O.E.
Vice President
Education: B.S. Civil Engineering
Professional Experience: 19 Years
Role: Traffic Engineering, QA/QC

Joe Felton
Senior Environmental Scientist
Education: B.S. Forestry-Environmental Resource Management
Professional Experience: 15 Years
Role: Natural Resources Technical Analysis, Joint Permit Application, and NRTR

Emily Drahos
Environmental Scientist
Education: B.S. Environmental Science
Professional Experience: 3 Years
Role: Natural Resources Technical Analysis, Joint Permit Application, and NRTR

Kevin Roberts
Project Environmental Scientist
Education: B.S. Natural Resource Management
Professional Experience: 10 Years
Role: Hazardous Materials Technical Analysis

Ana-Elisa Bryant
Environmental Scientist
Education: M.S. Natural Resource Management, B.S. Biology
Professional Experience: 2 Year
Role: Socioeconomics, Environmental Justice and Land Use Technical Analysis

Ashley Carpenter
Traffic Engineer
Education: B.S. Civil Engineering
Professional Experience: 2 Years
Role: FSEIS Traffic Engineering, Environmental Traffic Data

Evan Hershman, P.E.
Project Engineer
Education: M.S./B.S., Civil Engineering
Professional Experience: 7 Years
Role: Environmental Traffic Data QA/QC

Wendy Haubert
GIS Analyst
Education: M.S/B.S. Geography
Professional Experience: 26 Years
Role: GIS Analyst

Kenneth Bauer, P.E.
Project Engineer
Education: B.S. Civil Engineering
Professional Experience: 16 years
Role: Noise Modeling

David M. Capparuccini, P.E., P.T.O.E.
Senior Project Engineer
Education: M.S./B.S. of Civil Engineering
Professional Experience: 9 Years
Role: DSEIS Environmental Traffic Data QA/QC

Glenn Wilson
Project Environmental Scientist
Education: M.S. Biology & Ecology, B.S. Biology and Health Science
Professional Experience: 18 Years
Role: DSEIS Hazardous Materials Technical Memorandum

Valerie A. Kowalski, P.E
Senior Project Engineer
Education: B.S. Civil Engineering
Professional Experience: 9 years
Role: DSEIS Noise Modeling

Halie Stannard
Environmental Planner
Education: B.S. Environmental Policy & Planning
Professional Experience: 3 Years
Role: DSEIS Socioeconomics, Environmental Justice, and Land Use Technical Analysis, NEPA Document Writer

Matthew Mielke
Environmental Planner
Education: B.S. Environmental Science & Policy
Professional Experience: 5 Years
Role: DSEIS Socioeconomics, Environmental Justice, and Land Use Technical Analysis, NEPA Document Writer

The Philip A. Shucet Company

Philip A. Shucet
President
Education: B.A., VPI
Professional Experience: 43 Years
Role: Executive Oversight for US Route 460 Corridor Improvements Project

HDR Engineering, Inc.

Mike Tugman, P.E.
Senior Vice President
Education: B.S. Civil Engineering
Professional Experience: 28 Years
Role: Consultant Project Manager for US Route 460 Corridor Improvements Project

William L. Hurd, P.E.
Segment Lead
Education: B.S. Civil Engineering
Professional Experience: 44 Years
Role: Alternatives Technical Report Cost Opinion Lead

Daniel J. Baum, P.E.
Senior Highway Engineer
Education: B.S. Civil Engineering
Professional Experience: 17 Years
Role: Alternatives Technical Report Cost Opinion Support

Michael S. Snyder, P.E.
Assistant Project Manager Engineer
Education: B.S. Civil Engineering
Professional Experience: 22 Years
Role: Alternatives Technical Report Cost Opinion Support

Aaron Zdinak, P.E.
Geotechnical Engineer
Education: M.S./B.S. Civil / Structural Engineering
Professional Experience: 22 Years
Role: Alternatives Technical Report

Vijay R. Modi, P.E.
Senior Project Manager
Education: M.S./B.S. Civil Engineering
Professional Experience: 33 Years
Role: Alternatives Technical Report Cost Opinion Support

Carey W. Burch
Senior Environmental Scientist
Education: M.S. Plan Sciences, B.S. Environmental Sciences / Studies
Professional Experience: 37 Years
Role: Alternatives Technical Report QC Review

Jeffrey B. Arms, P.E.
Transportation
Education: B.S. Civil Engineering
Professional Experience: 5 Years
Role: Traffic Technical Report, QC Review

Robin Cumpston
Executive Assistant
Education: B.S. Liberal Arts
Professional Experience: 17 Years
Role: Technical Report Assistance

Robin Bedenbaugh, P.W.D.
Environmental Manager
Education: M.S./B.S. Biological Sciences
Professional Experience: 33 Years
Role: Natural Resources Technical Report Lead

Patrick Solomon, C.E.P.
Senior NEPA Project Manager
Education: M.S./B.A. Geography
Professional Experience: 21 Years
Role: QA Review

Vickie Miller, A.I.C.P., P.W.S.
Senior Environmental Scientist
Education: M.S. Natural Resources, B.S. Environmental Science
Professional Experience: 16 Years
Role: Natural Resources and QA Review

John Jamison, P.W.S.
Senior Environmental Scientist
Education: B.S. Natural Resources
Professional Experience: 16 Years
Role: Natural Resources Section Author, GIS Analyst

Joshua Mace
Senior Environmental Scientist
Education: M.S. Natural Resources, B.A. Environmental Sciences
Professional Experience: 11 Years
Role: Natural Resources Section Author

Susan L. Young, P.G.
Senior Geologist
Education: B.S. Geology
Professional Experience: 33 Years
Role: Geologist

Andrea Poole, P.M.P.
Senior NEPA Environmental Scientist
Education: M.S. Science and Technology Studies, B.A. Environmental Studies, B.A. Business Administration
Professional Experience: 15 Years
Role: Natural Resources Section Author

Stephanie Conner, W.P.I.T., G.I.S.P.
Environmental Scientist
Education: B.S. Environmental Science and Policy
Professional Experience: 14 Years
Role: GIS Remote Sensing

Megan Gambone
Biologist
Education: M.S. Biology, B.S. Environmental Science
Professional Experience: 9 Years
Role: Natural Resources Section Author

Karen Harrington, P.E.
Associate; GIS Analyst / Project Engineer
Education: B.S. Biological Systems Engineering
Professional Experience: 16 Years
Role: GIS Lead

Vincent Passaro, Q.E.P.
Environmental Scientist II
Education: M.S. Environmental Science, B.S. Fisheries and Wildlife Science
Professional Experience: 15 Years
Role: Natural Resources Section Author

Sara Easterly
Senior Environmental Scientist
Education: M.S. Environmental Science, B.A. Biology
Professional Experience: 21 Years
Role: Natural Resources Section Author

Jessica Tisdale, C.E.
Environmental Scientist II
Education: M.S. Forestry, B.S. Environmental Sciences
Professional Experience: 8 Years
Role: Natural Resources Section Author

Nicolas Frederick
Environmental Scientist II
Education: M.S. Biology, B.S. Psychology
Professional Experience: 6 Years
Role: Natural Resources Section Author

Stephen Armstrong
NEPA Environmental Scientist
Education: B.S. Environmental Science
Professional Experience: 4 Years
Role: Natural Resources Section Author

Robert Frazier, P.E., AICP
Sr. Traffic Engineer/Planner
Education: M.S./B.S., Civil Engineering, M.C.P., City and Regional Planning
Professional Experience: 22 Years
Role: Traffic Forecasting, Traffic Safety, and Traffic & Transportation Technical Report (TaTTR) Lead

David Petree, E.I.
Transportation Analyst
Education: B.S. Civil Engineering
Professional Experience: 4 Years
Role: Traffic Forecasting, Traffic Safety, and TaTTR

Mike Rose
Travel Demand Modeler
Education: B.S. Electrical Engineering
Professional Experience: 25 Years
Role: Travel Demand Modeling

Molly Nick
Transportation Planner
Education: B.A. Architecture, M.U.P., Urban Planning
Professional Experience: 14 Years
Role: Traffic Forecasting and TaTTR

Jon Markt, E.I.
Transportation Analyst
Education: M.S./B.S., Civil Engineering
Professional Experience: 5 Years
Role: Traffic Safety

Jacobs Engineering

Sarah Hammitt
Senior Environmental Planner
Education: Master of City Planning, B.A. Environmental Studies
Professional Experience: 5 Years
Role: FSEIS NEPA Document Writer, Indirect and Cumulative Effects Analysis

Christopher G. Collins
Senior Project Manager
Education: M.S./B.S. Biology
Professional Experience: 19 Years
Role: DSEIS NEPA Document Writer

Alexander J. Nies
Environmental Planner
Education: B.S. Environmental Science
Professional Experience: 4 Years
Role: DSEIS Noise Impact Modeling Analysis, GIS / Graphing, Noise Monitoring, Report Preparation

Rinker Design Associates, P.C.

William Missell, P.E.
General Manager / Principle
Education: B.S. Civil Engineering
Professional Experience: 26 Years
Role: Drainage Lead

Amber Thweat
Transportation Engineer
Education: B.S. Biological Systems
Professional Experience: 19 Years
Role: Drainage Engineer / SEIS Alternative Drainage Analysis

Michael Short, P.E.
Project Engineer III
Education: B.S. Civil Engineering
Professional Experience: 10 Years
Role: Drainage Engineer / SEIS Alternative Drainage Analysis

Edward Williams, III
Right of Way Specialist
Education: B.A. Economics
Professional Experience: 30 Years
Role: Right of Way and Relocations Lead

Ron Davis
Right of Way Agent
Education: Liberal Arts and Real Estate Courses
Professional Experience: 28 Years
Role: Right of Way and Relocations Technical Report Author

Patricia Nalley, C.R.R.E.A.
Right of Way Agent
Education: A.A. Business Management
Professional Experience: 9 Years
Role: Right of Way and Relocations Technical Report Author

Kimley-Horn and Associates, Inc.

William F. Mackey, Jr., P.E.
Vice- President
Education: B.S. Applied Mathematics/ Computer Science; Graduate Studies Transportation Engineering
Professional Experience: 27 Years
Role: Assistant Project Manager – Design

Ted Miller, P.E.
Associate
Education: Masters of Civil Engineering, B.S. Civil Engineering
Professional Experience: 19 Years
Role: Segment Lead – Design

Andrew Farthing, P.E.
Associate
Education: B.S. Civil Engineering
Professional Experience: 9 Years
Role: Senior Highway Engineer

Carroll Collins
Associate
Education: M.A., B.A.
Professional Experience: 19 Years
Role: Senior Transportation Engineer

Whitney Sokolowski
Analyst
Education: B.S. Civil Engineering
Professional Experience: 5 Years
Role: SEIS Transportation Analyst

Kyle Williams, P.E.
Senior Transportation Engineer
Education: B.S. Mechanical Engineering
Professional Experience: 9 Years
Role: Senior Highway Engineer

Kodi Padilla
Transportation Analyst
Education: B.S. Civil Engineering
Professional Experience: 4 Years
Role: SEIS Transportation Analyst

Carlin Hebert, P.E.
Senior Transportation Engineer
Education: B.S. Civil Engineering
Professional Experience: 8 Years
Role: SEIS Transportation Engineer

Benjamin Reim, P.E.
Senior Transportation Engineer
Education: B.S. Civil Engineering
Professional Experience: 8.5 Years
Role: SEIS Transportation Engineer

Jeremy Gruzd, P.E.
Senior ITS Engineer
Education: B.S. Civil Engineering
Professional Experience: 9 Years
Role: Senior ITS Engineer

Bryan Larsen, E.I.T.
ITS Engineer
Education: B.S. Electrical Engineering
Professional Experience: 4 Years
Role: Electrical Engineering Analyst

Harris, Miller, Miller, and Hanson, Inc.

Philip M. DeVita
Director of Air Quality
Education: M.S. Environmental Studies, B.S. Meteorology
Professional Experience: 24 Years
Role: Conducted the Air Quality Analysis

Coastal Carolina Research/CCRG, Inc.

Susan E. Bamann, Ph.D., RPA
Project Manager
Education: Ph.D./M.A. Anthropology
Professional Experience: 28 Years
Role: Cultural Resources Manager,

J. Eric Deetz, RPA
Senior Archeologist
Education: M.A. Archeology and Heritage Management
Professional Experience: 31 Years
Role: Archeological Principal Investigator

Jeroen van den Hurk, Ph.D.
Principal Architectural Historian
Education: Ph.D. Art History, M.A. Architectural History
Professional Experience: 21 Years
Role: Architectural Historian

Stantec Consulting Services, Inc.

Ellen M. Brady
Project Manager
Education: M.A. Anthropology
Professional Experience: 20 Years
Role: Cultural Resource Manager

Sandra DeChard
Senior Architectural Historian
Education: M.A. Preservation Studies, Architectural History Concentration with Work in Historic Archeology
Professional Experience: 23 Years
Role: Architectural Historian

Dewberry

Keith Patterson P.S.M., S.P., G.I.S.P.
Project Manager
Education: B.A. Geography
Professional Experience: 37 Years
Role: DSEIS Project Manager

Ryan Ligon
Senior Geospatial Analyst
Education: B.A. Geography
Professional Experience: 8.5 Years
Role: DSEIS Photo-Interpreter

Jay Brunkow
GIS Analyst
Education: 2 Years Undergraduate Studies
Professional Experience: 36 Years
Role: DSEIS Map Production

Dan Bubser
Production Manager
Education: A.A. Geographics
Professional Experience: 15 Years
Role: DSEIS QC, Photo Interpretation

Kimberly Vanness Larkin
Senior Wetland Scientist
Education: B.S. Environmental Science
Professional Experience: 29 Years
Role: DSEIS Wetland Mapping Consultant

Amin Davis
Wetland Scientist
Education: M.S. Zoology, B.S. Marine and Environmental Science
Professional Experience: 16 Years
Role: DSEIS Wetland and GIS Mapping Consultant

CHAPTER 6.0 | DISTRIBUTION LIST

Chapter 6.0 DISTRIBUTION LIST

Federal Agencies

Advisory Council on Historic Preservation

U.S. Army Corps of Engineers

U.S. Coast Guard

U.S. Department of Agriculture, Natural Resources Conservation Service, Chesapeake Office

U.S. Department of Housing and Urban Development

U.S. Department of the Interior, Fish and Wildlife Service

U.S. Department of the Interior, Office of Environmental Project Review

U.S. Department of the Navy

U.S. Department of Transportation, Federal Highway Administration

U.S. Department of Transportation, Federal Railroad Administration

U.S. Department of Transportation, Federal Transit Administration

U.S. Environmental Protection Agency

U.S. Environmental Protection Agency – Environmental Impact Statements Filing Station

State Agencies

Virginia Department of Agriculture and Consumer Services

Virginia Department of Aviation

Virginia Department of Conservation and Recreation

Virginia Department of Environmental Quality

Virginia Department of Forestry

Virginia Department of Game and Inland Fisheries

Virginia Department of Health, Office of Drinking Water

Virginia Department of Historic Resources

Virginia Department of Housing and Community Development

Virginia Department of Mines, Minerals, and Energy

Virginia Department of Rail and Public Transportation

Virginia Economic Development Partnership

Virginia Institute of Marine Science

Virginia Marine Resources Commission

Virginia Outdoor Foundation

Virginia Department of Emergency Management

Virginia Transportation Research Council

Local Government

City of Suffolk

Isle of Wight County

Prince George County

Southampton County

Sussex County

Surry County

Town of Wakefield

Town of Waverly

Town of Windsor

Town of Ivor

Regional Organizations

Hampton Roads Transportation Planning Organization

Richmond Area Metropolitan Planning Organization

The Port of Virginia (Virginia Port Authority)

Nottoway Indian Tribe of Virginia

Cheroenhaka (Nottoway) Indian Tribe

CHAPTER 7.0 | PUBLIC & AGENCY COORDINATION

Chapter 7.0 PUBLIC AND AGENCY COORDINATION

7.1 INTRODUCTION

The Virginia Department of Transportation (VDOT), in cooperation with Federal Highway Administration (FHWA) and the United States Army Corps of Engineers (USACE), has coordinated extensively with local, state, and federal entities (see **Appendix B: Agency Coordination**) as well as engaged in an extensive public involvement effort, throughout the Route 460 Location Study project, in order to provide information and solicit feedback. Agencies were contacted early in the study and asked to assist in determining and clarifying issues relative to the study. The public was notified about the study and invited to provide comments about transportation needs, potential alternative solutions, and environmental issues within the study area. The agency and public feedback received in response to these coordination efforts was used in the development of the purpose and need, potential alternatives, and environmental issues and methodologies included in this Supplemental Environmental Impact Statement (SEIS).

7.2 AGENCY COORDINATION

Pursuant to 40 CFR §1501.7, FHWA and USACE issued separate Notices of Intent (NOIs) in the Federal Register in December 2013.[1] The purpose of the NOIs was to announce the initiation of environmental studies associated with the preparation of an SEIS, intended to identify and evaluate new information on potential alternatives and their impacts to environmental resources, including streams and wetlands, that had not been previously included in the 2005 Draft Environmental Impact Statement (DEIS), 2008 Final Environmental Impact Statement (FEIS), or 2008 Record of Decision (ROD). Upon publication of the NOIs, the scoping process was initiated by inviting interested individuals, organizations, and agencies to provide their ideas, comments and concerns regarding proposed transportation solutions within the study area. The following agencies provided their comments and feedback during the 30-day comment period that followed the issuance of the NOIs:

- U.S. Environmental Protection Agency (EPA);
- U.S. Fish and Wildlife Service (USFWS);
- Virginia Department of Forestry;
- Virginia Department of Environmental Quality (VDEQ), Office of Environmental Impact Review; and,
- Virginia Department of Conservation and Recreation, Virginia Natural Heritage Program.

Chief among the issues and topics of concerns identified by the agencies listed above were: the refinement and selection of a preferred alternative in the 2008 FEIS; procedural guidance for the development and distribution of the SEIS; and concerns regarding wetland impacts and other environmental resources that include forestry impacts, threatened and endangered species, floodplains, and natural preserves.

[1] Federal Register Doc. 2013-76189 and 2013-78948, respectively. Available at http://www.gpo.gov/fdsys/pkg/FR-2013-12-16/pdf/2013-29836.pdf and http://docs.regulations.justia.com/entries/2013-12-27/2013-30927.pdf.

7.2.1 Cooperating and Participating Agencies

In accordance with 40 CFR §1501.6 of the Council on Environmental Quality's (CEQ) Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act, FHWA and USACE invited the EPA and USFWS in April 2014 to participate as cooperating agencies, as they were recognized in the 2005 DEIS. The USFWS respectfully declined the invitation to participate as a cooperating agency, but agreed to assist as a participating agency based on the project's potential impacts on threatened and endangered species within the study area.

The EPA accepted the invitation to participate as a cooperating agency and has provided meaningful feedback and guidance in the development of the purpose and need as well as project alternatives, analysis of indirect effects and cumulative impacts, identification of minority populations, photointerpretation and identification of wetlands and their functions, and documentation of natural resource impacts. EPA participated in numerous study team meetings that were held throughout the development of the SEIS.

Pursuant to 23 CFR §771.111(d), other local, state, regional, and federal agencies served as participating agencies over the course of the environmental study, providing insight and advice regarding the purpose and need, potential alternatives, environmental issues, and study methodologies. Agencies, such as the Natural Resources Conservation Service and the Port of Virginia, and local governments were contacted early in the study and identified issues, provided information and answered questions relative to the study. VDEQ also participated on the study team and provided input into avoidance and minimization, wetlands identification and assessment, and the development of an appropriate mitigation plan for wetlands and streams.

7.3 PUBLIC COORDINATION

In addition to the feedback solicited from local, state, and federal agencies following the issuance of the NOIs, many members of the public offered input during the 30-day Federal Register comment period. In total, 60 substantive comments were received during this time. These public comments, as well as the agency input previously described are included in the Draft SEIS and were considered in the development of this SEIS.

During July 2014, VDOT conducted five town hall meetings in communities along the Route 460 corridor between Suffolk and Petersburg to provide residents with updated information and an opportunity to discuss the study. The Draft SEIS was published in September 2014 and presented at three Location Public Hearings that took place in October 2014. A total of 521 comments were submitted during the public hearing, online, or by mail. These comments, and associated FHWA/USACE/VDOT responses, are included in **Appendix D: Draft SEIS Comments and Responses**.

During May 2015, VDOT conducted two public meetings to provide residents with an opportunity to discuss the FHWA/VDOT Preferred Alternative, new information, and the anticipated next steps for the project with Study Team representatives. A total of 272 residents and elected officials signed the attendance sheets for the meetings. Although a formal comment period was not associated with these meetings, the public was offered the opportunity to provide feedback to be considered in the development of the Route 460 Project and Final SEIS; a total of 33 comments were submitted.

Prior to VDOT's May 2015 public meetings, the USACE issued a Public Notice on November 30, 2015 to solicit comments on VDOT's Joint Permit Application for the FHWA/VDOT Preferred Alternative.

7.3.1 Public Coordination Next Steps

Prior to making any final decisions, VDOT and FHWA will provide the public, local governments, and state and federal resource and regulatory agencies additional opportunities to provide additional input and comment. Additional opportunities for public coordination that will occur include:

- Comment on this Final SEIS.
- During draft Six-Year Improvement Program (SYIP) public hearings.
  - The project must be scored under House Bill Two (HB2). HB2 requires major projects that would improve statewide corridors, like Route 460 to be scored based on an objective data-driven process. The CTB reviews and evaluates projects for inclusion into the draft SYIP and then seeks input through public hearings before approving SYIP updates.
- During additional public involvement outreach efforts, as determined necessary by FHWA, once a decision is made on funding.

Any comments received will be considered and addressed in the ROD to be completed by FHWA. The ROD is the final step in the EIS process for FHWA and will:

- Confirm the FHWA/VDOT Preferred Alternative;
- Present the basis for FHWA's decision;
- Summarize all the alternatives considered; and,
- Outline all commitments agreed upon during the NEPA process.

CHAPTER 8.0 | REFERENCES

Chapter 8.0 REFERENCES

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US ROUTE 460 FINAL SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT