



SKIFFES CREEK

CONNECTOR STUDY

INDIRECT & CUMULATIVE EFFECTS

TECHNICAL REPORT

JUNE 2018

SKIFFES CREEK CONNECTOR STUDY

Indirect and Cumulative Effects Technical Report

James City County

Project Number: 0060-047-627, P101; R201, C501; UPC: 100200

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List of Acronyms

ACS	American Community Survey
APE	Area of Potential Effects
C&O	Chesapeake and Ohio Railway
CBPA	Chesapeake Bay Preservation Act
CCB	Center for Conservation Biology
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CLOMR	Conditional Letters of Map Revision
CIM	Citizen Information Meeting
CLRP	Constrained Long-Range Transportation Plan
CSO	Combined Sewer Overflows
CSXT	CSX Transportation
CWA	Clean Water Act
EA	Environmental Assessment
EIS	Environmental Impact Statement
EJ	Environmental Justice
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
GIS	Geographic Information System
HHS	Health and Human Services
HRTPO	Hampton Roads Transportation Planning Organization
HUC	Hydrologic Unit Code
I-64	Interstate 64
ICE	Indirect and Cumulative Effect
INRMP	Integrated Natural Resources Management Plan
IPaC	Information for Planning and Conservation
FY	Fiscal Year
LMI	Labor Market Information
LOD	Limits of Disturbance
LOMR	Letters of Map Revision
L RTP	Long-Range Transportation Plan
MS4	Municipal Separate Storm Sewer Systems
NCDOT	North Carolina Department of Transportation
NCHRP	National Cooperative Highway Research Program
NEPA	National Environmental Policy Act
NHD	National Hydrography Dataset
NHPA	National Historic Preservation Act
NLCD	National Land Cover Database
NLEB	Northern Long-eared Bat
NOAA	National Oceanic and Atmospheric Administration
NRHP	National Register of Historic Places
NWI	National Wetland Inventory
PCB	Polychlorinated Biphenyl

RMA	Resource Management Area
RPA	Resource Protection Area
SCC	Skiffes Creek Connector
SHPO	State Historic Preservation Officer
SSO	Sanitary Sewer Overflows
SYIP	Six-Year Improvement Program
TMDL	Total Maximum Daily Load
TRB	Transportation Research Board
US 60	Pocahontas Trail (US Route 60)
USACE	United States Army Corps of Engineers
USC	United States Code
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VA 143	Merrimac Trail (State Route 143)
VAC	Virginia Administrative Code
VaFWIS	Virginia Fish and Wildlife Information Service
VDACS	Virginia Department of Agricultural and Consumer Services
VDCR	Virginia Department of Conservation and Recreation
VCRIS	Virginia Cultural Resource Information System
VDCR-DNH	Virginia Department of Conservation and Recreation Department of Natural Heritage
VDEQ	Virginia Department of Environmental Quality
VDGIF	Virginia Department of Game and Inland Fisheries
VDHR	Virginia Department of Historic Resources
VDOT	Virginia Department of Transportation
VEC	Virginia Employment Commission
VEZ	Virginia Enterprise Zone
WetCAT	Wetland Condition Assessment Tool
WERMS	Wildlife Environmental Review Service
WNS	White-Nose Syndrome

1. INTRODUCTION

The Virginia Department of Transportation (VDOT), in coordination with the Federal Highway Administration (FHWA) as the lead federal agency, has initiated an Environmental Assessment (EA) for the Skiffes Creek Connector (SCC) Study in James City County, Virginia. This study evaluates potential transportation improvements between Pocahontas Trail (US Route 60 (US 60)) and Merrimac Trail (State Route 143 (VA 143)). The purpose of the SCC is to create efficient local connectivity between US 60 and VA 143, in the area between VA 199 and VA 238, in a manner that improves safety, emergency evacuation, and the movement of goods along the two primary roadways.

To support the analysis in the EA, this Indirect and Cumulative Effects (ICE) Technical Report has been prepared to document the following:

- **Section 1** provides an overview of the study, the Purpose and Need of the project, and the alternatives being evaluated in this study;
- **Section 2** summarizes the methods used to identify the ICE resources for the project;
- **Section 3** summarizes the analysis for indirect effects;
- **Section 4** summarizes the cumulative effects; and
- **Section 5** provides the references used within the Technical Report.

The EA has been prepared in accordance with the National Environmental Policy Act of 1969, as amended, (NEPA) and in accordance with FHWA regulations¹. The environmental review process as part of the EA was carried out following the *National Environmental Policy Act and Clean Water Act (Section 404) Merged Process for Highway Projects in Virginia (merged process)*² between VDOT, the FHWA, the U.S. Army Corps of Engineers (USACE), the U.S. Environmental Protection Agency (USEPA), and the U.S. Fish and Wildlife Service (USFWS). In accordance with the merged process agreement, the environmental analysis methodologies were developed and concurred upon based on coordination and input from these agencies. The memorandum documenting these environmental analysis methodologies is included in **Appendix A**. Analyses were then carried out following the concurred upon methodologies and included in this Technical Report and summarized in the corresponding EA.

1.1 STUDY AREA

The SCC study area is bordered to the north by the southern edge of the Interstate 64 (I-64) right-of-way and to the south by the southern edge of the US 60 right-of-way. The eastern border is Skiffes Creek Reservoir and the western border is just west of the intersection of the inactive rail spur that lines up with BASF Drive, as shown on **Figure 1-1** and **Figure 1-2**.

¹ NEPA and FHWA's regulations for Environmental Impact and Related Procedures can be found at 42 USC §4332(c), as amended, and 23 CFR §771, respectively.

² The process is intended to facilitate an environmental review process and development of documentation that comply with the requirements of NEPA and provide sufficient information to support FHWA approval or Federal regulatory decision-making, including permits issued by other Federal agencies.



Figure 1-1
Skiffes Creek
Connector Initial Study
Area

VDOT Virginia Department of Transportation
 Skiffes Creek Connector Study
 VDOT Project Number: 0060-047-627, P101, R201, C501;
 UPC: 100200

0 0.25 0.5 1 Mile

W N E
 S

Source: Esri OpenStreetMap

 Study Area



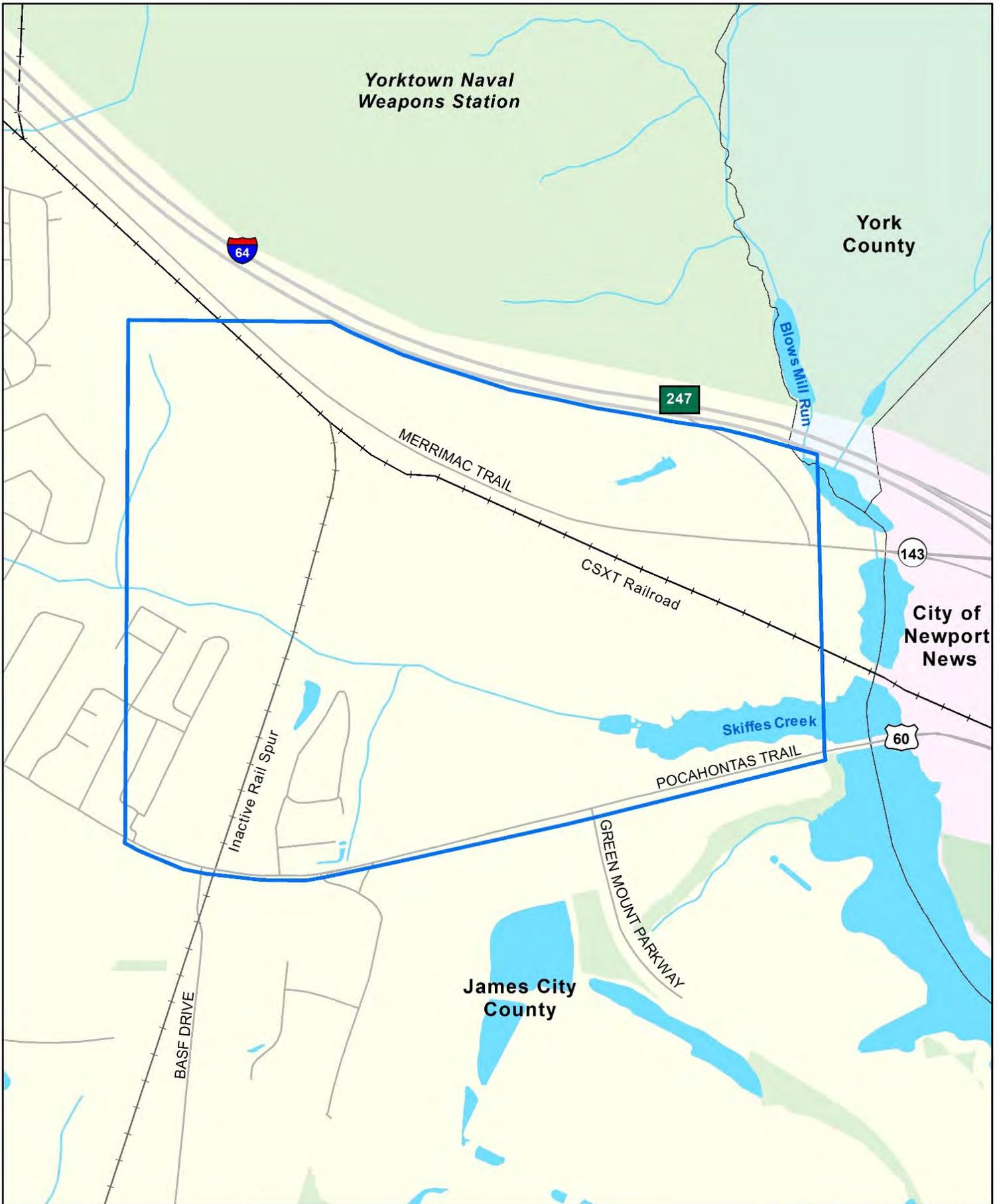
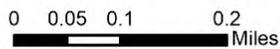


Figure 1-2
Skiffes Creek
Connector Study
Area

VDOT Virginia Department of Transportation
 Skiffes Creek Connector Study
 VDOT Project Number: 0060-047-627, P101, R201, C501;
 UPC: 100200



Source: ESRI, NHD

- Interstate Exit
- Study Area



The SCC study area is comprised mainly of undeveloped, residential, institutional/public land, and industrial land. The southwest portion of the study area contains two residential areas bisected north to south by the inactive rail spur that lines up with BASF Drive, west of Green Mount Parkway. A second rail line, the CSX Transportation (CSXT) railroad, runs west to east, separating the northern third of the study area from the southern portion. This area contains three institutional properties – the Virginia Peninsula Regional Jail, Merrimac Juvenile Detention Center, and a VDOT maintenance center, as well as an industrial use, the asphalt processing plant.

1.2 PURPOSE AND NEED

The purpose of the SCC is to create efficient local connectivity between US 60 and VA 143, in the area between VA 199 and VA 238, in a manner that improves safety, emergency evacuation, and the movement of goods along the two primary roadways. The SCC would address the following needs:

- **Improved local connectivity** – there is inadequate and or inefficient connectivity points between these two primary routes;
- **Provide efficient connectivity for local truck movement** – there are known truck destinations along the corridors; and
- **Emergency evacuation capability** – connectivity between identified evacuation routes should be enhanced to support connectivity and efficiency.

1.3 DESCRIPTION OF ALTERNATIVES

1.3.1 No Build Alternative

The No Build Alternative would retain the existing US 60 and VA 143 roadways and associated intersections/interchanges in their present configuration, and allow for routine maintenance and safety upgrades. This alternative assumes no major improvements to either corridor with the exception of previously committed projects, including projects currently programmed and funded in VDOT Fiscal Year (FY) 2018-2023 Six-Year Improvement Program (SYIP) and the Hampton Roads Transportation Planning Organization (HRTPO)'s 2040 Long-Range Transportation Plan (LRTP). As these other projects are independent of the proposed action, they are not evaluated in the EA.

1.3.2 Build Alternative 1

Build Alternative 1 would provide an approximate one-mile two-lane roadway between US 60 and VA 143. Build Alternative 1 would tie into US 60 at the existing US 60/Green Mount Parkway signalized intersection, bridge³ over Skiffes Creek, the CSXT railroad, and VA 143, then turn east to connect at a new intersection with VA 143. Potential environmental impacts of Build Alternative 1 were estimated based on the planning-level limits of disturbance (LOD), estimated to be 140 feet wide. This width includes sufficient area to accommodate the required right-of-way as well as any necessary utility or construction easements. It is anticipated that this planning-level LOD would be refined as the project advances through more detailed design and permitting following a FHWA NEPA decision. Additionally, resources within a larger 225-foot

³ The type and length of bridge-like structure over Skiffes Creek would be determined during final design/permitting.

Inventory Corridor were identified to provide the ability for future shifts or refinements to be made within this corridor during the process of design and/or permitting.

1.3.3 Build Alternative 2

Build Alternative 2 would provide an approximate one-mile two-lane roadway between US 60 and VA 143. Build Alternative 2 would begin at a new intersection with US 60, approximately 1,000 feet west of the existing US 60/Green Mount Parkway intersection. Build Alternative 2 would then bridge⁴ over Skiffes Creek, the CSXT railroad, and VA 143, then turn east to connect at a new intersection with VA 143. Potential environmental impacts of Build Alternative 2 were estimated based on the planning-level LOD, estimated to be 140 feet wide. This width includes sufficient area to accommodate the required right-of-way as well as any necessary utility or construction easements. It is anticipated that this planning-level LOD would be refined as the project advances through more detailed design and permitting following a FHWA NEPA decision. Additionally, resources within a larger 225-foot Inventory Corridor were identified to provide the ability for future shifts or refinements to be made within this corridor during the process of design and/or permitting.

2. METHODOLOGY

2.1 REGULATORY CONTEXT

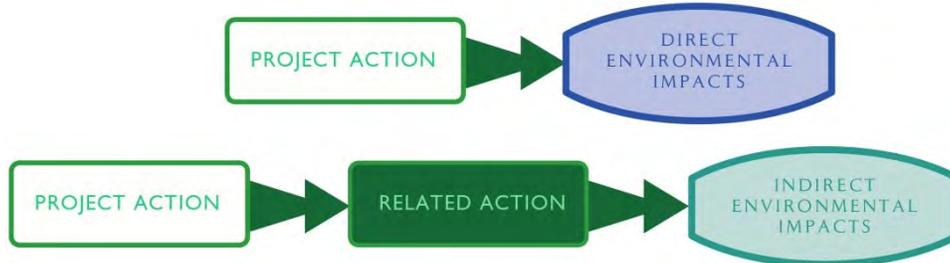
The NEPA legislation does not mention indirect or cumulative impacts; however, the Council on Environmental Quality (CEQ) regulations for implementing NEPA address federal agency responsibilities applicable to indirect and cumulative considerations, analysis, and documentation (40 CFR §1508.25) in the content requirements for the environmental consequences section of an Environmental Impact Statement (EIS) (40 CFR §1502.16) (FHWA, 2014). In addition to CEQ's regulations, an indirect and cumulative effects assessment is conducted in accordance with the requirements and processes outlined in 23 CFR Part 771, FHWA Interim Guidance: Indirect and Cumulative Impacts in NEPA (2003), FHWA Position Paper on Secondary and Cumulative Impact Assessment (1992), FHWA's Questions and Answers on Considering Indirect and Cumulative Impacts in the NEPA Process (2014), the Transportation Research Board's (TRB) National Cooperative Highway Research Program (NCHRP) Report 466: Desk Reference for Estimating the Indirect Effect of Proposed Transportation Projects (TRB, 2002), NCHRP Project 25-25 Task 22: Land Use Forecasting for Indirect Impacts Analysis (TRB, 2007), NCHRP Project 25-25 Task 11: Secondary/Indirect and Cumulative Effects Analysis (TRB, 2006), as well as CEQ's Considering Cumulative Effects under the National Environmental Policy Act (1997) and Guidance on the Consideration of Past Actions in Cumulative Effects Analysis (2005).

CEQ defines indirect effects as "...effects which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable" (40 CFR §1508(b)). Indirect effects may include "growth-inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems"

⁴ The type and length of bridge-like structure over Skiffes Creek would be determined during final design/permitting.

(40 CFR §1508(b)). These induced actions are those that may or may not occur without the implementation of the proposed project, as illustrated in **Figure 2-1**.

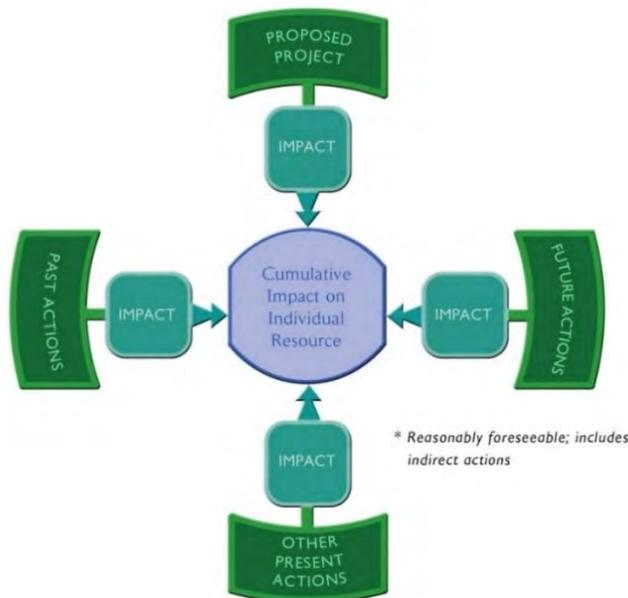
Figure 2-1: Direct vs. Indirect Environmental Impact



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

CEQ defines cumulative effects (or impacts) as, “...the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time” (40 CFR §1508.7). Cumulative effects include the total of all impacts, direct and indirect, experienced by a particular resource that have occurred, are occurring, and/or would likely occur as a result of any action or influence, including effects of a federal activity (EPA, 1999), as illustrated in **Figure 2-2**.

Figure 2-2: Cumulative Impacts



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

Because indirect and cumulative effects 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 impact 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 is 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 effects (CEQ, 1997; FHWA, 2014).

This direction on identifying reasonably foreseeable actions is taken into account in both indirect and cumulative effects analyses described in the following sections. Specific methodologies on how these analyses were conducted are presented below.

2.2 INDIRECT EFFECTS

This section presents an analysis of the potential indirect impacts related to the alternatives described in **Section 1.3**. For the purposes of this Technical Report and associated EA, the methodology followed for analyzing indirect effects is prescribed in TRB’s NCHRP Report 466, *Desk Reference for Estimating the Indirect Effects of Proposed Transportation Projects* (TRB, 2002).

In NCHRP Report 466, the 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).

Transportation improvements often reduce time and cost of travel, as well as provide new access to properties, enhancing the attractiveness of surrounding land to developers and consumers (NCDOT, 2001). Development of vacant land, or conversion of the built environment to more intensive uses, is often a consequence of highway projects. Important characteristics for induced growth are described in North Carolina Department of Transportation’s (NCDOT) *Guidance for Assessing Indirect and Cumulative Impacts of Transportation Projects in North Carolina, Vol. II: Practitioners Handbook* (NCDOT, 2001). 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 (NCDOT, 2001). The study area is in an advanced land use progression; and is therefore likely to experience more infill development than urban/suburban sprawl.

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 of redevelopment. The stepwise process TRB recommends in NCHRP Report 466 for assessing indirect effects has been used as the structure for this analysis, and consists of the following steps:

- Step 1 Scoping;
- Step 2 Identify Study Area Direction and Goals;
- Step 3 Inventory Notable Features in the Study Area;
- Step 4 Identify Impact-Causing Activities of the Build Alternatives;
- Step 5 Identify Indirect Effects for Analysis;
- Step 6 Analyze Indirect Effects and Evaluate Analysis Results; and,
- Step 7 Assess Consequences and Develop Mitigation.

To complete these steps, the required analysis relies on planning judgment. The NCHRP 25-25 program, Task 22, *Forecasting Indirect Land Use Effects on Transportation Projects*, documents means of applying planning judgement to indirect and cumulative effects analysis (TRB, 2007). The direction provided in the TRB document is the basis for the indirect effects analyses presented in this Technical Report. Each of the steps for the indirect effects evaluation process is discussed in **Section 3** of this Technical Report.

2.3 CUMULATIVE EFFECTS

To document cumulative effects for this study, the analysis followed the five-part evaluation process outlined in *Fritiofson v. Alexander*, 772 F.2d 1225 (5th Cir., 1985), as described in FHWA’s *Guidance: Questions and Answers Regarding the Consideration of Indirect and Cumulative Impacts in the NEPA Process* (FHWA, 2014):

1. What is the geographic area and temporal boundaries affected by the study?
2. What are the resources affected by the study?
3. What are the other past, present, and reasonably foreseeable actions that have impacted these resources?
4. What were those impacts?
5. What is the overall impact on these various resources from the accumulation of the actions?

Each of these parts of the cumulative effects evaluation process is discussed in **Section 4** of this Technical Report.

3. INDIRECT EFFECT ANALYSIS

3.1 STEP 1: SCOPING

The first step in the indirect effects analysis includes scoping activities and the identification of the study area in order to set the stage for the remaining steps. As part of this scoping effort, a number of planning documents prepared by the localities were reviewed, including the James City County 2035 Comprehensive Plan, the City of Newport News 2030 Comprehensive Plan, the York County 2035 Comprehensive Plan, the James City County 2035 Land Use Map, the City of Newport News Framework for the Future 2030 and Transportation Plan Map, the York County Land Use 2035 Map, the James City County 2035 Strategic Plan, the HRTPO 2040 LRTP, and HRTPO FY 2018-2021 Transportation Improvement Program (City of Newport News, 2008, 2016a, 2016b, 2017; HRTPO, 2016, 2017; James City County, 2015a, 2015b, 2015c, 2016; and York County, 2013a, 2013b, 2013c). These documents illustrate that the proposed improvements have been considered in the local and regional planning processes for some time.

Pursuant to 23 CFR §771.111 and the CEQ’s *Memorandum for General Counsels, NEPA Liaisons, and Participants in Scoping*, the VDOT, in cooperation with FHWA, has coordinated extensively with local,

state, and federal entities as well as engaged in public involvement efforts throughout the development of the SCC Study. Scoping activities originally occurred in 2012, when the SCC Study was initiated before it was placed on hold. As the study was reinitiated in 2017, scoping activities included additional updated coordination efforts. VDOT mailed scoping letters to the following local, state, and federal agencies and non-governmental organizations to obtain pertinent information and to identify key issues regarding the potential environmental impacts for this study. The letters and questionnaires related to the recipient's purview were mailed to the following government agencies:

- Advisory Council on Historic Preservation
- City of Newport News
- City of Williamsburg
- Hampton Roads Planning District Commission
- Hampton Roads Transportation Accountability Commission
- Hampton Roads Transportation Planning Organization
- James City County
- National Oceanic and Atmospheric Administration, Habitat Conservation Division
- United States Army Corps of Engineers
- United States Department of Agriculture, Forest Service
- United States Department of Agriculture, Natural Resources Conservation Service
- United States Department of Homeland Security, Federal Emergency Management Agency
- United States Department of Homeland Security, United States Coast Guard
- United States Department of Housing and Urban Development
- United States Department of the Interior, Fish and Wildlife Service
- United States Department of the Interior, National Park Service, Northeast Region
- United States Department of the Interior, Office of Environmental Policy and Compliance
- United States Department of Transportation, Federal Railroad Administration
- United States Department of Transportation, Federal Transit Administration
- United States Environmental Protection Agency
- United States Joint Base Langley-Eustis
- Virginia Department of Agricultural and Consumer Services
- Virginia Department of Conservation and Recreation
- Virginia Department of Emergency Management
- Virginia Department of Environmental Quality
- Virginia Department of Forestry
- Virginia Department of Game and Inland Fisheries
- Virginia Department of Health
- 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 Marine Resources Commission
- Virginia Outdoors Foundation
- Virginia Peninsula Regional Jail
- Virginia State Police Department

- York County
- Yorktown Naval Weapons Station

Scoping letters were customized to specifically ask appropriate parties questions regarding indirect and cumulative effects. The information obtained through these efforts was used to further inform discussions on the directions and goals of the region, as well as the resources included in the study area. The USACE and Virginia Department of Agriculture and Consumer Services (VDACS) provided specific suggestions that apply to the study area and directions and goals of the region. USACE recommended that the study area boundary for analyzing indirect and cumulative effects include an area of sufficient size to include any indirect downstream effects. USACE also recommended that VDOT obtain information regarding impaired waters in the region and ascertain the basis for their designation as impaired, which may provide helpful information for establishing a geographic study area for the analysis of potential indirect and cumulative effects to streams. Lastly, in determining a timeframe for evaluating cumulative effects, the USACE recommended that VDOT consider the dates of construction of highways (US 60, I-64, and VA 143) or any major development/change in land use within and adjacent to the study area in setting a past date. These suggestions were recognized when developing resource study areas, as described in **Section 3.2.1**.

VDACS suggested that VDOT be mindful of any actions that could result in alteration of water flow within surrounding agricultural lands and, to the greatest extent possible, minimize any adverse drainage or erosion issues that may result. These topics are addressed in **Section 3.7.2.1**.

VDOT staff reached out to Walmart and Newport News Waterworks to gather additional information about the study area. Walmart provided details regarding the number of trucks that travel to and from the distribution center and which roadways are typically used by the trucks, including the primary roadways on the peninsula, VA 143 and US 60. Newport News Waterworks provided information on the use of Skiffes Creek Reservoir and how transportation projects typically affect the reservoirs.

VDOT held a Citizen Information Meeting (CIM) to provide citizens and organizations the opportunity to comment on the proposed project. CIMs were held on November 9, 2017 from 5:00 p.m. to 7:00 p.m. and on February 15, 2018 from 6:00 p.m. to 8:00 p.m. at James River Elementary School, 8901 Pocahontas Trail, Williamsburg, VA. At the first CIM, comments corresponding to indirect and cumulative effects of the project primarily were concerned with safety, development, and impacting the quality of life in the area. At the second CIM, all of the commenters agreed with the decision to retain Build Alternative 1. Half of the commenters disagreed with the decision to retain Build Alternative 2 citing that the alternative would interfere with the development of a proposed church and that it would be too close to existing housing. Comments corresponding to indirect and cumulative effects of the project were concerned with future traffic flow, multi-modal connectivity, environmental and reservoir impacts, safety, and effects to existing communities in the area.

Through the merged process, Concurring, Cooperating, and Participating Agencies for the SCC Study (resource agencies), have received clarifications based on comments and discussions in response to concerns including that the ICE Study Area figures be included in the approved ICE methodology (**Appendix A**), wildlife corridors and downstream waters be included in the ICE analysis, all tools used in specific resources analyses be used in the ICE analysis, as appropriate, and that the ICE report receives updates to language on assessing overall impact of cumulative actions.

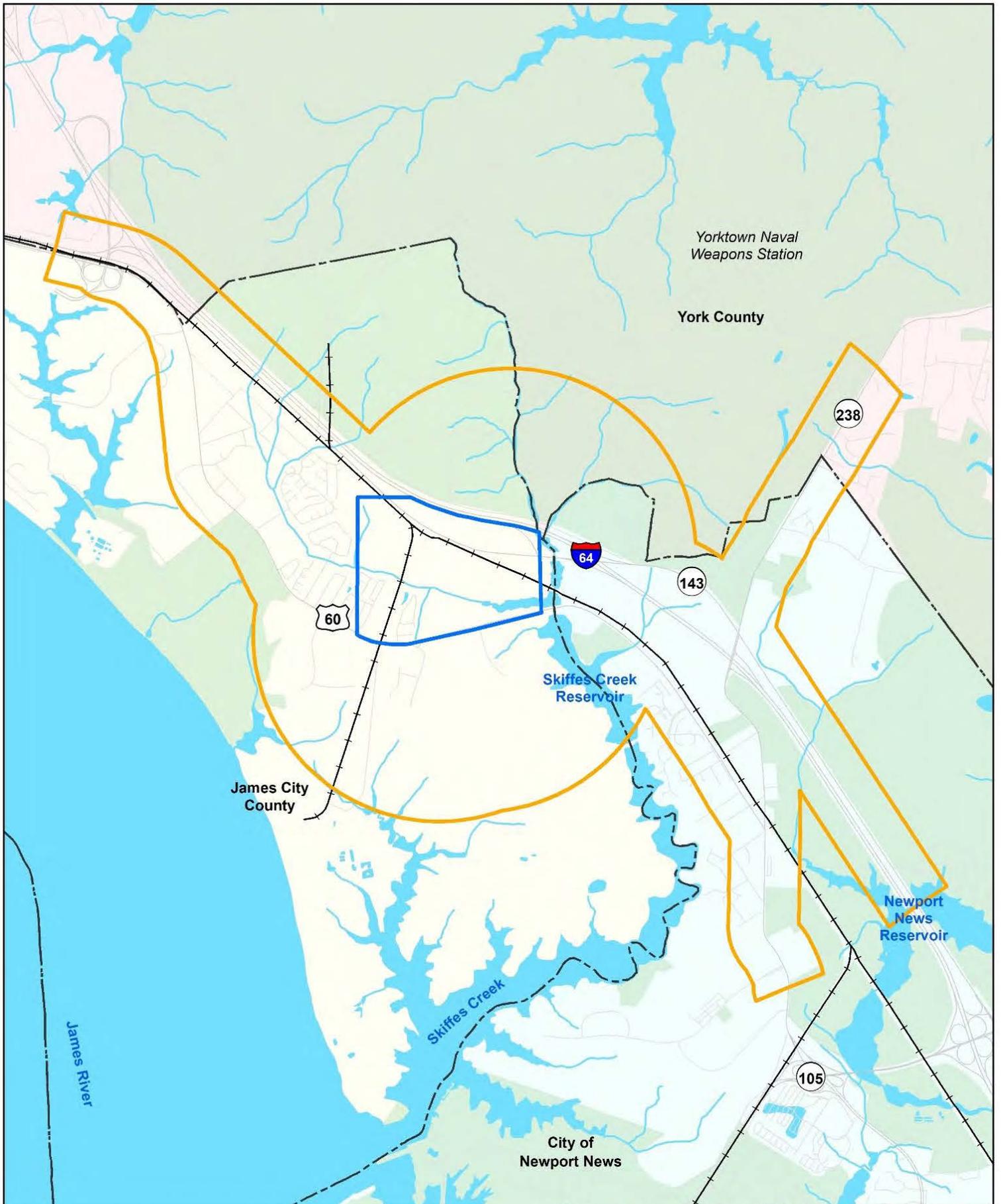
3.2 STEP 2: IDENTIFY STUDY AREA DIRECTION AND GOALS

The second step in the indirect effects analysis focuses on assembling information about general trends and goals within the study area. This included identifying the study areas in which resources were identified and analyzed as part of the analysis.

3.2.1 Study Areas

The study area for this analysis, 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 of the following resource topics:

- **Induced Growth Study Area** –The Induced Growth Study Area incorporates a one-mile buffer around all new intersections, including the new connections between US 60 and VA 143 and a 1,000-foot buffer area along three miles of major feeder roads extending from all new intersections (refer to **Figure 3-1**).
- **Socioeconomic Resources ICE Study Area** (including socioeconomics, environmental justice [EJ] populations, community facilities, recreational resources, and land use) – The Socioeconomic Resources ICE Study Area includes all Census block groups partially or fully within the Induced Growth Study Area (refer to **Figure 3-2**).
- **Natural Resources ICE Study Area** (including water resources, floodplains, wildlife habitat, and threatened, endangered, and special status species) – The Natural Resources ICE Study Area uses the US Geological Survey (USGS) subwatershed 12-digit Hydrologic Unit Codes (HUCs) that encompass the Induced Growth Study Area (HUC 020802060802 - Skiffes Creek-James River, HUC 020801070203 - Carter Creek-York River, and HUC 020802060901 - Warwick River). The HUCs were cut at the shorelines of the James River and York River to form the Natural Resources ICE Study Area since it is unlikely that implementation of the project would cause discernable indirect effects to the James River or the York River (refer to **Figure 3-3**).
- **Historic Resources ICE Study Area** – Indirect effects such as altering the setting, feeling and association of archaeological and architectural historic properties are considered under Section 106 of the National Historic Preservation Act (NHPA). The types of indirect effects that will be assessed for the ICE analysis would be changes to accessibility or visitation during or after construction. The Historic Resources ICE Study Area will be the same as the Area of Potential Effects (APE) which was developed in consultation with the State Historic Preservation Officer (SHPO) (refer to **Figure 3-4**). The identification of historic resources in the Historic Resources ICE Study Area would be limited to existing studies previously completed within the study area and a desktop review of the Virginia Cultural Resource Information System (VCRIS) website.



**Figure 3-1:
Induced Growth
Study Area**

VDOT Virginia Department of Transportation
 Skiffes Creek Connector Study
 VDOT Project Number: 0060-047-627, P101, R201, C501;
 UPC: 100200

0 0.25 0.5 1 Miles

W N E S

—+— Railroad
 - - - County Boundary

Induced Growth Study Area
Study Area



Source: ESRI, NHD

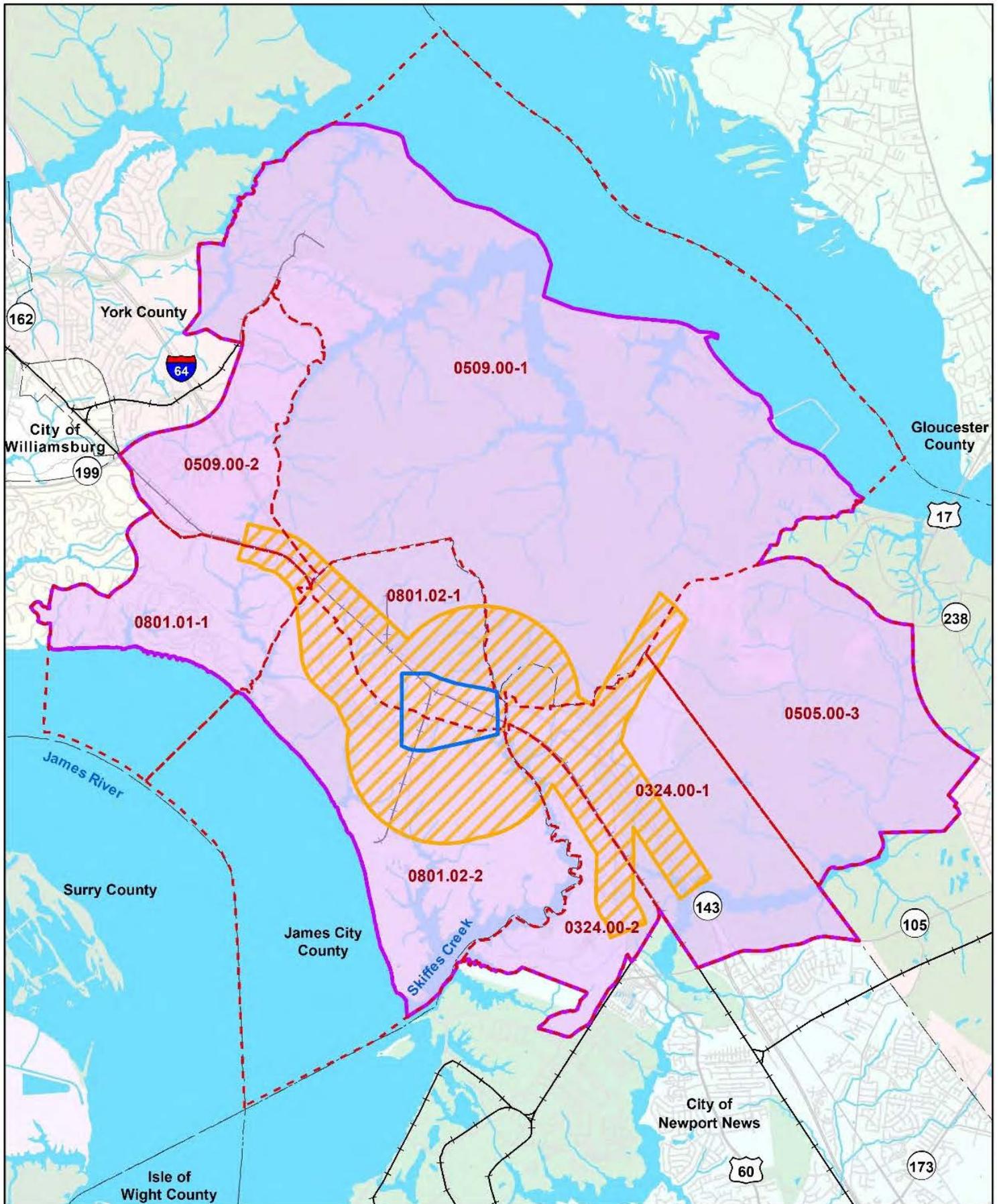


Figure 3-2
Socioeconomic
Resources ICE
Study Area

VDOT Virginia Department of Transportation
 Skiffes Creek Connector Study
 VDOT Project Number: 0060-047-627, P101, R201, C501;
 UPC: 100200

0 0.5 1 2 Miles

Source: ESRI, NHD, Census

-  Socioeconomic Resources
-  ICE Study Area
-  Induced Growth Study Area
-  Study Area
-  Census Block Group





**Figure 3-3
Natural Resources ICE
Study Area**

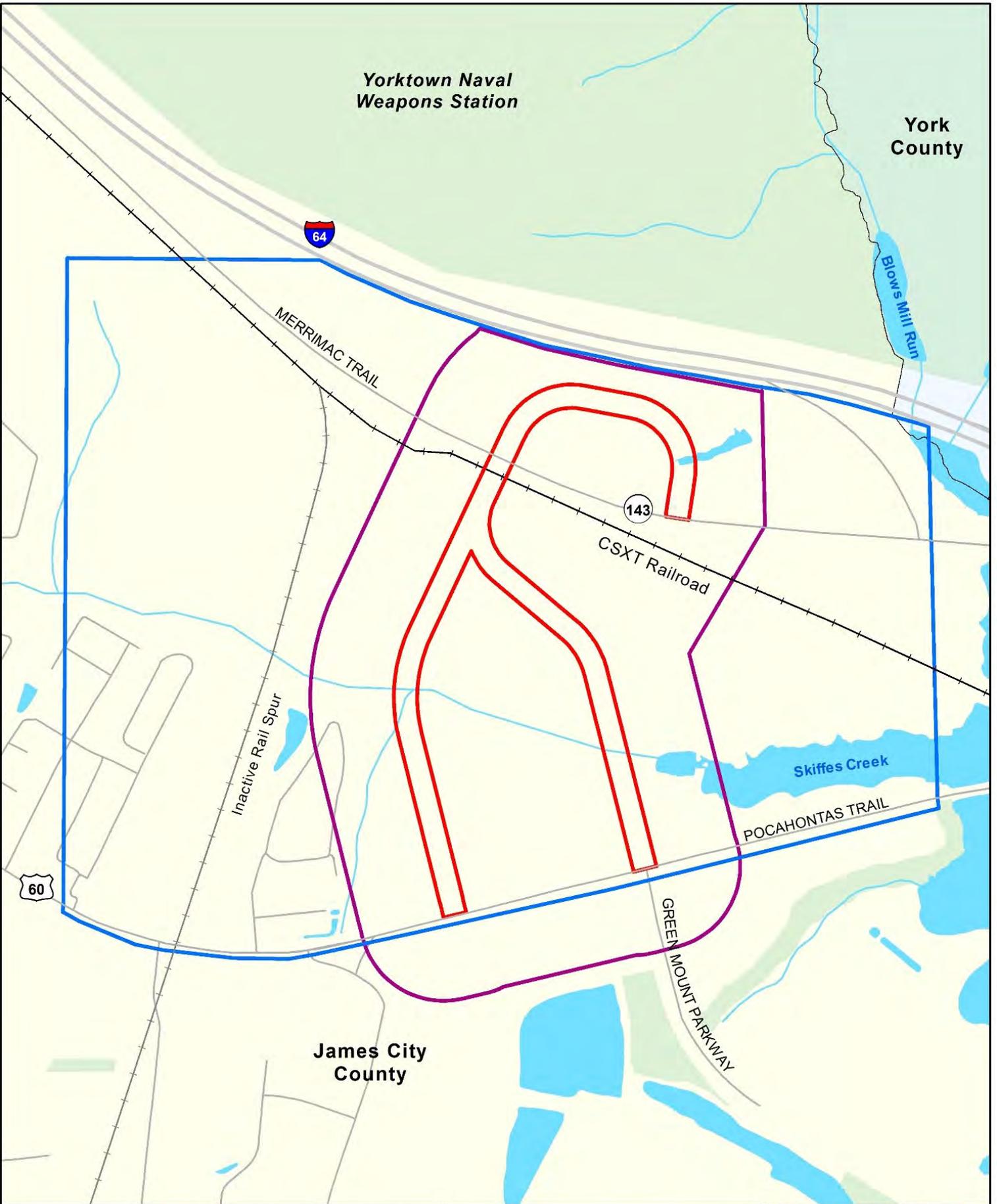
VDOT Virginia Department of Transportation
 Skiffes Creek Connector Study
 VDOT Project Number: 0060-047-627, P101, R201, C501;
 UPC: 100200



Source: ESRI, USGS, NHD

- Study Area
- Natural Resources ICE Study Area
- Induced Growth Study Area
- 12-Digit Hydrologic Unit Code (HUC)





<p>Figure 3-4 Historic Resources ICE Study Area</p>	<p>VDOT Virginia Department of Transportation Skiffes Creek Connector Study VDOT Project Number: 0060-047-627, P101, R201, C501; UPC: 100200</p> <p>0 0.05 0.1 0.2 Miles</p> <p>Source: ESRI, NHD</p>	<p>Area of Potential Direct Effects (Red outline)</p> <p>Area of Potential Indirect Effects (Purple outline)</p> <p>Study Area (Blue outline)</p> <p>Railroad (Line with cross-ticks)</p>	<p>Richmond 64 49 95 66 17 Newport News</p>
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3.2.2 Directions and Goals

The directions and goals considered for the analysis are independent of the transportation alternatives being evaluated in the EA and include social, economic, growth-related, and natural resource-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, and a favorable 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.

Understanding the regional goals is also important for 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 ICE study areas in order to provide insight to the direction and goals for the study area.

3.2.2.1 Historic Land Use

The Socioeconomic and Natural Resources ICE Study Areas (ICE Study Areas) encompass a portion of the peninsula bordered by the cities of Williamsburg and Newport News. In 1881, the establishment of the Chesapeake and Ohio Railway (C&O) (present day CSXT railroad) opened up transportation on the peninsula. While focused on transporting coal from West Virginia to the port in Newport News for shipping, the C&O also established freight and passenger stations at frequent intervals along the peninsula. Since 1918, two large portions of the ICE Study Areas have been encompassed by military development. The Yorktown Naval Weapons Station occupies approximately 20 square miles in the northeastern portion of the ICE Study Areas (between present day I-64 and the York River) and the Joint Base Langley-Eustis (Fort Eustis) occupies approximately 13 square miles in the southwestern portion of the ICE Study Areas along the James River. In addition, approximately 750 acres of land adjacent to the James River was occupied by Carter's Grove Plantation. The military lands and the plantation have not undergone significant development, remaining relatively undeveloped to this day. The Lee Hall Reservoir/City of Newport News Reservoir was identified as being used as a reservoir and pumping station by 1919 (United States Department of War, 1920). Additionally, in 1919, the Skiffes Creek Reservoir was developed to help meet the increased needs for water on the peninsula for World War I troops traveling through Newport News, (City of Newport News Waterworks, 2018).

By the 1930s, the ICE Study Areas had become intersected by the newly renumbered US 60, and State Route 168 (present day VA 143), with sparse buildings across the peninsula and the majority of the land still being used for agriculture. In 1940, VA 170 was renumbered to become VA 238 and followed the boundary of the Yorktown Naval Weapons Station to I-64. The addition of these transportation routes allowed for increased access to development and settlement in these areas.

Review of Historic Mapping

Knowledge of the historic effects of transportation investments on land use can help define potential future land use changes related to transportation investments, therefore, the following review of historic mapping

and historic land use primarily utilizes USGS historic topographic maps starting from 1943, supplemented by Google Earth historic aerial imagery, beginning in 2005.

The USGS historic topographic maps from 1943 show additional military, transportation, and commercial land uses, specifically the Cheatham Annex, the present day Newport News/Williamsburg International Airport next to Fort Patrick Henry, an unpaved US 17, and various other unpaved roadways outside the protected areas (see **Appendix B** for USGS historical topographical maps). The City of Newport News Reservoir is labeled on the 1943 Yorktown topographic map and the Skiffes Creek Connector Reservoir dam can be seen clearly on the 1944 Yorktown topographic map. The 1950 USGS topographic maps show a growth in residential and public land designated for park use, specifically the Colonial National Historical Park and Newport News Park (located between I-64 and Yorktown Naval Weapons Station), and the Lackey community between Newport News Park and military base. Other residential growth is shown along VA 143 and US 60 in the Grove and Lee Hall communities, including the Morning Star Church, Mount Gilead Church, and Zion Church. On these 1950s USGS historic topographic maps, the majority of the areas in close proximity to stream valleys and reservoirs can be seen as forested and undeveloped. Further into the 1950s, on the USGS historic topographic maps from 1957, US 17 is shown as a paved road and additional residential land use can be seen along US 60 and VA 238, including Lebanon Church. These developments encroached on the mapped forested areas in proximity to Skiffes Creek. Additionally, on the 1957 topographic map in the area between US 60 and the James River, a rail spur was constructed connecting the CSXT rail line to new industrial development on the coast. Both the rail line and the industrial development intersected and encroached on streams, wetlands, and forested areas.

On the 1965 USGS topographic map, I-64 is shown bisecting the ICE Study Areas, generally following the CSXT railroad, and additional residential development is shown off US 60, in James City County and the City of Newport News, along VA 238, and around the Lee Hall community, where VA 238 meets US 60. The development of I-64 encroached on forested areas surrounding the City of Newport News Reservoir to allow for the Exit 250 interchange. Newport News saw additional residential land use around US 60 and VA 173 along with construction of the Patrick Henry Airport. This residential development in both localities encroached on mapped forested areas and streams associated with Skiffes Creek and the City of Newport News Reservoir. The 1965 Yorktown USGS topographic map also shows the addition of a water tank and substation toward the James River west of the Skiffes Creek Reservoir. The Skiffes Creek Reservoir is first labeled on the 1965 topographic map. Historic topographic maps from the 1970s show increasing residential development around Fort Eustis and the airport, and generally surrounding US 60 on the southern portion of the study area. This residential development disturbed mapped forested areas and wetland areas between US 60 and I-64 and towards the Warwick River. The manufacturing plant of Anheuser-Busch Inc. is shown as planned development on the 1972 Hog Island topographic map along US 60 towards Williamsburg. Additional development along US 60 surrounding VA 199, including Carver Gardens, is shown on the northern portion of the study area. In 1975, Busch Gardens first opened as Busch Gardens: The Open Country, seen on the 1979 topographic map as various buildings and identified on the 1984 topographic map as Busch Gardens.

Residential construction continued through the 1980s, primarily on the southern portion of the study area, and along arterial roads, as seen on the 1986 Mulberry Island and 1980 Yorktown topographic map. Water Country USA opened in 1984 and the Patrick Henry Mall open in 1987, contributing to the growth surrounding Williamsburg and the Newport News/Williamsburg International Airport, likely due to the

ease of access granted by I-64. On the 1994 topographic map, industrial development can be seen near Fort Eustis, including several present day distribution centers. Around this time, a large percent of the ICE Study Areas located in Newport News is shown as residential land use. The 1994 topographic map, in James City County, shows a majority of the residential development surrounding US 60 with infill residential development. Previously mapped forested areas can be seen as residential development, with encroachment on the natural resources in those areas, primarily surrounding I-64 and in close proximity to associated exits. The southern portion of the York County part of the ICE Study Areas, excluding the Yorktown Naval Weapons Station, Colonial National Historical Park, and Newport News Park, experienced suburban development during the 1970s, and was essentially fully developed by the early 2000s (USGS, 2016).

Google Earth aerial imagery from 2005 depicts additional industrial development located in the vicinity of I-64, in addition to residential development in the northwest portion near and within the Grove community by Busch Gardens (Google Earth, 2005). Around this time, various distribution centers were being located in James City County and the City of Newport News in designated industrial parks located primarily south of US 60. Forested areas can still be seen in Yorktown Naval Weapons Station, Colonial National Historical Park, and Newport News Park, surrounding a majority of the industrial and residential development, and interspersed along the reservoirs, rivers, lakes, ponds, and streams throughout or surrounding the study area. Much of the protected land from the 1930s still exists in the ICE Study Areas today and a majority of the development seen from 2005 to present day aerial images is adjacent to already developed areas, likely depicting the use of present day locality strategic development planning.

Historic Population Increases

Table 3-1 shows the population increase between 1940 and 2015 for the localities encompassing or intersecting the ICE Study Areas including James City County, York County, and the City of Newport News. James City County, York County, and the City of Newport News experienced the greatest increase between 1950 and 1960, likely due to the formation of I-64 on the peninsula in 1957. James City County's 10-year growth remained above 20 percent from 1940 to 2010. From 2010 to 2015, the percent increase was 9 percent, a similar annual increase as the past. While growth continued steadily in James City County, followed by York County, growth in the City of Newport News increased more slowly, leveling out to minimal change between 2000 and 2015 (Census, 2018b and 2018c).

Table 3-1: Historic Populations

Locality	1940	1950	1960	1970	1980	1990	2000	2010	2015
James City County	4,907	6,317	11,539	17,853	22,763	34,859	48,102	67,009	73,147
<i>Growth %</i>	--	22%	45%	35%	22%	35%	28%	28%	9%
York County	8,857	11,750	21,583	33,203	35,463	42,422	56,297	65,464	67,837
<i>Growth %</i>	--	25%	46%	35%	6%	16%	25%	14%	4%
City of Newport News	37,067	42,358	113,662	138,177	144,903	170,045	180,150	180,719	182,385
<i>Growth %</i>	--	12%	63%	18%	5%	15%	6%	0%	1%
Virginia	2,677,773	3,318,680	3,966,949	4,651,448	5,346,797	6,187,358	7,078,515	8,001,024	8,382,993
<i>Growth %</i>	--	19%	16%	15%	13%	14%	13%	12%	5%

Source: U.S. Census of Population and Housing (Census, 2018b and 2018c).

3.2.2.2 Land Use Patterns and Local Plans

The following sections describe the local plans that guide the land use patterns and other development in each locality within the Socioeconomic Resources ICE Study Area. Each locality has a general, overarching plan guiding community development as described below.

Within James City County, the Socioeconomic Resources ICE Study Area primarily consists of undeveloped land, followed by residential, industrial, and transportation land uses, with much less public, institutional, and business land uses. The area south of US 60 is primarily composed of limited and general industrial land use, with a small portion of open space/recreational and mixed space land use bisecting these areas. The land use south and west of Busch Gardens is primarily residential. James City County's Comprehensive Plan *Toward 2035: Leading the Way* anticipates increased growth in the next 20 years that is accounted for in the County's future land use patterns (JCC, 2015b). The James City County 2035 Land Use Map depicts land uses similar to existing land uses with the proposed SCC as a connection between VA 143 and US 60. General industrial land use is anticipated south of VA 143 and above the residential and mixed use areas near the identified SCC (JCC, 2015a).

York County has primarily conservation and military land uses adjacent to James City County, including Yorktown Naval Weapons Station, Colonial National Historical Park, Newport News Park, and the Cheatham Annex Naval Supply Center (Cheatham Annex) (York County, 2013b). The portions of York County south of the Cheatham Annex, west of Yorktown Naval Weapons Station, and north of I-64 consist of primarily vacant, commercial, and conservation use, with mixed residential use. According to the York County Land Use 2035 map, the conservation and military land uses in York County are not anticipated to change in land use (York County, 2013c). York County's *Charting the Course to 2035: The County of York Comprehensive Plan 2013* Comprehensive Plan aims to "promote development and land use strategies that enhance roadway safety and preserve the carrying capacity of the roadway network" (York County, 2013a).

The City of Newport News encompasses the eastern portion of the Socioeconomic Resources ICE Study Area and consists of a mix of residential, retail commercial, park, military, industrial and mixed land use (City of Newport News, 2016a). This section of the Socioeconomic Resources ICE Study Area includes Newport News Park, which does not show any anticipated land use change on Newport News' *Framework for the Future 2030 & Transportation Plan* map (City of Newport News, 2016b). The other areas in Newport News show similar land uses for 2030 with a few areas shifting to community facility and residential land use. Accordingly, Newport News' *One City, One Future Comprehensive Plan* aims to "maintain a safe, accessible, and efficient multi-modal transportation system," to effectively "connect neighborhoods, employment, and activity centers," and "maintain an attractive street and highway system that allows safe, convenient and efficient movement of people and goods" (City of Newport News, 2017).

3.2.2.3 Future Population Projections

The Weldon Cooper Center for Public Service, Demographics Research Group produces Virginia locality population projections for three future consecutive decennial years (2020, 2030 and 2040) utilizing past available U.S. Census Bureau (Census) data. Similar to the trends shown in **Table 3-1**, the population within James City County is anticipated to continue to grow at a steady rate, faster than surrounding localities and Virginia projections, with a 50 percent increase projected between 2015 and 2040. York County is anticipated to have a slower rate of increase, with a 30 percent increase between 2015 and 2040. Finally,

similar to the growth rate between 2000 and 2010, the City of Newport News is projected to have a minimal increase between 2015 and 2040 (see **Table 3-2**) (Weldon Cooper Center for Public Service, 2017).

Table 3-2: Population Projections

Geographic Area	2015	2020	2030	2040	Change from 2015 to 2040
James City County	73,147	79,404	95,549	110,044	-
<i>Growth %</i>	-	9%	20%	15%	50%
York County	67,837	73,161	81,370	88,288	-
<i>Growth %</i>	-	8%	11%	9%	30%
City of Newport News	182,385	185,620	186,514	184,820	-
<i>Growth %</i>	-	2%	0%	-1%	1%
Virginia	8,382,993	8,744,273	9,546,958	10,201,530	-
<i>Growth %</i>	-	4%	9%	7%	22%

Source: Weldon Cooper Center for Public Service, Demographics Research Group, Virginia Population Projections

3.2.2.4 Economic Development and Employment

Table 3-3 shows reported employment for 2000 and 2010 and forecasted employment for 2040. Between 2000 and 2040, the anticipated employment growth in James City County exceeds surrounding localities and the Hampton Roads Peninsula. James City County and York County employment percent change both exceed 90 percent, with 125 percent and 91 percent, respectively. Although the City of Newport News employment total is only predicted to grow by 12 percent and the Hampton Roads Peninsula is expected to grow by 33 percent, cumulatively, the employment in these localities and subsequently the region as a whole is growing.

Table 3-3: Employment Totals of Localities and Hampton Roads Peninsula

Location	Employment Totals			
	2000	2010	Forecast 2040	2000-2040 Percent Change
James City County	25,943	37,183	58,300	125%
York County	24,746	33,354	47,290	91%
City of Newport News	115,678	115,265	129,700	12%
Hampton Roads Peninsula	963,231	994,089	1,277,700	33%

Source: HRTPO, 2012.

Note: Derived from HRTPO 2040 Socioeconomic Forecast; summarizing Peninsula: Gloucester, James City, and York Counties, and cities of Hampton, Poquoson, Williamsburg, and Newport News.

The top employment industries within James City County, York County, and the City of Newport News are listed below. Employment within the study area is largely dependent on the Retail Trade industry, shown in the top three industries in each locality (LMI, 2018a, 2018b, 2018c).

James City County

1. Retail Trade (16%)
2. Arts, Entertainment, and Recreation (13%)
3. Accommodation and Food Services (12%)

York County

1. Accommodation and Food Services (23%)
2. Retail Trade (21%)
3. Local Government (17%)

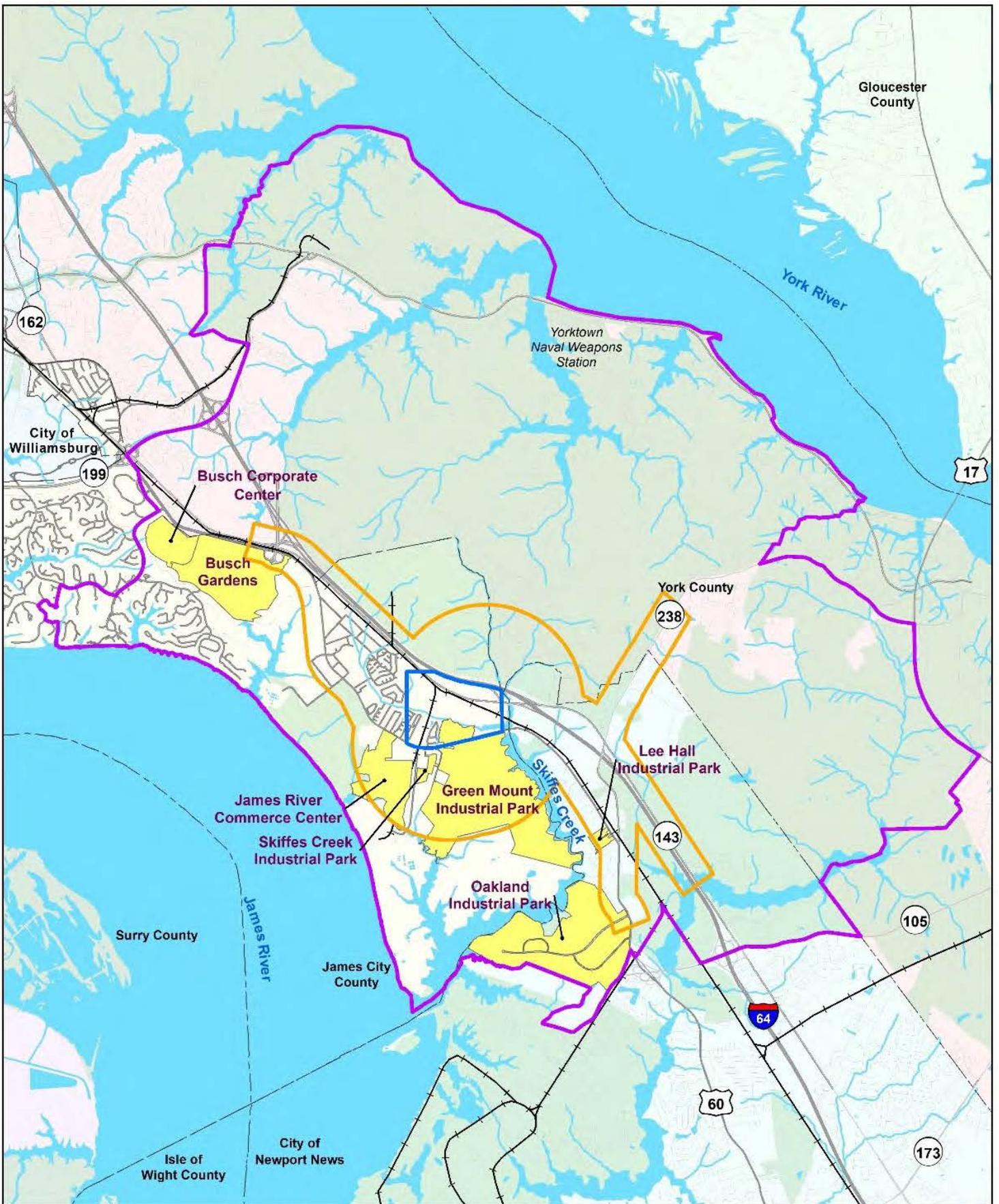
City of Newport News

1. Health Care and Social Assistance (15%)
2. Retail Trade (12%)
3. Local Government (11%)

Within the vicinity of the Socioeconomic Resources ICE Study Area, there are six designated industrial/office parks: the Green Mount Industrial Park, the James River Commerce Center, Skiffes Creek Industrial Park, the Busch Corporate Center, Lee Hall Industrial Park, and Oakland Industrial Park, all of which are located along US 60 (JCC, 2018c) (see **Figure 3-5**). Additionally, Busch Gardens Williamsburg Theme Park, a large commercially-zoned area and an important economic driver for this area, is located along US 60.

The industrial, commercial, and office parks constitute approximately 20 percent of the Socioeconomic Resources ICE Study Area, not including the military or conservation land uses, illustrating their influence on the local economy and employment. The six industrial/office parks are all located within a Virginia Enterprise Zone (VEZ). The VEZ program is a partnership between state and local government that encourages job creation and private investment in the VEZs. Additionally, the Green Mount Industrial Park, James River Commerce Center, Skiffes Creek Industrial Park, Lee Hall Industrial Park, Oakland Industrial Park, and the former BASF property are located within a federally-designated Opportunity Zone, a newly developed designation to encourage investment in low-income census tracts (JCC, 2018a).

A prominent import center located along Green Mount Parkway is the Walmart facility, the second largest Walmart direct import center (out of six total in the US) on the east coast. This Walmart serves eight regional distributions centers which provide for 870 retail stores from Virginia north to Maine and west to Ohio. Although numerous port-related distribution centers contribute to truck traffic in the area, the Walmart distribution center accounts for 43 percent of port-related distribution center traffic entering and exiting Hampton Roads (HRTPO, 2018). According to the Virginia Employment Commission (VEC) Labor Market Information (LMI), Walmart is the third largest employer in James City County and York County, and the ninth largest employer in the City of Newport News (LMI, 2018a, 2018b, 2018c). The facility provides for approximately 960 trips per day which typically utilize the I-64 Exit 250 Fort Eustis interchange to connect to US 60 to travel west through Lee Hall to Green Mount Parkway. The most traffic from the Virginia port is received between 9 AM and 4 PM. The total number of inbound and outbound Walmart truck trips in 2017 totaled 193,295, with 60 percent (115,886) of the truck trips moving east to the Port of Norfolk (Stone, 2017). According to the Port of Virginia, the tons of freight shipped via the port has been increasing and is anticipated to continue increasing steadily (The Port of Virginia, 2016). Therefore,



**Figure 3-5
Industrial/Office/Commercial
Parks Within the
Socioeconomic Resources
ICE Study Area**

VDOT Virginia Department of Transportation
Skiffes Creek Connector Study
VDOT Project Number: 0060-047-627, P101, R201, C501
UPC: 100200



Source: ESRI, NHD, James City County, Newport News, York County

- Industrial/Office/Commercial Park
- Induced Growth Study Area
- Study Area
- Socioeconomic Resources ICE Study Area



3.2.2.5 Natural Resources Protection/Ecosystems

The Natural Resources ICE Study Area underwent a period of rapid urban development from the 1970s to the 1990s, resulting in the loss of the majority of the natural ecosystems that were historically present (see **Section 3.2.2.1 - Historic Land Use**). The remaining natural areas are now largely restricted to the major stream corridors, which have received higher levels of protection with passage of the Clean Water Act of 1972 (CWA), formation of the joint Maryland-Virginia Chesapeake Bay Legislative Advisory Commission in 1978, formation of the Chesapeake Bay Commission in 1980, and enactment in Virginia of the Chesapeake Bay Preservation Act (CBPA) in 1988. Additional laws and regulations that protect major stream corridors include the Virginia Erosion and Sediment Control Law, the Virginia Stormwater Management Act, the Virginia Water Resources and Wetlands Protection Program, floodplain management regulations, and local land disturbance regulations.

The CWA provides water quality, wetland, and stream protections, which are administered and enforced by the USEPA, USACE, and Virginia Department of Environmental Quality (VDEQ). The CBPA provides protections for riparian habitats that buffer wetlands and streams through the designation of Resource Protection Areas (RPAs) and Resource Management Areas (RMAs). In Virginia, administration and enforcement of the CBPA is carried out by the individual localities subject to the CBPA. In the Natural Resources ICE Study Area, the CBPA is enforced by James City County, York County, and the City of Newport News. RPAs within these three localities are defined by slightly different criteria but generally include tidal wetlands, tidal shores, non-tidal wetlands connected by surface flow and contiguous to tidal wetlands or water bodies with perennial flow, and a 100-foot buffer adjacent and landward of the components listed above. Generally, development within the RPA is limited to water dependent activities (e.g., stormwater management facilities, sanitary sewer gravity lines, etc.), redevelopment of existing developed areas (e.g., development within the footprint of an existing structure or impervious surface), and linear transportation and utility projects. James City County, York County, and the City of Newport News currently enforce their respective Chesapeake Bay Preservation Ordinances and generally do not allow residential or commercial development within the RPAs. RMAs usually include any area not designated as an RPA. Development within the RMA is generally less restrictive; however, coordination with the County or City is still required prior to development.

A substantial portion of the wildlife habitat in the Natural Resources ICE Study Area lies within the stream corridors and their floodplains; therefore, wildlife and wildlife habitat also receive protection through the CWA and the CBPA. Threatened, endangered, and special status species, if present, receive direct protection through federal or state endangered species laws. The majority of remaining natural areas within the Natural Resources ICE Study Area are located within County-owned parks, Yorktown Naval Weapons Station, and Fort Eustis. Conservation management and protection of these areas are guided by local plans such as James City County Parks and Recreation's Natural Resources Management Plan and the Integrated Natural Resources Management Plan (INRMP) for Naval Station Norfolk and Yorktown Naval Weapons Station (Department of Defense, 2017).

Although RPA, County-owned parks, and Yorktown Naval Weapons Station provide habitat, the current habitat has been severely fragmented by roads and development and has been degraded in overall ecological functionality compared to historic conditions. Additionally, much of the habitat is degraded and populated with invasive species, including Japanese honeysuckle (*Lonicera japonica*), Nepalese browntop

(*Microstegium vimineum*), Chinese privet (*Ligustrum sinense*), and Oriental bittersweet (*Celastrus orbiculatus*). Much of this development, including housing, agriculture, retail, rail lines, roadways, and reservoirs, occurred prior to the establishment of environmental laws and permits and allowed environmental impacts to go unchecked. Today, regulations prevent unrestrained environmental impacts, but do not reverse the effects of previous environmental degradation.

3.3 STEP 3: INVENTORY OF SENSITIVE RESOURCES IN THE STUDY AREA

Sensitive resources 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 communities and community facilities, economic characteristics, land use, and EJ); natural resources (including water resources, floodplains, wildlife habitat, and threatened, endangered, and special status species); and historic resources.

3.3.1 Socioeconomic Resources

Socioeconomic resources such as communities, community facilities (including recreational resources), and EJ populations are considered valuable and/or unique and may be more sensitive to impacts from a transportation improvement. The surrounding land use and population of a community forms a foundation for a community's character and growth, therefore, the assessment of impacts to communities and community facilities includes the effects associated with changes in land use and socioeconomics.

3.3.1.1 Communities and Community Facilities

James City County, York County, and the City of Newport News identify twenty-six (26) neighborhoods within the Socioeconomic Resources ICE Study Area. The majority of the neighborhoods are located in the southwest portion of the Socioeconomic Resources ICE Study Area and southwest of I-64, including four mobile home parks located adjacent to US 60 (see **Figure 3-6**).

Community facilities in the Socioeconomic Resources ICE Study Area were identified through a review of locality Geographic Information System (GIS) data and online mapping. Numerous public facilities occur throughout the Socioeconomic Resources ICE Study Area, as listed in **Table 3-4**, and shown on **Figure 3-7**. The majority of the community facilities are located along or in close proximity to US 60 and VA 143.

Table 3-4: Community Facilities in the Socioeconomic Resources ICE Study Area

Map ID	Facility	Facility Type
1	New Quarter Park	Park
2	Colonial National Historical Parkway	Trail
3	Navy Region Mid-Atlantic Fire and Emergency Services Station	Fire Station
4	Lee Cemetery	Cemetery
5	Jackson Post Cemetery	Cemetery
6	Colonial National Historical Park	Park
7	York County Fire Station 4	Fire Station
8	Shiloh Baptist Church	Religious Facility
9	Yorktown Middle School	School
10	Newport News Park	Park

Map ID	Facility	Facility Type
11	James City County Fire Station 2	Fire Station
12	Curtis Cemetery	Cemetery
13	Little Zion Baptist Church	Religious Facility
14	Mount Gilead Cemetery	Cemetery
15	Mount Gilead Baptist Church and Christian Academy	Religious Facility/School
16	Grove Community Playground	Playground
17	Carter's Grove Campground	Campground
18	Merrimac Juvenile Detention Center	Government Service
19	Virginia Peninsula Regional Jail	Government Service
20	James River Elementary School	School
21	Abraham Frink Jr. Community Center (formerly James River Community Center)	Community Center
22	Abram Frink Jr Community Center	Community Center
23	Morning Star Church	Religious Facility
24	Skiffes Creek Park	Park
25	Skiffes Creek Redoubt	Park
26	Lebanon Christian Church	Religious Facility
27	St Lukes Methodist Church	Religious Facility
28	Endview Plantation	Historic Plantation
29	Lee Hall Plantation	Historic Plantation
30	Lee Hall Mansion	Historic Property
31	Newport News Park	Park
32	Queen's Hithe	Park
33	Charles Brown Park	Park
34	Newport News Community Gardens	Community Garden
35	Lee Hall Elementary School	School
36	Newport News Fire Training Center	Fire Station
37	Newport News Fire Station 4	Fire Station
38	Newport News Park Ranger Station	Park Ranger Station
39	French Cemetery	Cemetery
40	New Quarter Church	Religious Facility

Note: List finalized April 2018.

3.3.1.2 Environmental Justice

Minority Populations

For the purposes of this study, the minority population for a study Census block group was found to be “meaningfully greater” if its minority population is greater than James City County’s (24 percent minority). Refer to the *Socioeconomic and Land Use Technical Report* for additional information on this methodology (VDOT, 2018c). Based on this threshold, seven of the eight study Census block groups within or partially within the Socioeconomic Resources ICE Study Area meet the definition of minority populations (see **Table 3-5** and **Figure 3-8**).

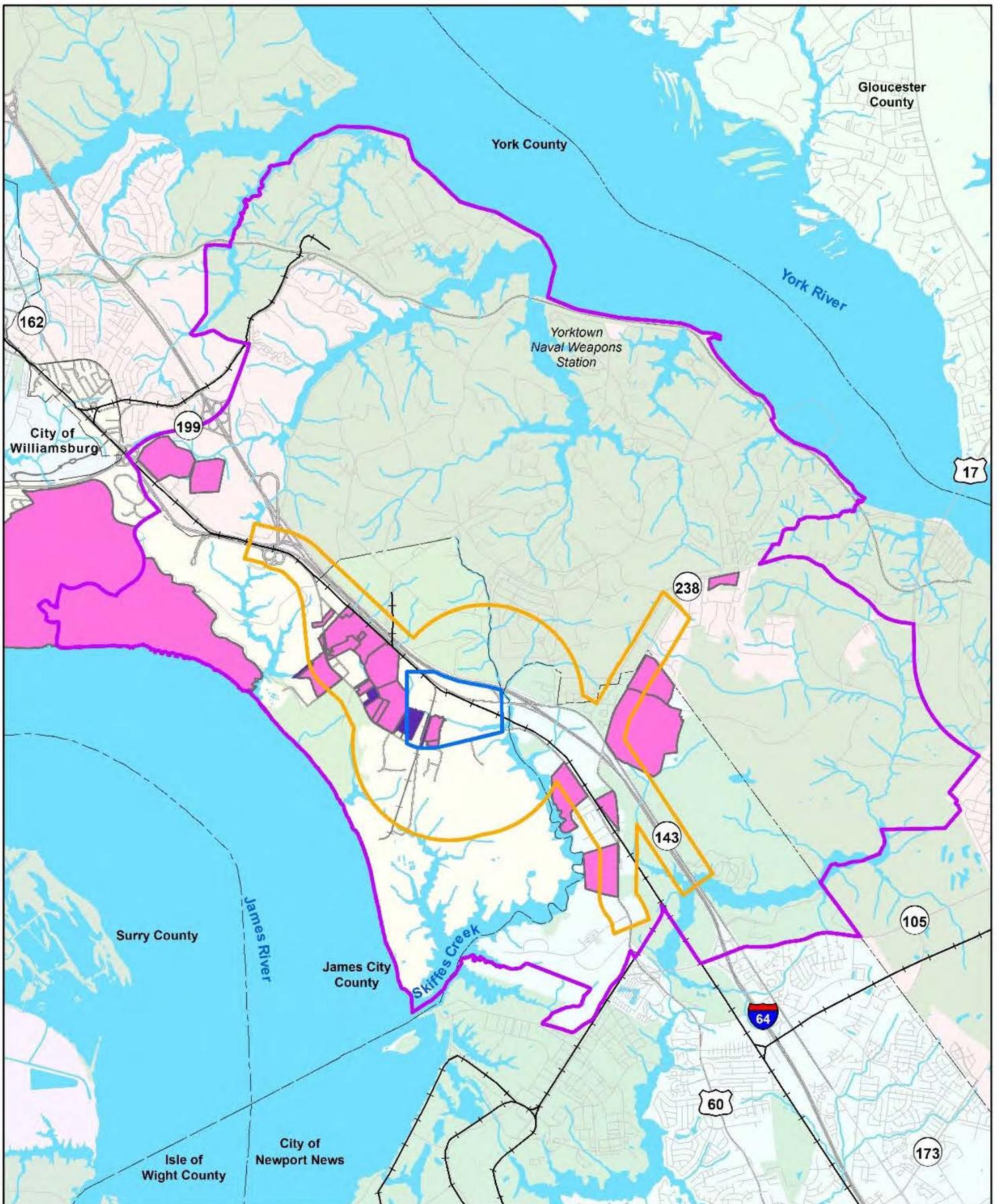


Figure 3-6
Neighborhoods within the
Socioeconomic Resources
ICE Study Area

VDOT Virginia Department of Transportation
 Skiffes Creek Connector Study
 VDOT Project Number: 0060-047-627, P101, R201, C501
 UPC: 100200



Source: NHD, James City & York County, City of Newport News

- Residential Neighborhood
- Mobile Home Park
- Induced Growth Study Area
- Study Area
- Socioeconomic Resources ICE Study Area



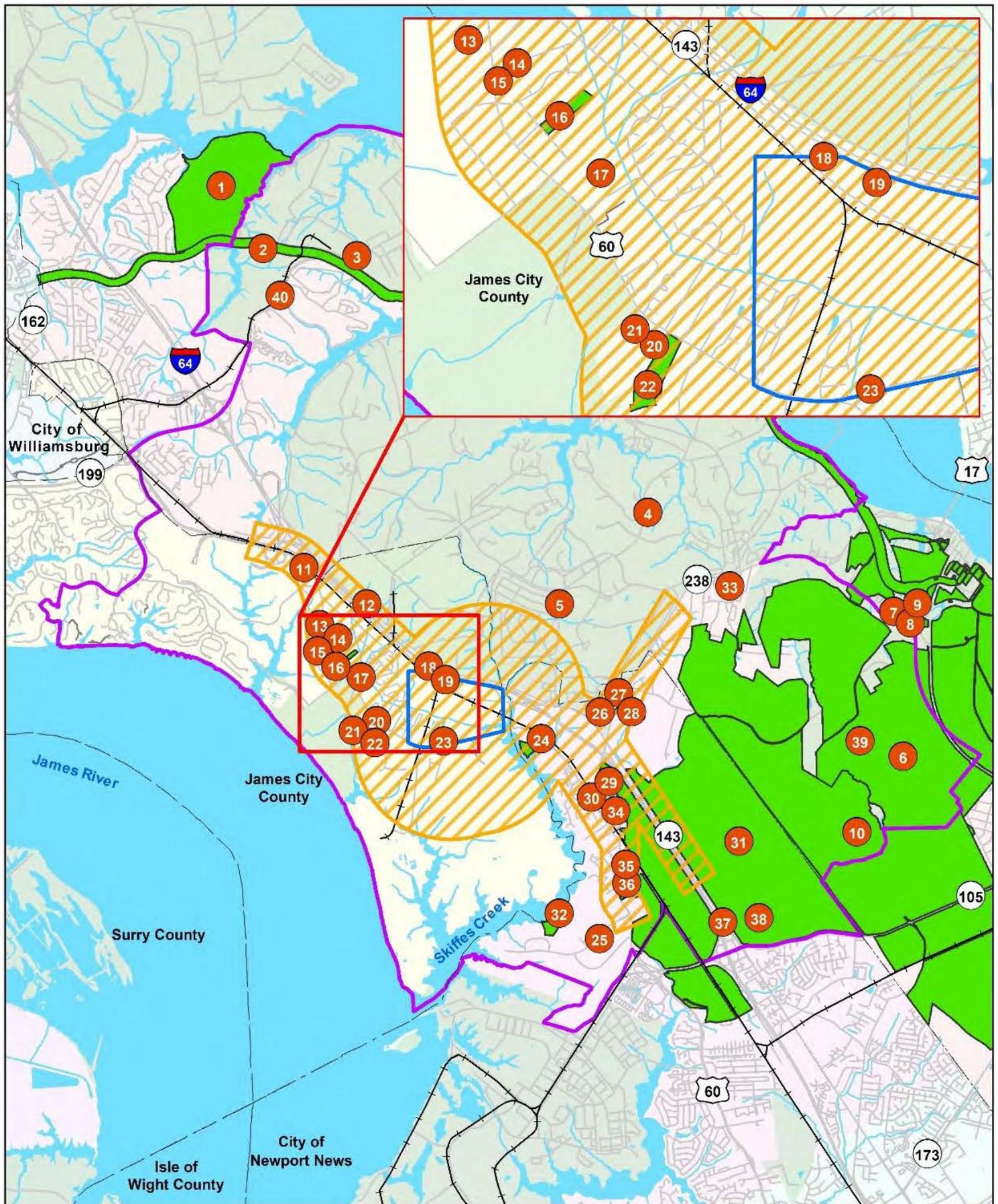


Figure 3-7
Community Facilities
 within the Socioeconomic
 Resources ICE
 Study Area

VDOT Virginia Department of Transportation
 Skiffes Creek Connector Study
 VDOT Project Number: 0060-047-627, P101, R201, C501
 UPC: 100200



Source: ESRI, NHD, James City County, York County, Newport News

- Community Facility
- Community Facility Park
- Study Area
- Induced Growth Study Area
- Socioeconomic Resources ICE Study Area



Table 3-5: Minority or Low-Income Populations within the Socioeconomic Resources ICE Study Area

Geographic Areas / Block Groups	Total Population	% Minority Population ¹	EJ Threshold	Median Household Income	Poverty Threshold (4 Persons/ Household)	EJ Population
801.01-1	1,091	12%	24%	\$141,833	\$24,250	No
801.02-1	1,481	59%		\$29,318		Yes
801.02-2	2,541	51%		\$42,804		Yes
505.00-3	1,097	56%		\$70,875		Yes
509.00-1	884	33%		N/A ²		Yes
509.00-2	1,394	54%		\$54,778		Yes
324.00-1	1,196	41%		\$40,588		Yes
324.00-2	2,040	58%		\$65,000		Yes
Study Area Block Groups Total	11,724	48%		\$38,192		
James City County	70,673	24%		\$75,710		
York County	66,471	27%		\$81,749		
City of Newport News	181,323	55%		\$50,077		
Virginia	8,256,630	37%		\$65,015		

¹Total minority population is the sum of all non-White races plus Hispanic or Latino – White; block groups with percentages of minority and/or Hispanic/Latino greater than the 24 percent threshold are highlighted in blue.

²Due to the low response rate, ACS did not calculate the median household income; however, a review of the data revealed that the median household income of those that did respond is approximately \$50,000.

Source: U.S. Census Bureau, American Community Survey (ACS) 2011-2015 5-Year Estimates

Low-Income Populations

Low-income populations are identified where the median household income for a study Census block group is at or below the Department of Health and Human Services (HHS) 2015 poverty threshold for a family of four, or \$24,250. Refer to the *Socioeconomic and Land Use Technical Report* for additional information on this methodology (VDOT, 2018c). **Table 3-5** presents the median household income of residents in the study Census block groups. No study Census block groups have median household incomes below this threshold, and therefore, none are considered low-income populations.

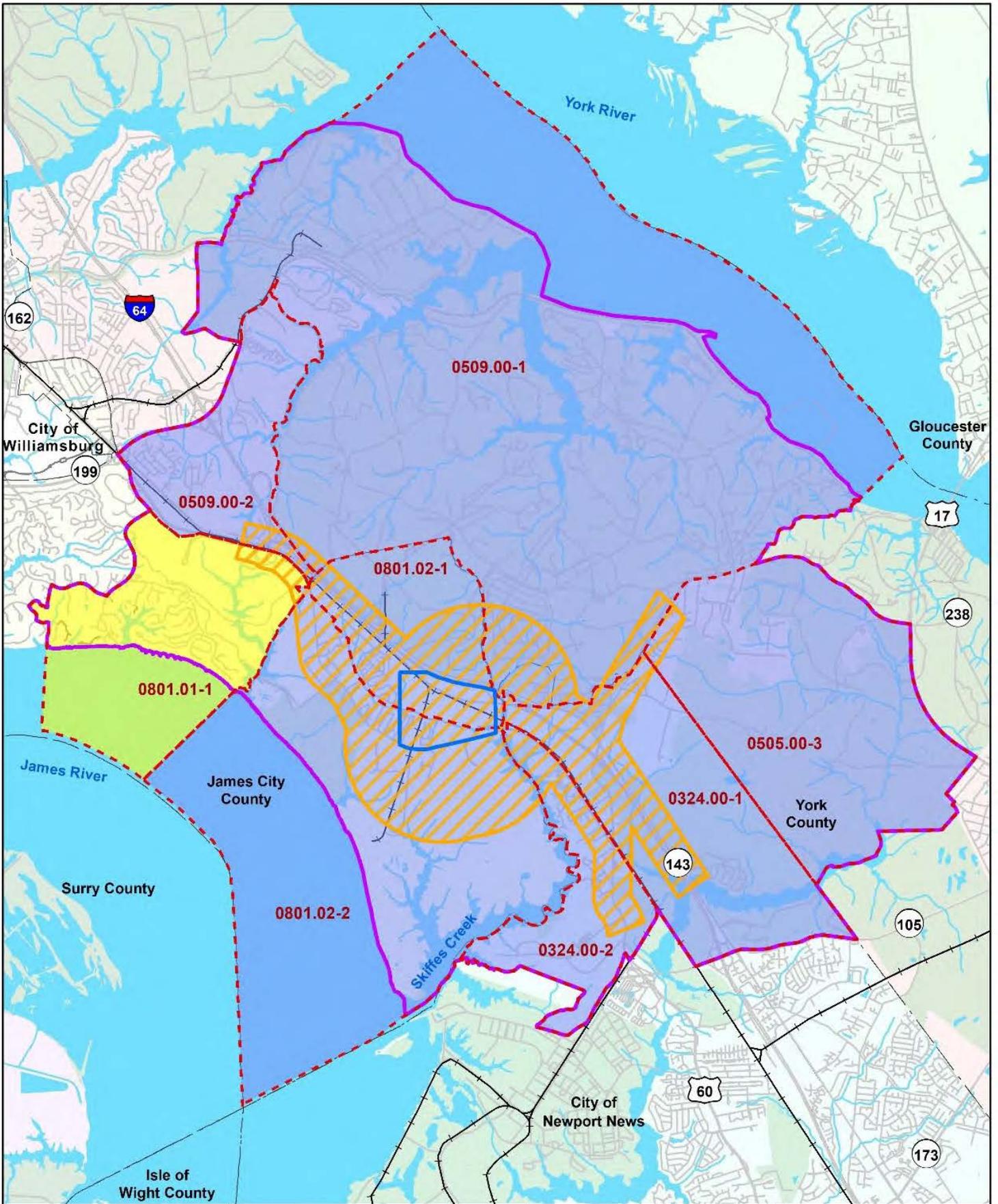


Figure 3-8
Environmental Justice
Populations within the
Socioeconomic Resources
ICE Study Area

VDOT Virginia Department of Transportation
 Skiffes Creek Connector Study
 VDOT Project Number: 0060-047-627, P101, R201, C501;
 UPC: 100200

0 0.5 1 2 Miles

Source: ESRI, NHD, Census

- Non-Minority Population
- Minority Population
- Census Block Group
- Study Area
- Induced Growth Study Area
- Socioeconomic Resources
- ICE Study Area



3.3.2 Natural Resources

Natural resources, including water resources; floodplains; wildlife habitat; and threatened, endangered, and special status species, are considered valuable and/or unique and may be less able to bear impacts from the proposed transportation improvements. Vulnerable natural resources within the Natural Resources ICE Study Area are discussed below.

3.3.2.1 Water Resources

The Natural Resources ICE Study Area contains a large number of named and unnamed perennial and intermittent streams and wetlands (see **Figures 3-9** and **3-10**). Given the size of the Natural Resources ICE Study Area, only Build Alternative 1 and 2 streams and wetlands were field investigated; the rest of the study area was approximated with National Hydrography Dataset (NHD) and National Wetlands Inventory (NWI) per the concurred methods with resource agencies. Approximately 232 miles of stream (combined NHD and 2013/2018 wetland investigation data) are present in the Natural Resources ICE Study Area. Of these, Warwick River, Skiffes Creek, Stony Run, King Creek, and Deep Creek are the most prominent stream corridors in the Natural Resources ICE Study Area. All of the streams in the study area ultimately flow to the James River or the York River.

Approximately 9,052 acres of wetlands (combined NWI and 2013/2018 wetland investigation data) are present in the Natural Resources ICE Study Area; and of these, approximately 2,277 acres (approximately 25 percent) are palustrine vegetated wetlands, 5,494 acres (approximately 61 percent) are estuarine and marine deepwater wetlands, 629 acres (approximately 7 percent) are lacustrine wetlands, 359 acres (approximately 4 percent) are palustrine unconsolidated bottom wetlands, 267 acres (approximately 3 percent) are riverine, and 26 acres (less than 1 percent) are palustrine aquatic bottom wetlands (see **Figure 3-10**). These wetlands and waters are interspersed within the industrial, commercial, and residential areas, and are frequently remnants of larger ecosystems within the floodplains. Often, the wetlands and other aquatic sites directly abut the impervious and semi-impervious developed surfaces within the floodplain with little or no buffer. According to VDEQ's Wetland Condition Assessment Tool (WetCAT), wetland habitat stress levels and water quality stress levels within the Natural Resources ICE Study Area range from slightly stressed to severely stressed (VDEQ, 2017). These scores are consistent for all wetland types, ranging from pristine to severely impacted.

Many surface waters in the Natural Resources ICE Study Area fail to meet state water quality standards and are designated as "impaired waters" under Section 303(d) of the CWA. According to the Final 2014 VDEQ 305(b)/303(d) Integrated Report, there are approximately 290 acres of impaired reservoirs, 2,895 acres of impaired estuaries, and 3.15 miles of impaired streams within the Natural Resources ICE Study Area (see **Figure 3-11**) (VDEQ, 2014). Common causes of impairment include copper, mercury in fish tissue, polychlorinated biphenyls (PCB) in fish tissue, dissolved oxygen, aquatic plants (macrophytes), chlorophyll-a, E. coli, estuarine bioassessments, and fecal coliform.

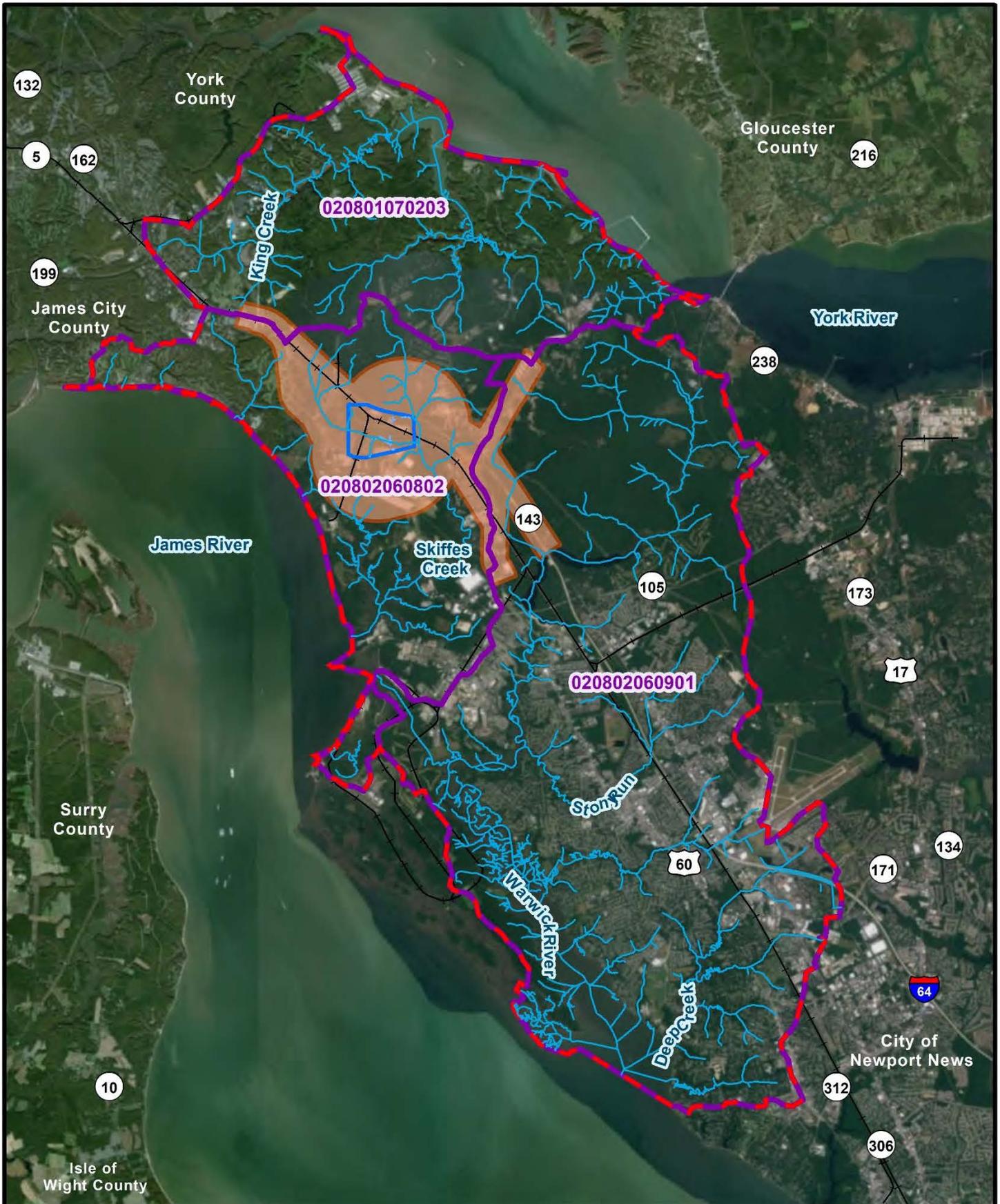


Figure 3-9
Streams Within the
Natural Resources ICE
Study Area

VDOT Virginia Department of Transportation
 Skiffes Creek Connector Study
 VDOT Project Number: 0060-047-627, P101, R201, C501;
 UPC: 100200



Source: VDOT, ESRI, USGS

- Study Area
- Natural Resources ICE Study Area
- Induced Growth Study Area
- HUCs in Study Area
- NHD/Field
- Investigated Streams





Figure 3-10
Wetlands Within the
Natural Resources ICE
Study Area

VDOT Virginia Department of Transportation
 Skiffes Creek Connector Study
 VDOT Project Number: 0060-047-627, P101, R201, C501;
 UPC: 100200



Source: VDOT, ESRI, USGS

- Study Area
- Natural Resources ICE Study Area
- Induced Growth Study Area
- HUCs in Study Area
- Palustrine Vegetated Wetland
- Estuarine
- Lacustrine
- PUB
- Riverine



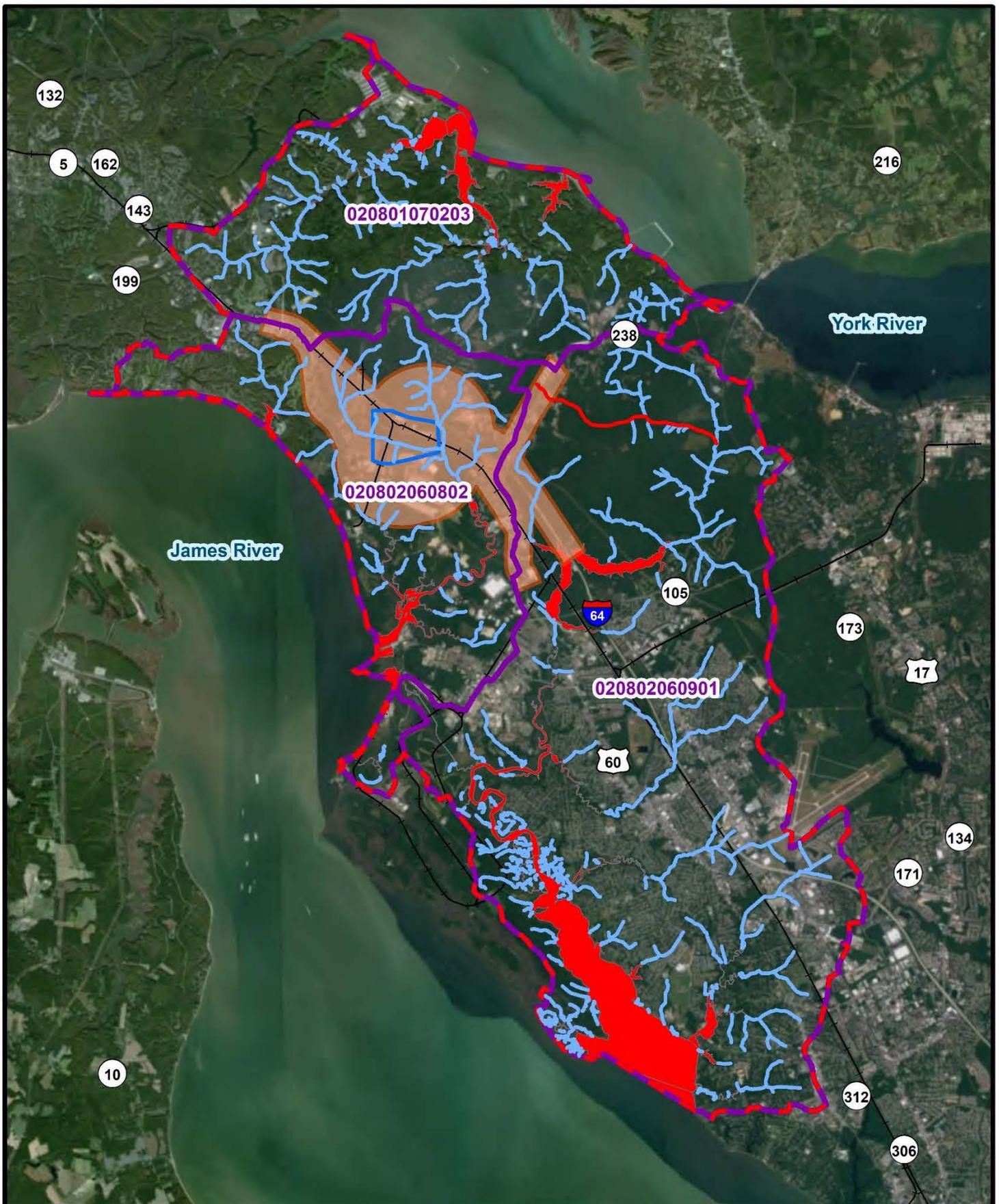


Figure 3-11
Impaired Waters Within
the Natural Resources ICE
Study Area

VDOT Virginia Department of Transportation
 Skiffes Creek Connector Study
 VDOT Project Number: 0060-047-627, P101, R201, C501;
 UPC: 100200

0 0.5 1 2
 Miles

Source: VDOT, ESRI, USGS

- Study Area
- Natural Resources ICE Study Area
- Induced Growth Study Area
- HUCs in Study Area
- Assessed Waters, Not Impaired
- Impaired Waters



The major suspected sources of the impairments include municipal (urbanized high density area), atmospheric deposition – nitrogen, clean sediments, industrial point source discharge, internal nutrient recycling, loss of riparian habitat, municipal point source discharges, wet weather discharges (point source and combination sewer), Sanitary Sewer Overflows (SSO) or Combined Sewer Overflows (CSO), source unknown, and discharges from municipal separate storm sewer systems (MS4). The entire Natural Resources ICE Study Area is within the Eastern Virginia Groundwater Management Area. The Natural Resources ICE Study Area contains six public drinking wells that are a part of a community waterworks and two surface water intakes on Skiffes Creek Reservoir and Lee Hall Reservoir.

3.3.2.2 Floodplains

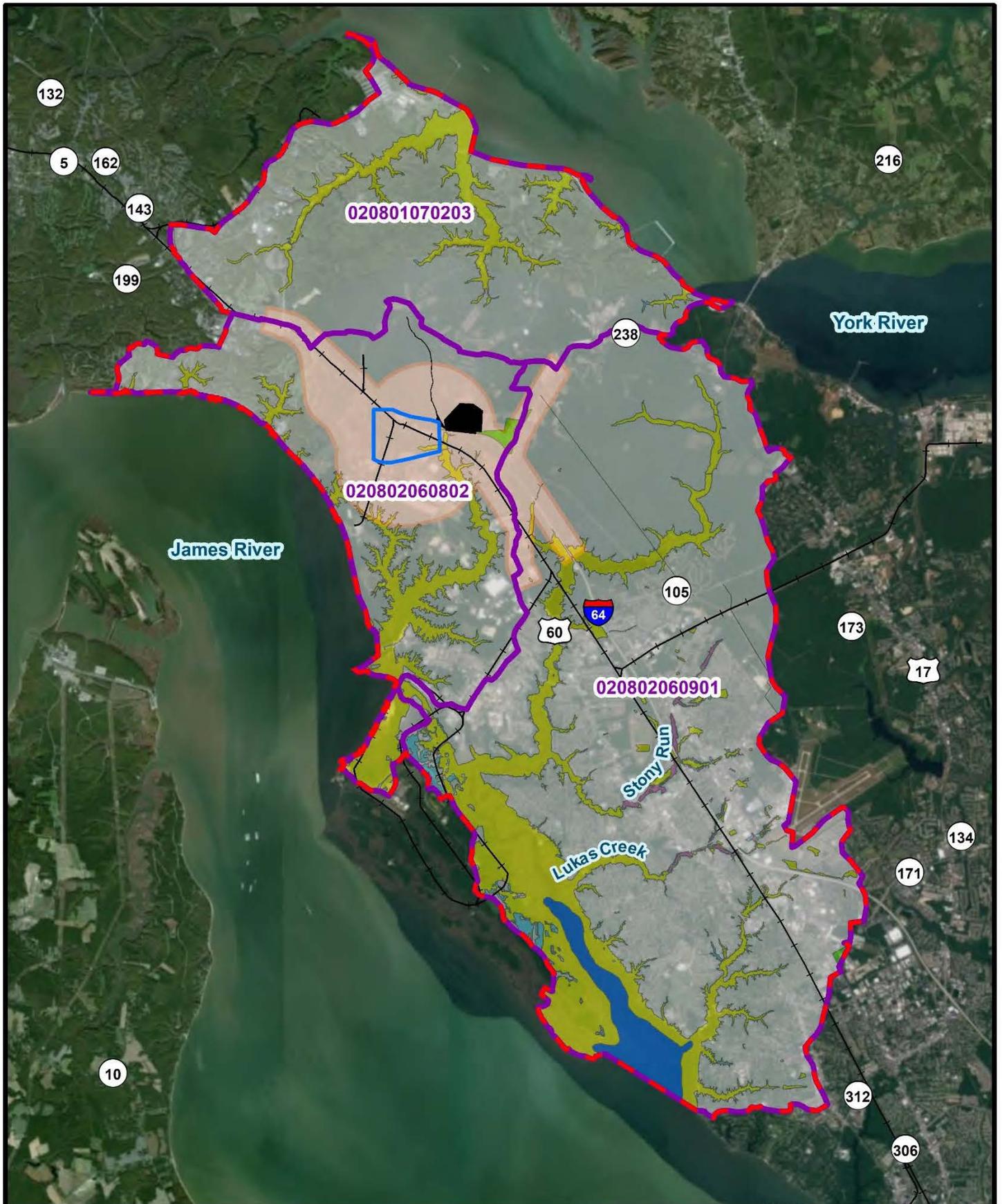
The Federal Emergency Management Agency (FEMA)-regulated floodways within the Natural Resources ICE Study Area occur along Stony Run and Lukas Creek. These floodways experienced a relatively high level of development encroachment historically, but are now generally well-protected. An estimated 8,486 acres of 100-year floodplains (including 123 acres of floodway), 898 acres of open water, and 410 acres of 500-year floodplains exist within the Natural Resources ICE Study Area. Approximately 136 acres of the Natural Resources ICE Study Area contain unmapped FEMA areas, where FEMA has not published a FEMA map. Additionally, 110 acres of Zone D (possible but undetermined flood hazards) are within the Natural Resources ICE Study Area. The remaining 44,913 acres are classified as Zone X (areas outside of the 500-year floodplain) (refer to **Figure 3-12**). For more information on floodplains, see the *Natural Resources Technical Report* (VDOT, 2018b).

3.3.2.3 Wildlife Habitat

The Natural Resources ICE Study Area contains a number of different kinds of land cover including, but not limited to, developed land, forest lands, wetlands, scrub/shrub and grasslands, agricultural lands, and barren land (see **Figure 3-13**). The composition of land cover directly affects the natural communities, wildlife, and biodiversity found within a given environment. **Table 3-6** shows the acreage and percentage of each land cover within the Natural Resources ICE Study Area.

The wildlife in the ICE Study Area primarily consists of species that are adapted to urban environments; however, some of the major riparian corridors contain forested habitat that supports fauna more typically found in less disturbed floodplain forests, including neotropical migrant birds. These riparian corridors with native vegetation can serve as wildlife corridors, linking wildlife habitats that might otherwise be separated by human development. Information regarding the wildlife that is commonly found within the area is detailed in the *Natural Resources Technical Report* (VDOT, 2018a).

Wildlife corridors within the Natural Resources ICE Study Area were identified using aerial imagery. Streams with contiguous forest cover generally greater than 0.25 mile in width were selected as wildlife corridors, and include portions of Warwick River, Beaverdam Creek, Baptist Run, Great Run, Ballard Creek, Indian Field Creek, Blows Mill Run, Skiffes Creek, Black Swamp, Whiteman Swamp, King Creek, and Felgates Creek. Many of these streams are located within Newport News Park and/or Yorktown Naval Weapons Station. Corridors are intersected by roads, which fragment the corridor, but do not prevent the continued use of corridors.



**Figure 3-12
FEMA Floodplains Within
the Natural Resources ICE
Study Area**

VDOT Virginia Department of Transportation
 Skiffes Creek Connector Study
 VDOT Project Number: 0060-047-627, P101, R201, C501;
 UPC: 100200

0 0.5 1 2 Miles

Source: VDOT, ESRI, USGS

Study Area	500 Year Floodplain
Natural Resources ICE Study Area	100 Year Floodplain
Induced Growth Study Area	Flood Zone X
HUCs in Study Area	Flood Zone D
Unmapped FEMA Area	Floodway
	Open Water



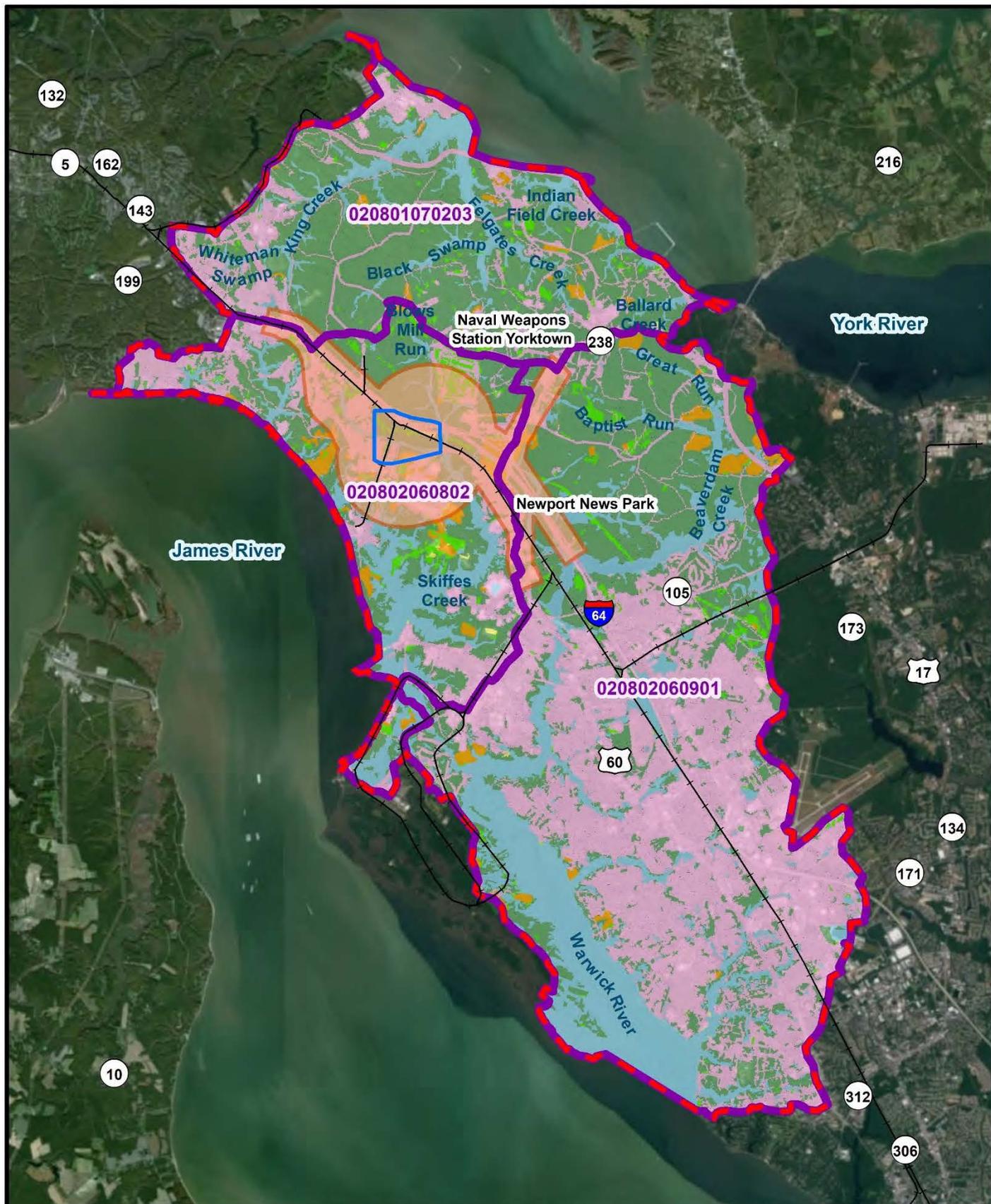


Figure 3-13
Land Cover Within the
Natural Resources ICE
Study Area

VDOT Virginia Department of Transportation
 Skiffes Creek Connector Study
 VDOT Project Number: 0060-047-627, P101, R201, C501;
 UPC: 100200

0 0.5 1 2 Miles

Source: VDOT, ESRI, USGS

Study Area	Developed
Natural Resources ICE Study Area	Barren Land
HUCs in Study Area	Forest
Induced Growth Study Area	Scrub/Shrub/Grasslands
Wetlands (Including Open Water)	Agriculture



Additionally, Yorktown Naval Weapons Station lies within the Natural Resources ICE Study Area, providing wildlife corridors and core areas for a variety of species. The wetlands and forests of Yorktown Naval Weapons Station provide natural habitat adjacent to an otherwise developed area.

Table 3-6: Land Cover within the Natural Resources ICE Study Area

Land Cover	Acres within Natural Resources ICE Study Area	Percent of Natural Resources ICE Study Area
Developed	22,292	41%
Forest	19,403	35%
Wetlands (including open water)	10,601	19%
Scrub/Shrub/Grasslands	1,380	2.5%
Agriculture	1,220	2%
Barren Land	57	<1%
Total	54,953	100%

Note: Where appropriate, some land use types have been combined to reflect similar types in total.

Source: NLCD, 2011

3.3.2.4 Threatened, Endangered, and Special Status Species

In December 2017, threatened, endangered, and special status species database queries were conducted in accordance with the methodology presented in the *Natural Resources Technical Report* (VDOT, 2018b). All species carried forward for further analysis are depicted in **Table 3-7**.

No streams within the ICE Study Area were identified as Threatened and Endangered Waters. Portions of three tidal waters, Indian Field Creek, the James River, and the York River, are classified as Anadromous Fish Use Streams. These waters total 5,349 acres and have documented occurrences of alewife (*Alosa pseudoharengus*), hickory shad (*Alosa mediocris*), American shad (*Alosa sapidissima*), blueback herring (*Alosa aestivalis*), striped bass (*Morone saxatilis*), and yellow perch (*Perca flavescens*).

Following is a description of each of the identified federal threatened, endangered, and special status species potentially located within the Natural Resources ICE Study Area.

Atlantic Sturgeon

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. The Atlantic Sturgeon was last recorded within a two-mile buffer of the Natural Resources ICE Study Area by VaFWIS in 1998.

Table 3-7: Threatened and Endangered Species Carried Forward for Further Analysis

Common Name	Scientific Name	Status	IPaC	VDCR-DNH (HUC 12)	VaFWIS (2 Mile Buffer)	WERMS	CCB	USFWS VA Bald Eagle
Atlantic sturgeon	<i>Acipenser oxyrinchus</i>	FE, SE		X	X			
Barking treefrog	<i>Hyla gratiosa</i>	ST		X				
Canebrake rattlesnake	<i>Crotalus horridus</i>	SE		X	X	X		
Eastern tiger salamander	<i>Ambystoma tigrinum</i>	SE			X			
Harper's fimbry	<i>Fimbristylis perpusilla</i>	SE		X				
Bald eagle	<i>Haliaeetus leucocephalus</i>	¹					X	X
Kemp's ridley sea turtle	<i>Lepidochelys kempii</i>	FE, SE			X	X		
Little brown bat	<i>Myotis lucifugus lucifugus</i>	SE			X	X		
Loggerhead sea turtle	<i>Caretta caretta</i>	FT, ST			X	X		
Mabees salamander	<i>Ambystoma mabeei</i>	ST		X	X	X		
Northern long-eared bat	<i>Myotis septentrionalis</i>	FT, ST	X		X	X		
Peregrine falcon	<i>Falco peregrinus</i>	ST			X	X		
Roseate tern	<i>Sterna dougallii dougallii</i>	FE, SE			X			
Small whorled pogonia	<i>Isotria medeoloides</i>	FT, SE	X					
Tri-colored bat	<i>Perimyotis subflavus</i>	SE			X	X		

Source: USFWS's Information for Planning and Conservation (IPaC), Virginia Department of Game and Inland Fisheries (VDGIF) Fish and Wildlife Information Service (VaFWIS), Virginia Department of Conservation and Recreation Division of Natural Heritage (VDCR-DNH), Wildlife Environmental Review Service (WERMS), Center for Conservation Biology (CCB), USFWS VA Field Office.

FE = federally endangered, FT= federally threatened, SE = state endangered, ST = state threatened

¹ Bald and Golden Eagle Protection Act (16 USC § 668) and Migratory Bird Treaty Act (16 USC §§ 703–712)

Kemp's Ridley Sea Turtle

Kemp's ridley sea turtle was listed by USFWS as a federally endangered species throughout its range on December 2, 1970. Threats to this species include incidental capture in fishing gear (NOAA, 2017). Nesting

of Kemp's ridley is primarily limited to Mexico and Texas, although their range extends as far north as Nova Scotia and Newfoundland. Adult Kemp's ridleys inhabit nearshore areas with muddy or sandy bottoms; juveniles swim offshore for open ocean development where they passively drift within the Sargassum seaweed for two years before returning to nearshore habitats. Threats to Kemp's ridley include human activities, including direct harvest and incidental capture (USFWS, 2015). Within a two-mile buffer of the Natural Resources ICE Study Area, Kemp's ridley sea turtle was last recorded by VaFWIS in 2007.

Loggerhead Sea Turtle

The loggerhead sea turtle was listed by USFWS as a federally threatened species on July 23, 1978. Threats to this species include incidental capture in fishing gear and direct harvest (NOAA, 2017). They occur throughout the temperate and tropical regions of the Atlantic, Pacific, and Indian Oceans. Loggerhead sea turtles occupy three different ecosystems throughout their lifecycle: beaches, water, and nearshore coastal areas. Beaches are used for nesting, juveniles live in open water, and adults inhabit nearshore coastal areas. Current threats to loggerhead sea turtles include beach development, accidental capture as bycatch, pollution, and disorientation of hatchlings by beachfront lighting. Within a two-mile buffer of the Natural Resources ICE Study Area, loggerhead sea turtle was last recorded by VaFWIS in 2008.

Northern Long-eared Bat

The northern long-eared bat (NLEB) was listed by the USFWS as threatened in April 2015. Home range for the northern long-eared bat is widely but patchily distributed in the eastern and north-central United States and adjacent southern Canada, and southward to southern Texas, Louisiana, Alabama, Georgia, and Florida, and westward in the United States generally to the eastern margin of the Great Plains region (NatureServe, 2017). In the winter, they hibernate in caves, mines, and tunnels with relatively constant and cool temperatures, high humidity, and no air currents. In the summer, they roost in old-growth forests with uneven forest structure, single and multiple tree-fall gaps, standing snags, and woody debris. Major threats to the species existence include the fungal disease white-nose syndrome (WNS), wind energy development, and habitat modification. This species was recorded within a two-mile buffer of the Natural Resources ICE Study Area by VaFWIS in 2014. VDGIF's northern long-eared bat winter habitat and roost trees mapper indicates the closest known hibernacula or roost tree is over 32 miles away from the Natural Resources ICE Study Area (VDGIF, 2017c).

Roseate Tern

The roseate tern northeast U.S. nesting population was listed as federally endangered on November 2, 1987 (USFWS, 2017). This species nests on small barrier islands, in hollows, or under dense vegetation. In the winter, roseate terns migrate to Trinidad and northern South America. Threats include human activity, development, predation, and competition from gulls. The roseate tern was last recorded within a two-mile buffer of the Natural Resources ICE Study Area by VaFWIS in 1980.

Small Whorled Pogonia

Small whorled pogonia was federally listed by the USFWS as threatened in 1994. This species is found from Maine to Georgia; in Virginia, it is known to occur in Prince William, Stafford, Spotsylvania, Madison, Caroline, Gloucester, James City, Lee, Wise, and Fairfax Counties. The small whorled pogonia is a short (<14 inch) single stem orchid with green leaves and flowers. Habitat includes mature forests with

open understories, gently sloping topography, and northern or eastern exposure. Threats include destruction of habitat. IPaC predicted potential habitat within the Natural Resources ICE Study Area.

Bald Eagle

The bald eagle (*Haliaeetus leucocephalus*) was removed from the federal list of threatened and endangered species in 2007 and removed from the Virginia list of threatened and endangered species in 2013. However, the bald eagle still receives protection under the federal Bald and Golden Eagle Protection Act (16 USC § 668) and federal Migratory Bird Treaty Act (16 USC §§ 703–712).

The bald eagle is a wide-ranging species found throughout much of North America (NatureServe, 2017). Most eagles that breed in Canada and the northern United States move south for winter. Bald eagles migrate widely over most of North America. In the northern Chesapeake Bay region, radio-tagged northern migrants arrive in late fall and depart in early spring; radio-tagged southern migrants arrive throughout April-August and depart June-October. Winter home ranges can be very large, especially for nonbreeding birds.

Breeding habitat most commonly includes areas close (within 2.5 miles) to coastal areas, bays, rivers, lakes, reservoirs, or other bodies of water that reflect the general availability of primary food sources including fish, waterfowl, or seabirds. Nests usually are in tall trees, on pinnacles, or cliffs near water. Tree species used for nesting vary regionally and may include pine, spruce, fir, cottonwood, poplar, willow, sycamore, oak, beech, or others. The same nest may be used year after year, or a pair may use alternate nest sites in successive years.

In winter, bald eagles may associate with waterfowl concentrations or congregate in areas with abundant dead fish or other food resources. Wintering areas are commonly associated with open water though in the region some bald eagles use habitats with little or no open water if upland food resources (e.g., rabbit or deer carrion, livestock afterbirths) are readily available. Wintering eagles tend to avoid areas with high levels of nearby human activity (boat traffic, pedestrians) and development (buildings). Bald eagles preferentially roost in conifers or other sheltered sites in winter in some areas and typically select larger, more accessible trees. Communal nesting sites used by two or more eagles are common. Winter nesting sites vary in their proximity to food resources (up to 20 miles) and may be determined to some extent by a preference for a warmer microclimate at these sites. Available data indicate that energy conservation may or may not be an important factor in winter nest-site selection. The CCB mapping portal depicts over 20 bald eagle nests within the Natural Resources ICE Study Area (CCB, 2017).

3.3.3 Historic Resources

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 NHPA [16 USC §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. Historic resources within the Historic Resources ICE Study Area are shown on **Figure 3-14**.

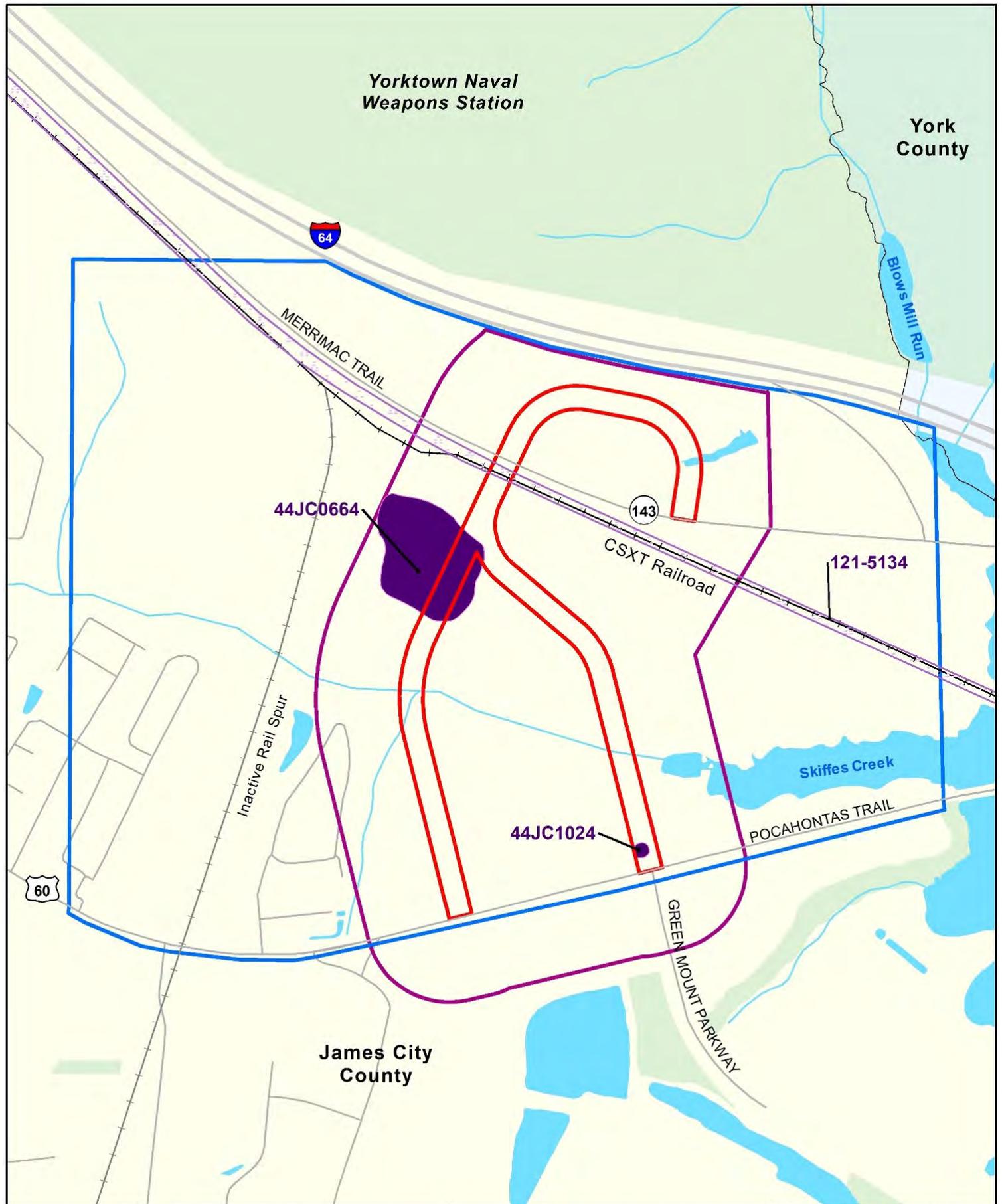


Figure 3-14
Historic Resources within the Historic Resources ICE Study Area

VDOT Virginia Department of Transportation
 Skiffes Creek Connector Study
 VDOT Project Number: 0060-047-627, P101, R201, C501;
 UPC: 100200

0 0.05 0.1 0.2 Miles

Source: ESRI, NHD, CEDAR

Architectural resources potentially eligible for the NRHP	Area of Potential Direct Effects
Archaeological sites potentially eligible for the NRHP	Area of Potential Indirect Effects
	Study Area



The project area was subject to archaeological surveys in 2013 and 2018. VDOT’s archaeological surveys located five archaeological sites within the APE for direct effects. Two sites, 44JC0664 and 44JC1024, previously had been identified by other surveyors. In 2001, after these sites were first identified by others, the SHPO determined each site to be potentially eligible for the NRHP. Based on VDOT’s 2013 survey findings for the SCC Study, the SHPO confirmed its previous determination on February 6, 2018. Each site requires further investigation to conclusively establish its NRHP eligibility.

The 2018 survey identified three archaeological sites, 44JC1343, 44JC1344, and 44JC1345, that VDOT does not believe meet the NRHP eligibility criteria. VDOT will be seeking the concurrence of the SHPO with its NRHP eligibility determinations for sites 44JC1343, 44JC1344, and 44JC1345 once the final report on the 2018 survey is complete.

3.4 STEP 4: IDENTIFY IMPACT CAUSING ACTIVITIES OF THE BUILD ALTERNATIVE

The objective of this step is to identify direct impacts that could have indirect effects that may conflict with the regional directions and goals discussed in **Step 2** and/or impact the resources identified in **Step 3**. The NCHRP Report 466 includes groups of actions associated with transportation projects that are known to trigger indirect effects (TRB, 2002). 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 estimated direct impacts due to impact-causing activities are summarized in **Table 3-8**. Comparing impact causing activities to regional directions and goals and the resources in the ICE study areas enables the identification of resources that could be indirectly affected. The findings of this identification process are presented in **Step 5**.

Table 3-8: Direct Impacts of the Alternatives

Notable Feature	No Build Alternative	Build Alternative 1	Build Alternative 2
<i>Socioeconomic Resources</i>			
Right of Way Acquisition and/or Easements (Acres)	0	14.6	14.9
Potential Relocations (No.)	0	0	0
Community Cohesion	Communities remain fragmented	Improved access to other communities	Improved access to other communities
Community Facilities	Access would not be improved	Improved access to community facilities and improved emergency vehicle access	Improved access to community facilities and improved emergency vehicle access
Environmental Justice Populations	No disproportionate impacts	No disproportionate impacts	No disproportionate impacts
<i>Water Resources</i>			
Ground Water Sources (No.) / Surface Water Intakes (No.)	0	0 / 0	0 / 0
Delineated Stream Impacts (Linear Feet)	0	673	365

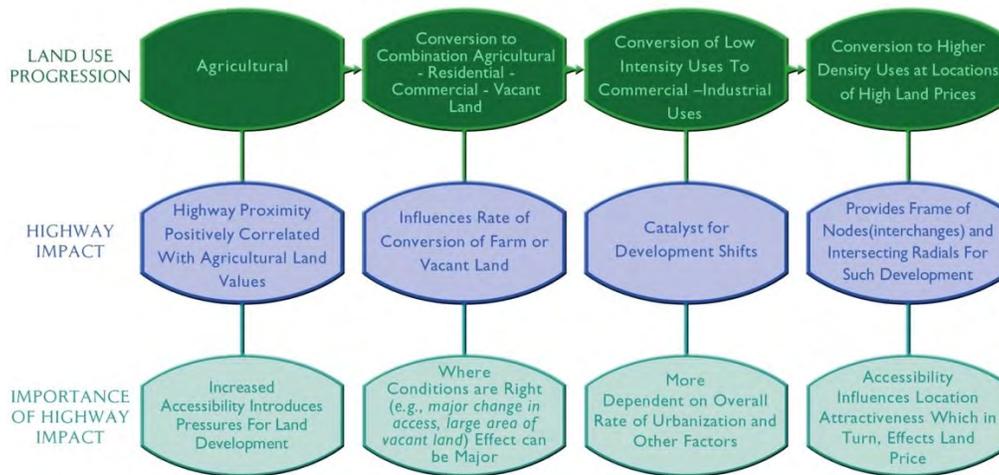
Notable Feature	No Build Alternative	Build Alternative 1	Build Alternative 2
Delineated Wetlands (Acres)	0	0.85	0.95
Delineated Jurisdictional Ditch (Linear Feet)	0	0	0
Floodplains			
Floodways (Acres)	0	0	0
100 Year Floodplains (Acres)	0	0	0
500 Year Floodplains (Acres)	0	0	0
Wildlife			
Forested Habitat/Wildlife Corridors (Acres)	0	6.4 / 0	6.4 / 0
Threatened Endangered, and Special Status Species			
Threatened, Endangered, and Special Status Species or potential habitat (No.)	0	0	0
Anadromous Fish (No.)	0	0	0
Threatened and Endangered Waters (Acres)	0	0	0
Historic Resources			
Historic Resources Properties (No.)	0	3	2

3.5 STEP 5: IDENTIFY INDIRECT EFFECTS FOR ANALYSIS

The objective of this step is to assess whether direct impacts identified above would have the potential to have indirect effects on the identified resources. As discussed in **Section 2.2**, indirect effects can occur in the following three broad categories:

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

Development of vacant land or conversion of the built environment to more intensive uses are often consequences of highway projects. The NCDOT *Guidance for Assessing Indirect and Cumulative Impacts of Transportation Projects in North Carolina, Vol. II: Practitioners Handbook* provides characteristics for induced growth as well as illustrates the different stages of development (see **Figure 3-15**) (NCDOT, 2001). 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.

Figure 3-15: Highway Investment on Typical Progress of Urbanization

When the term “induced growth effects” is used in this document, it is specifically referring to potential growth along feeder roads at a distance of one mile from existing and new intersections on all study corridors and a 1,000-foot buffer either side of the feeder roads along three miles of major feeder roads extending from all new intersections. Build Alternatives 1 or 2 would not create any new interchange(s); however, they would create new intersections. Build Alternative 1 would create a new intersection along VA 143, and the US 60/Green Mount Parkway intersection would receive an additional intersection point. Build Alternative 2 would create a new intersection along VA 143 and a new intersection with US 60, approximately 1,000 feet west of the existing US 60/Green Mount Parkway intersection. Although NCDOT guidance utilizes interchanges to identify induced growth effects and the subsequent study area, intersections have the potential to create similar induced growth effects, therefore, modified or new intersections were used for this analysis.

In general, with regard to induced growth, transportation improvements often reduce time and cost of travel, as well as provide new or improved access to properties, enhancing the attractiveness of surrounding land to developers and consumers. Build Alternatives 1 and 2 would create a road on a new alignment which opens land that was previously less accessible to development; however, the proposed project is not anticipated to encourage or accelerate any changes in land use that are not already expected in the localities within the study area. A similar alignment to Build Alternative 1 is included in transportation plans of James City County, and additional infill development and redevelopment is anticipated in York County and the City of Newport News.

Additionally, much of the land within the Induced Growth Study Area is already developed or protected by environmental regulations (e.g., RPAs and associated buffers, VDCR conservation lands, FEMA 100-year floodplains, Lee Hall Plantation, Endview Plantation, and Carter’s Grove Plantation), located in parks (Skiffes Creek Park and Newport News Park), or inaccessible within military installations (Yorktown Naval Weapons Station) (see **Table 3-9**). While development is still possible, these factors could limit the amount of private development. **Figure 3-16** displays the existing development and constraints limiting the potential for induced growth within the Induced Growth Study Area.

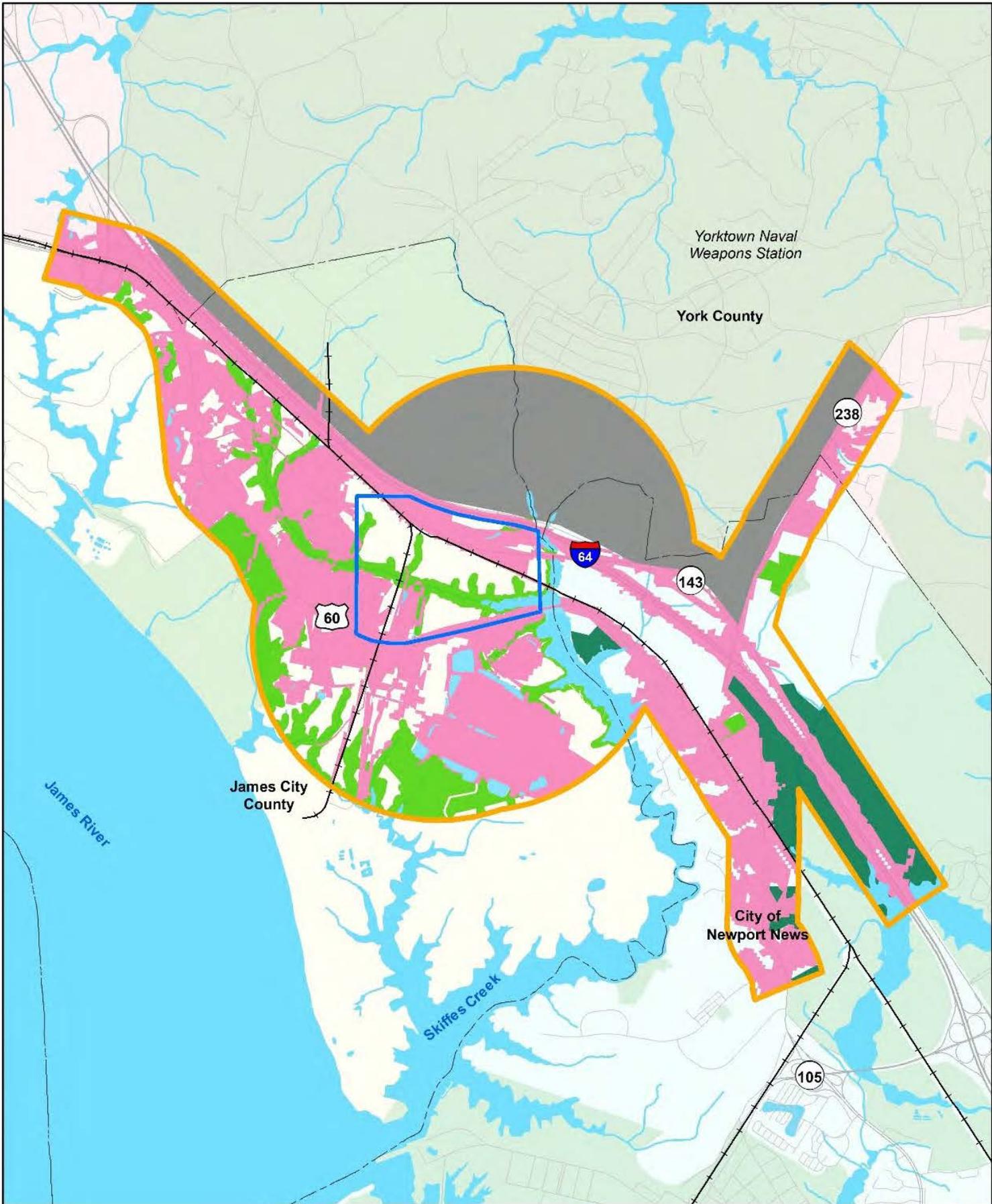


Figure 3-16
Land Use Within the
Induced Growth Study
Area

VDOT Virginia Department of Transportation
 Skiffes Creek Connector Study
 VDOT Project Number: 0060-047-627, P101, R201, C501;
 UPC: 100200

0 0.25 0.5 1 Miles

N
 W E
 S

Source: ESRI, NHD, NLCD, James City County, FEMA, VDCR

- Study Area
- Induced Growth Study Area
- Developed
- Environmental Regulations
- Military Installation
- Parkland



Table 3-9: Land Use within the Induced Growth Study Area

Land Category ¹	Acres within Induced Growth Study Area	Percent of Induced Growth Study Area
Developed ²	2,151	43%
Military Installations	1,062	21%
Protected by Environmental Regulations	493	10%
Parkland	267	5%
Water	181	4%
Developable	899	18%
Total	5,053	100%

¹ Designated land use categories are based on locality definitions and interpretation of applicable state and federal data and are not indicative of the type of land use presently occurring.

² Based on aerial interpretation, James City County GIS data, and the NLCD dataset, which includes developed open-space, residential, commercial, and industrial development.

Source: VDCR, James City and York County, City of Newport News, FEMA, NHD, and NLCD.

Approximately 82 percent (4,154 acres) of the total Induced Growth Study Area (5,053 acres), is already developed or limited for growth by environmental regulations, parklands, or military installations.

The discussion below provides a summary of potential indirect effects meriting analysis, identifying the indirect effect type, the impact-causing activities (direct effects), indirect effects from direct effects, and a description of the potential change.

3.5.1 Socioeconomic Resources

Build Alternatives 1 and 2 have the potential to directly impact land use within and immediately adjacent to the corridor, including permanent and temporary right-of-way acquisition. The indirect impacts to communities, community facilities, and EJ populations due to these direct impacts are closely related and are described together throughout the rest of the indirect effects analysis.

Build Alternatives 1 and 2 could indirectly impact communities, community facilities, and EJ populations within the Socioeconomic Resources ICE Study Area. Indirect impacts may include altering access to communities and associated community facilities or services. Because indirect effects are possible, socioeconomic resources has been advanced to **Step 6** in this analysis.

3.5.2 Natural Resources

3.5.2.1 Water Resources

Construction of either Build Alternative 1 or 2 would result in direct impacts to water resources through the placement of fill into Waters of the US. Potential indirect effects resulting from construction could include increased runoff from the addition of impervious surface and the consequent increase in pollutant discharge and changes to hydrologic regime. Additional indirect effects could include changes in wetland vegetation composition.

Development within the Induced Growth Study Area could impact water resources. The Induced Growth Study Area has approximately 16 miles of streams, as approximated with NHD and 2013/2018 wetland

investigation mapping. One stream segment, totaling approximately 1,889 linear feet, is impaired due to *E. coli* from unknown sources. Twenty-five acres of the Lee Hall Reservoir, located within the Induced Growth Study Area, are impaired due to copper, mercury in fish tissue, and PCB in fish tissue. This impairment is likely caused by municipal sources (urban high density area) and unknown sources. The Induced Growth Study Area contains two public drinking water wells that are a part of a community waterworks and no surface water intakes. Wetlands within the Induced Growth Study Area total approximately 401 acres, as determined with NWI and 2013/2018 wetland investigation mapping. Because indirect effects are anticipated, water resources have been advanced to **Step 6** in this analysis.

3.5.2.2 Floodplains

Construction of Build Alternative 1 or 2 would not result in direct impacts to floodplains. However, the Build Alternatives could cause indirect impacts to floodplains by altering drainage patterns and flood flows.

The Induced Growth Study Area contains approximately one acre of 500-year floodplains, 210 acres of 100-year floodplains, 87 acres of floodplain Zone D, and 136 acres of unmapped FEMA areas. Because indirect effects on floodplains are possible, this resource has been advanced to **Step 6**.

3.5.2.3 Wildlife Habitat

Construction of Build Alternative 1 or 2 would cause direct impacts to wildlife habitat through the placement of fill. Construction of the road on new alignment could potentially lead to indirect effects such as changes in regime (e.g., light, hydrology), changes in vegetation composition, increased pollution, increased road noise, and introduction of invasive species on construction equipment.

Development within the Induced Growth Study Area could impact wildlife habitat. The Induced Growth Study Area contains approximately 2,325 acres of developed land, 1,758 acres of forest land, 433 acres of wetlands/open water, 260 acres of shrub/scrub/grasslands, 259 acres of agricultural lands, and 21 acres of barren land. Additionally, the Induced Growth Study Area contains portions of two wildlife corridors along Skiffes Creek and Blows Mill Run. Because indirect effects are anticipated, wildlife habitat has been advanced to **Step 6**.

3.5.2.4 Threatened, Endangered, and Special Status Species

Build Alternatives 1 and 2 are not anticipated to directly impact threatened, endangered, or special status species. However, construction of either Build Alternative may indirectly affect threatened and endangered species by altering landscape habitat. Such alterations include increased road noise, increased pollution, and alteration of animal foraging behavior.

Additionally, development within the Induced Growth Study Area could impact threatened, endangered, and special status species and/or their habitat. Three federally listed species (northern long-eared bat, Atlantic sturgeon, and Kemps ridley sea turtle) and five state listed species (little brown bat, tri-colored bat, canebrake rattlesnake, Mabee's salamander, and Harper's fimbry) have been known to occur or have potential habitat within the Induced Growth Study Area. Given the likelihood of land use changes within the Natural Resources ICE Study Area, threatened, endangered, and special status species have been advanced to **Step 6**.

3.5.3 Historic Resources

Both Build Alternatives 1 and 2 have the potential to directly and/or indirectly affect historic resources. Two archaeological resources and one historic resource potentially eligible for the NRHP are within the APE of Build Alternative 1 and one archaeological resource and one historic resource potentially eligible for the NRHP are within the APE of Build Alternative 2. There is potential for direct effects to the archaeological resources, therefore, both of the resources could be indirectly impacted during construction. Because indirect effects are possible, historic resources has been advanced to **Step 6**.

3.6 STEP 6: ANALYZE INDIRECT EFFECTS AND EVALUATE ANALYSIS RESULTS FOR THE NO BUILD AND BUILD ALTERNATIVES

Using planning judgement, this step analyzes indirect and induced growth effects potentially resulting from each alternative under consideration.

3.6.1 No Build Alternative

3.6.1.1 Effects to Socioeconomic Resources

With steady development occurring in James City County, York County, and the City of Newport News and continued usage of the peninsula's primary roads, VA 143 and US 60, for the movement of goods from the Port of Virginia, additional truck and residential traffic is expected to occur, placing a greater demand on the primary road network. Under the No Build Alternative, continued limited local connectivity coupled with population growth and increases in truck traffic through the study area would have a negative impact on businesses, community facilities, residents, and through-traffic throughout the Socioeconomic Resources ICE Study Area. Lack of local connections would continue to limit access to community facilities and communities would continue to be isolated from other communities and community facilities across the CSXT railroad. With the expected planned and/or approved development within the study area, an increase in traffic would also likely occur along US 60 impacting James City County and the communities along US 60. The increase in truck traffic on US 60 could contribute to safety concerns to adjacent communities. Additional proximity impacts such as noise, air quality, and visual intrusions are also expected as a result of the increased traffic along the existing roadway network.

No induced growth would be expected as a result of the No Build Alternative. The Socioeconomic Resources ICE Study Area and surrounding localities are already developing or are planned and/or approved for development, as identified in locality future land use plans, and any growth would continue regardless of the conditions of the surrounding roadway network (City of Newport News, 2018; James City County, 2015, York County, 2013). Since no induced growth would be expected as a result of the No Build Alternative, there would likely be no effects related to the lack of induced growth.

3.6.1.2 Effects to Natural Resources

Existing development within the watersheds would continue to contribute to surface water impairments. No induced growth would be expected as a result of the No Build Alternative; therefore, there would likely be no effects related to the lack of induced growth.

3.6.1.3 Effects to Historic Resources

No loss or damage to historic or archaeological resources is anticipated under the No Build Alternative. As with socioeconomic resources, proximity effects including noise, air quality, and visual intrusions could continue to affect historic resources along the existing roadway network (see the *Archaeological Survey for the Skiffes Creek Connector; August 2013, Revised October 2017* [VDOT, 2017] for more information).

No induced growth would be expected as a result of the No Build Alternative; therefore, there would likely be no effects related to the lack of induced growth.

3.6.2 Build Alternative 1

3.6.2.1 Effects to Socioeconomic Resources

Since the project would be on undeveloped land, it would not divide or segment any existing communities or interfere with community cohesion. Existing communities and community facilities, primarily on US 60, are likely to experience less through truck movement due to the increased travel efficiency and would benefit from additional access to VA 143 as an access route to other neighborhoods and community facilities. Additionally, travelers from VA 143 would experience easier access to communities along US 60. These communities would also benefit from increased reliability for emergency vehicles and enhanced evacuation routes. The improved local connectivity could increase the desirability of living or working within the area, which would have a positive indirect impact on businesses and residents throughout the Socioeconomic Resources ICE Study Area. Additionally, the SCC would likely improve the primary roadway network as a whole.

During construction, short-term road closures and detours would be limited to construction connecting to the two existing roadways. Since construction would be limited in duration, there would be no short-term indirect effects to access between neighborhoods and community facilities.

Improved local connectivity and access between communities, community facilities, and for emergency vehicles would include the Census block groups containing EJ populations. Therefore, there would not be high and adverse disproportionate impacts to EJ populations.

James City County's comprehensive plans have consistently identified the SCC study area as a growth area with particular potential for industrial development and mixed use areas. Furthermore, in the Induced Growth Study Area, a majority of the land south of I-64 identified as developable land (as discussed in **Section 3.5**) is included in the VEZ, specifically referred to as the James River Enterprise Zone in James City County and as Enterprise Zone 1 in the City of Newport News (see **Figure 3-17**) (City of Newport News, 2016c). The James River Enterprise Zone incentivizes economic development in this area. Since these enterprise zones are identified as development areas, they were used synonymously with the localities' designated growth areas. Approximately 40 percent (2,007 acres) of the Induced Growth Study Area is identified as part of a VEZ.

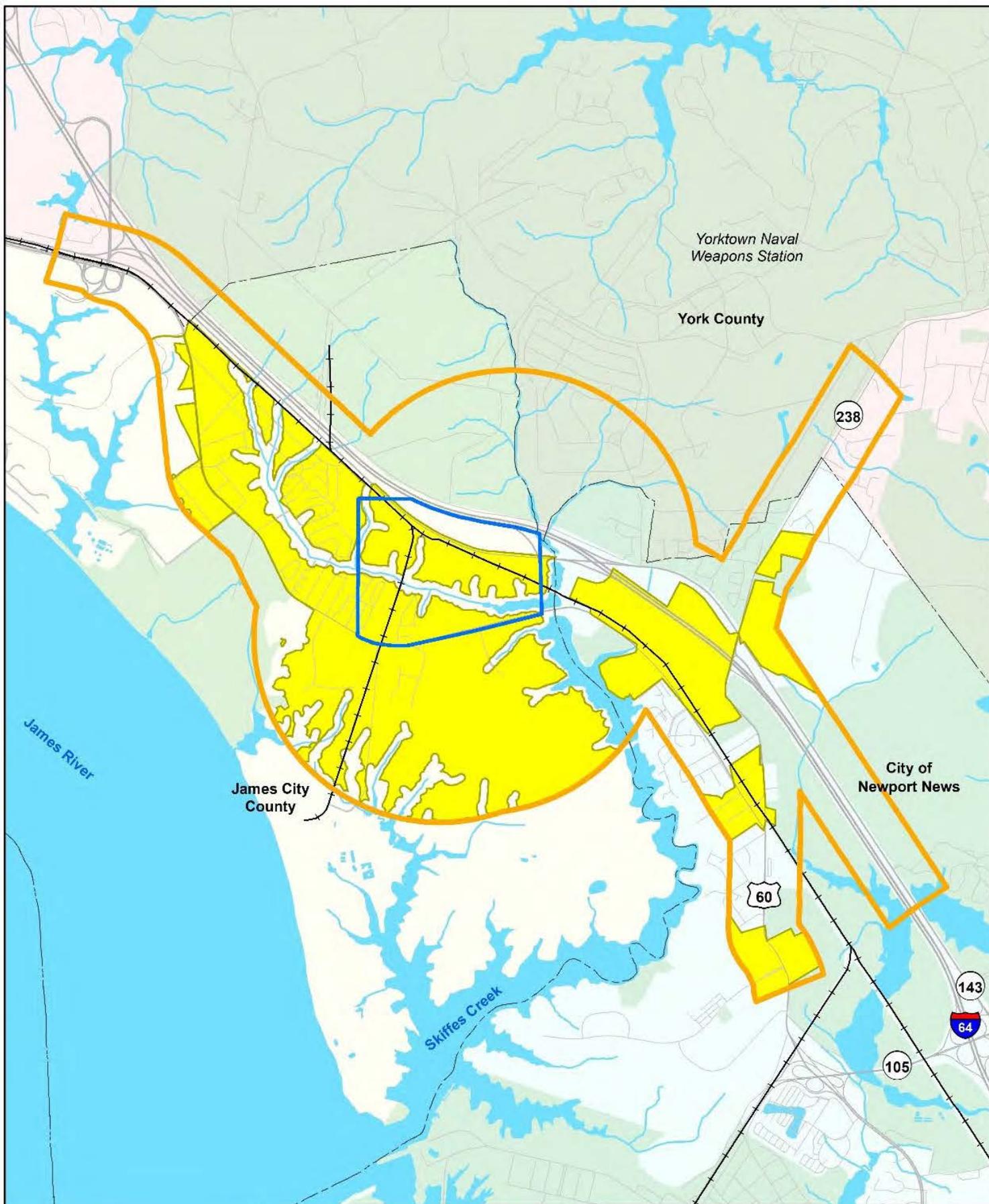


Figure 3-17
Designated Growth Areas
Within the Induced
Growth Study Area

VDOT Virginia Department of Transportation
 Skiffes Creek Connector Study
 VDOT Project Number: 0060-047-627, P101, R201, C501;
 UPC: 100200



Source: ESRI, NHD, James City County, Newport News

-  Study Area
-  Induced Growth Study Area
-  Designated Growth Area



The Induced Growth Study Area extends outside the associated VEZ and designated growth areas; however, 80 percent (718 acres) of the developable land is within designated growth areas. Twenty percent (181 acres) of the developable land is outside the VEZ and designated growth areas, which accounts for only 4 percent (181 acres) of the total Induced Growth Study Area (5,053 acres) (see **Table 3-10**). The majority of the total acres outside of designated growth areas are shown on James City County’s 2035 Comprehensive Plan Land Use Map and the City of Newport News’ 2030 *Framework for the Future* and *Transportation Map* as federal, state, or county land, mixed use, limited industry, or residential land uses (JCC, 2015a; City of Newport News, 2016b). The future land use and zoning plans are designed to accommodate this development.

Table 3-10: Developable Land within the Induced Growth Study Area

Land Category	Acres of Developable Land	Percent of Developable Land
Developable Land within VEZ	718	80%
Developable Land outside VEZ	181	20%
Total Developable Land	899	100%

Since Build Alternative 1 is not anticipated to encourage or accelerate any changes in land use that are not already expected in the localities within the study area, the construction of Build Alternative 1 is unlikely to create pressure on city councils and boards of supervisors to make changes to their land use plans to allow types of development in areas not currently approved for it or to allow greater development densities.

No induced growth would be expected as a result of Build Alternative 1; therefore, there would likely be no effects related to the lack of induced growth.

3.6.2.2 Effects to Natural Resources

Water Resources

Construction of Build Alternative 1 may potentially result in short- and long-term minor adverse degradation of water resources. Short-term minor adverse effects include increased downstream sedimentation from land disturbing activities. Since Build Alternative 1 is on new alignment, long-term minor adverse effects include increased runoff due to the construction of a new impervious road. Additionally, Build Alternative 1 has the potential to introduce pollutants from vehicle exhaust, brake pads, fuel spills, and hydraulic spills to a currently undeveloped area. Many of these pollutants carried in roadway runoff, including copper and nitrogen, could worsen the existing surface water impairments of the Natural Resources ICE Study Area. The introduction of pollutants from roadway runoff can facilitate the degradation of nearby terrestrial and aquatic habitat through deposition of sediments or contamination from chemical pollutants. This 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. Since there are two community waterworks public drinking wells located within the Induced Growth Study Area, the introduction of pollutants from roadway runoff has the potential to impact drinking water supplies.

Pursuant to the Clean Water Act of 1972 (as amended) and the Virginia State Water Control Law, which encompasses the Chesapeake Bay Preservation Act, the Virginia Erosion and Sediment Control Law, the

Virginia Stormwater Management Act, and the Virginia Water Resources and Wetlands Protection Program, various control measures would be incorporated into the roadway design and maintenance plans to reduce impacts to wetland hydrology, water quantity, and water quality. Control measures would include implementing stormwater best management practices (BMPs) and adhering to strict erosion and sediment control measures (see discussion under **Section 3.7** – Step 7).

Additionally, the City of Newport News' Skiffes Creek Reservoir surface water intake is located approximately 0.5 miles downstream of Build Alternative 1. However, this reservoir is only used to store raw water; drinking water is treated and stored at the City of Newport News Reservoir and the Lee Hall water treatment plant. Due to the off-site treatment of Skiffes Creek Reservoir water, contamination of public drinking water is not a major concern (see discussion under **Section 3.7** – Step 7).

Construction of the roadway also has the potential to change the hydrologic regime, resulting in minor adverse indirect impacts. Construction of a new road embankment can act as a barrier to lateral surface flow causing upslope impoundment of water and can also restrict lateral groundwater flow by compressing the underlying soil. The weight of a new road embankment can also laterally displace underlying soil resulting in a “mudwave” at the toe of the new embankment fill. Wetland vegetative communities and habitat could change as a result of the altered water flows and the increased elevations associated with mudwaves. As part of the design of the project, bridges and culverts would be designed to ensure adequate hydraulic openings are in place so that hydrologic flow patterns are not disrupted, that hydraulic connectivity is maintained to wetlands upstream and downstream. Additionally, cut/fill areas in wetlands would be reduced to the minimal design slope necessary.

Due to tree removal associated with Build Alternative 1, changes in light regime may be expected along the proposed alignment, resulting in long-term minor adverse impacts. Trees would be cleared within the maintained right-of-way, creating more open space and edge habitats. The resulting changes in light regime could alter the wetland vegetation composition, allowing for the establishment of invasive species and thus modifying habitat and wildlife composition.

No induced growth would be expected as a result of Build Alternative 1; therefore, there would likely be no effects related to the lack of induced growth.

Floodplains

Construction of Build Alternative 1 could potentially cause long-term minor adverse indirect impacts to floodplains by altering existing drainage patterns and flood flows. However, with adequately sized culverts and bridges, no indirect effects to floodplains would be anticipated (see discussion under **Section 3.7** – Step 7).

No induced growth would be expected as a result of Build Alternative 1; therefore, there would likely be no effects related to the lack of induced growth.

Wildlife Habitat

Implementation of Build Alternative 1 could potentially result in long-term minor adverse impacts to wildlife habitat. Clearing vegetation for the maintained right-of-way could allow opportunistic species, including invasive species, to permanently establish. Further, the introduction of invasive species on

construction equipment or vehicles could lead to permanent vegetation, habitat, and wildlife composition changes. Although as described in **Section 3.2.2.5**, invasive species are already established in the Natural Resources ICE Study Area. Consequently, introduction of additional invasive species as a result of Build Alternative 1 would have a minor impact on the study area.

Additional long-term indirect effects to wildlife could include changes in vegetative composition due to changes in light and hydrologic regimes. These vegetative composition changes, as well as vegetation removal, could displace wildlife due to habitat and food loss. Due to the establishment of a new alignment, increased noise and pollution may occur. However, construction of stormwater facilities, as described above, would serve to neutralize the pollution impacts. Although the culverts and bridge would prevent wildlife habitat fragmentation, species could experience altered foraging behavior due to limited habitat connectivity on opposite sides of the road.

No induced growth would be expected as a result of Build Alternative 1; therefore, there would likely be no effects related to the lack of induced growth.

Threatened, Endangered, and Special Status Species

Impacts to threatened, endangered, and special status species would be similar to the impacts described to wildlife, except that the life history characteristics of threatened, endangered, and special status species tend to render them less resilient when faced with habitat loss or alteration or competition from invasive species. Even so, the indirect effects would be minor, given that no habitat for threatened, endangered, or special status species nor any known occurrences of these species have been documented within the LOD of Build Alternative 1 (see the *Natural Resources Technical Report* [VDOT, 2018b] for more information). In addition, any known occurrences of these species are far enough away from the LOD that any indirect effects would be negligible.

Although databases identified little brown bat, northern long-eared bat, and tri-colored bat within a two-mile buffer of the Natural Resources ICE Study Area, these were observations of bats caught in mist nets. No roost trees or hibernacula were observed. The closest known northern long-eared bat hibernaculum or roost tree is over 40 miles away from the Natural Resources ICE Study Area. The closest little brown bat or tri-colored bat hibernaculum is over 130 miles away; there are no known roosts for these species in Virginia. Therefore, it is unlikely that little brown bat, northern long-eared bat, or tri-colored bat would experience any indirect effects resulting from the project.

No induced growth would be expected as a result of Build Alternative 1; therefore, there would likely be no effects related to the lack of induced growth.

3.6.2.3 Effects to Historic Resources

Build Alternative 1 would not have an indirect effect on historic resources. The two archaeological resources that would be directly effected are important chiefly for the information they contain, which could be retrieved through data recovery. The creation of a new crossing of the CSXT rail line will not indirectly effect the views of the rail line since the original late nineteenth-century setting of the railroad in the project area has already been substantially modified by the mid-twentieth century of VA 143, a VDOT maintenance facility, an asphalt plant, and a regional jail facility, and new highway infrastructure is not incompatible

with the original industrial nature of the railroad; however, the new crossing would allow travelers to view the rail line from the SCC (see the *Archaeological Survey for the Skiffes Creek Connector; August 2013, Revised October 2017* [VDOT, 2017] for more information).

No induced growth would be expected as a result of Build Alternative 1, therefore there would likely be no effects related to the lack of induced growth.

3.6.3 Build Alternative 2

3.6.3.1 Effects to Socioeconomic Resources

Due to the close proximity of the Build Alternatives, indirect effects to socioeconomic resources from Build Alternative 2 are the same as those identified for Build Alternative 1. As described, from either Build Alternative, there could be a positive indirect impact on businesses and residents throughout the Socioeconomic Resources ICE Study Area due to improved connectivity; however, residents may experience an increase in idling traffic associated with the new intersection. During construction, short-term road closures and detours would be limited to construction connecting to the two existing roadways. Since construction would be limited in duration, there would be no short-term indirect effects to access between neighborhoods and community facilities.

Improved local connectivity and access between communities, community facilities, and for emergency vehicles would benefit the Census block groups containing EJ populations. Although housing located near the proposed connection could experience short-term and long-term minor impacts; these impacts are not considered to be disproportionately high and adverse impacts to EJ populations.

No induced growth would be expected as a result of Build Alternative 2, therefore there would likely be no effects related to the lack of induced growth.

3.6.3.2 Effects to Natural Resources

Water Resources

Build Alternative 2 indirect effects to water resources would be identical to those identified for Build Alternative 1. Although the two alignments would result in different acreages of direct impacts, due to the close proximity of Build Alternative 1 and Build Alternative 2 (less than 0.2 miles away from each other), similar roadway design, and comparable construction techniques, indirect effects are expected to be the same.

No induced growth would be expected as a result of Build Alternative 2; therefore, there would likely be no effects related to the lack of induced growth.

Floodplains

Build Alternative 2 indirect effects to floodplains would be identical to those identified for Build Alternative 1. Neither alignment is expected to result in direct impacts to floodplains; however, potential indirect impacts to drainage patterns and flood flows are expected to be the same due to the close proximity of Build Alternative 1 and Build Alternative 2, similar roadway design, and comparable construction techniques.

No induced growth would be expected as a result of Build Alternative 2; therefore, there would likely be no effects related to the lack of induced growth.

Wildlife Habitat

Build Alternative 2 indirect effects to wildlife habitat would be identical to those identified for Build Alternative 1. Although the two alignments would result in different acreages of land cover impacts, due to the close proximity of Build Alternative 1 and Build Alternative 2, similar roadway design, and comparable construction techniques, indirect effects are expected to be the same.

No induced growth would be expected as a result of Build Alternative 2; therefore, there would likely be no effects related to the lack of induced growth.

Threatened, Endangered, and Special Status Species

Build Alternative 2 indirect effects to threatened, endangered, and special status species would be identical to those identified for Build Alternative 1. Neither alignment is expected to directly impact threatened, endangered, or special status species; however, resulting impacts to habitat and animal behavior are expected to be the same due to the close proximity of Build Alternative 1 and Build Alternative 2, similar roadway design, and comparable construction techniques.

No induced growth would be expected as a result of Build Alternative 2; therefore, there would likely be no effects related to the lack of induced growth.

3.6.3.3 Effects to Historic Resources

While Build Alternative 2 would directly effect one archaeological resource, similar to Build Alternative 1, Build Alternative 2 would not have an indirect effect on historic resources. (see the *Archaeological Survey for the Skiffes Creek Connector; August 2013, Revised October 2017* [VDOT, 2017] for more information).

No induced growth would be expected as a result of Build Alternative 2, therefore there would likely be no effects related to the lack of induced growth.

3.7 STEP 7: ASSESS CONSEQUENCES AND DEVELOP MITIGATION

The No Build Alternative would not result in substantial indirect impacts to any resource. Therefore, mitigation is not required for the No Build Alternative. The following sections assess the consequences and mitigation for potential impacts resulting from Build Alternatives 1 or 2.

3.7.1 Socioeconomic Resources

Build Alternatives 1 or 2 would result in the conversion of undeveloped land to transportation land use. James City County has accounted for this land use conversion; therefore, it would not change the overall existing and planned land use pattern in James City County. Localities plan for and incorporate growth, development, and land use into comprehensive plans. The comprehensive plans for all of the localities state that redevelopment and new development is planned and likely to occur. These plans for development and changes in land use are likely to happen independently of the implementation of this project.

Neither Build Alternative 1 or 2 would result in residential or business acquisitions as the alignment is on undeveloped land, therefore, adverse indirect effects to existing community cohesion surrounding the alignments should be minor. However, the indirect effects of the enhanced local connectivity would improve overall community cohesion and linkage.

As noted above, both Build Alternatives would have beneficial effects on EJ populations, and Build Alternative 2 would have only minor short- and long-term indirect effects to EJ populations. Therefore, there would be no disproportionately high and adverse effects to EJ populations.

3.7.2 Natural Resources

3.7.2.1 Water Resources

Mitigation for impacts to water resources generally consists of three components: avoidance, minimization, and compensation. Avoiding and minimizing direct effects would also serve to reduce indirect effects.

To reduce potential indirect effects, staging areas would not be located in waters or wetlands, disposal of excess material would not occur in waters or wetlands, and borrow material would not be excavated from waters or wetlands. Implementation of strict erosion and sediment control and stormwater measures during construction would minimize permanent and temporary impacts to waters, and thereby indirect effects as well.

3.7.2.2 Floodplains

Neither Build Alternative 1 or 2 would encroach into or directly impact the 100-year floodplain. During final design of either alternative, a hydrologic and hydraulic analysis would be conducted to ensure adequate design of the hydraulic openings of culverts and bridges, allowing proper conveyance of floodwaters and minimizing potential indirect impacts to floodplains and floodplain hazards. The design of either alternative would 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 would conform with all applicable state and local floodplain protection standards.

3.7.2.3 Wildlife Habitat

Potential impacts to wildlife habitat expected as a result of either Build Alternative could be minimized through use of design measures such as countersinking culverts and reducing the roadway cut/fill footprint. Countersinking culverts and constructing bridges minimizes habitat impacts by allowing the natural hydrologic processes to remain largely intact while also providing wildlife crossings.

In addition, temporary impacts would be reduced through proper location and minimization of staging areas and construction access roads in valuable habitats. To prevent the introduction and establishment of invasive species, during construction, the contractor would adhere to VDOT's Road and Bridge Specifications Manual, Chapter 40 of Title 3.2 of the Code of Virginia, Virginia Administrative Code (VAC) 2VAC-5-390-20, and other applicable regulations.

3.7.2.4 Threatened, Endangered, and Special Status Species

Direct loss of threatened, endangered, and special status species is not expected as a result of either Build Alternative. However, potential indirect impacts to threatened, endangered, and special status species could be minimized through design measures such as countersinking culverts, constructing stormwater management facilities, reducing construction footprint, avoiding key habitat, implementing stormwater and erosion and sediment control measures, and utilizing best management practices. In addition, temporary impacts could further be reduced through proper location and minimization of staging areas, construction access roads, and modifying construction techniques in valuable habitats.

Additional coordination with VDGIF and USFWS would occur prior to construction in the advanced stages of the project design. Consultation would occur before the permit decision, as any mitigation measures, conditions, or restrictions determined necessary by USFWS would be included by regulatory agencies as conditions of any permit issued. Mitigation measures may include presence/absence surveys; contractor training in recognizing and avoiding threatened, endangered, and special status species and their habitats; or restoration of habitat.

3.7.3 Historic Resources

No indirect effects are anticipated with either Build Alternative. VDOT will coordinate its findings of the 2018 supplemental archaeological survey with the SHPO and will seek the concurrence of the SHPO that the SCC project will have no effect on the CSXT/Peninsula Subdivision of the Chesapeake and Ohio Railroad (VDHR Inventory No. 121-5134). VDOT anticipates completing the Section 106 process through execution of a Programmatic Agreement for the SCC Study with the Virginia SHPO, pursuant to §800.14(b)(3) of the Section 106 regulations. The Programmatic Agreement would stipulate the process VDOT would follow to complete efforts to identify archaeological historic properties potentially affected by the selected alternative, assess the undertaking's effect on those sites, and implement measures that would resolve any adverse effects through avoidance, minimization, or mitigation. The Programmatic Agreement would also stipulate the measures necessary to ensure that the project has no effect on the CSXT/Peninsula Subdivision of the Chesapeake and Ohio Railroad.

4. CUMULATIVE EFFECTS

As noted in **Section 2.3**, the cumulative effects analysis is based on the process outlined in *Fritiofson v. Alexander*, 772 F.2d 1225 (5th Cir. 1985), as described in FHWA's *Guidance: Questions and Answers Regarding the Consideration of Indirect and Cumulative Impacts in the NEPA Process* (FHWA, 2014). The following sections follow this direction.

4.1 WHAT IS THE GEOGRAPHIC AREA AND TEMPORAL BOUNDARIES AFFECTED BY THE STUDY?

The geographic limits for the cumulative effects analysis are the same as the study areas described in **Section 3.2.1** of this Technical Report.

The analysis of cumulative effects must consider past, present, and reasonably foreseeable future actions. The temporal boundary that was used for the cumulative effects assessment spans from 1930, around the

time when VA 143 was built to supplement US 60, to 2040, the date of HRTPO's Long-Range Transportation Plan. Mapping was reviewed from 1943, when the earliest USGS historic topographic map for the area was available, to present day. Notable projects that occurred prior to 1930 are described in **Section 4.3.1** to give context to the development of the study area.

4.2 WHAT ARE THE RESOURCES AFFECTED BY THE STUDY?

These resources affected by either Build Alternative 1 or 2 would be the same as those resources identified in **Step 3**, discussed in **Section 3.3** of the indirect effects analysis.

4.3 WHAT ARE OTHER PAST, PRESENT, AND REASONABLY FORESEEABLE ACTIONS THAT HAVE IMPACTED OR MAY IMPACT THESE RESOURCES?

4.3.1 Past Actions

Many of the past actions that have contributed to the baseline for this analysis occurred as part of the residential, commercial, and industrial development described in **Section 3.2.2.1**. This development transformed a rural landscape into an urban/suburban environment which resulted in a loss of wildlife habitat and species, impacts to wetlands and streams, and increased levels of air and water pollution. The expanded transportation routes and continued land use intensification in the area formed the basis for the high level of population growth in the region. This growth has resulted in a concurrent increase in employment and investment in the ICE Study Areas. Past notable projects and transportation resources that have occurred within the Socioeconomic and Natural Resources ICE Study Areas are listed below.

- CSXT Rail Line – Successor to the Chesapeake and Ohio (C&O) Railway which opened the Peninsula Extension in 1881 to transport coal from West Virginia to the harbor in Newport News. The C&O also established freight and passenger stations at frequent intervals along the Peninsula, including a large depot in Lee Hall.
- Yorktown Naval Weapons Station – A 20.7 square mile naval weapons station in Yorktown acquired in 1916 that hosts 37 tenant commands that provide services for the Atlantic Fleet.
- Joint Base Langley-Eustis – Joint U.S. Air Force and U.S. Army military base first established in 1918. Although technically combined, the bases are separated physically by 17 miles.
- US 60 – In 1926, many roadways were renumbered and combined to become US 60, which currently spans from Arizona to Virginia Beach. US 60 parallels I-64 through much of Virginia. On each side of the study area US 60 was widened to 4 lanes in the 1970's; however, the portion of US 60 between Busch Gardens and the VA 238 remains a 2-lane roadway.
- VA 238 – In 1940, VA 170 was renumbered to become VA 238. At seven miles long, VA 238 connects the Yorktown Naval Weapons Station to I-64.
- Cheatham Annex Naval Supply Center – Naval base and weapons facility commissioned in 1943 that now employs 2,500 officers, enlisted personnel, and civilian employees. The annex provides supply support services including custody asset storage for Navy materials and programs.
- VA 143 – In 1944, VA 168 was renumbered as VA 143 and additional lanes were added between 1955 and 1979; VA 143 throughout James City County, York County, and the City of Newport News is currently four lanes wide.

- Newport News/Williamsburg International Airport – Built after World War II on the site of the US Army's Camp Patrick Henry with commercial air service starting in 1949. The airport serves around 400,000 passengers per year although they have been declining in service since 2012.
- I-64 – The first sections of I-64 opened in 1957 and were mostly completed by the late 1970s with six lanes. James City County, York County, and the City of Newport News experienced widening in 1999.
- Christopher Newport University, Newport News – Public Institution with about 5,000 undergraduate students, founded in 1960 on a 260-acre campus in Newport News.
- Lee Hall Reservoir/Dam – Watershed created in 1966 that contains a 230-acre reservoir that is owned by the City of Newport News. The surrounding 8,000-acre Newport News Park offers a variety of recreational opportunities for those visiting.
- Skiffes Creek Reservoir – Reservoir developed in 1919, owned and operated by the City of Newport News, and managed by the Newport News Waterworks, a regional water provider. The water collected from Skiffes Creek Reservoir is pumped to the City Reservoir where it is treated at Lee Hall water treatment plant. The reservoir serves over 400,000 people in the cities of Hampton, Newport News, Poquoson, and portions of York County and James City County.
- Manufacturing plant of Anheuser-Busch beer – Williamsburg's Anheuser-Busch brewery opened in 1972 and serves Virginia, District of Columbia, Maryland, North Carolina, South Carolina, West Virginia, Kentucky, Georgia with a total area of 1.2 million square feet and approximately 250 trucks per day shipped.
- Busch Gardens – 383-acre theme park operating since 1975 developed by Anheuser-Busch and is owned by SeaWorld Entertainment in James City County. The award-winning park provides roller coasters, dining and shopping opportunities and kid friendly attractions and events.
- Water Country USA – Opened in 1984, Virginia's largest water park owned by SeaWorld Parks & Entertainment, Inc. provides recreation such as water slides, raft rides, pools and lazy rivers.
- Patrick Henry Mall – Opened in 1987 in the City of Newport News as the second enclosed mall in the Peninsula area region. Contains a large number of retail stores, entertainment options, and various events throughout the year.
- Walmart Distribution Center, Williamsburg – Two-million-square-foot Distribution center building on 200-acre site in James City County opened in 2000. Today the distribution center holds merchandise bought overseas and employs approximately 878.

4.3.2 Present and Reasonably Foreseeable Future Actions

Currently, a number of development actions are occurring and/or are planned to occur that could contribute to cumulative effects on resources affected by the project. **Table 4-1** lists the present and reasonably foreseeable future transportation projects that have the potential to contribute to cumulative effects and are either identified in VDOT's Final 2018 SYIP, James City County 2035 Comprehensive Plan, James City County FY 2016-2020 Capital Improvement Program, HRTPO FY 2018-2021 Transportation Improvement Program and the 2040 LRTP. Pedestrian accessibility, pedestrian and bicycle improvements, shoulder improvements, and bridge replacements projects were excluded as they would have minimal disturbance compared to larger roadway projects.

Table 4-1: Present and Reasonably Foreseeable Future Transportation Projects within the Vicinity

Project	Status
Atkinson Blvd – 4 Lanes	Advertised
I-64 Capacity Improvements – Segment II	Construction Started
Intersection Improvements – to Minimize Flooding (Route 60 / Bland Blvd)	Construction Started
Amtrak Multimodal Station – Station, Platform, Parking Lot	Construction Underway
Streetscaping, Storm, Sanitary, Underground Utilities (24 th Street to 12 th Street)	Construction Underway
Amtrak Station Relocation – Amtrak Multimodal Station Relocation	Design Underway
Penniman Road/Gov Road/Roadway Improvements	Design Underway
Pocahontas Trail Reconstruction	Design Underway
Route 60 – Relocation & Upgrading (Ft. Eustis Blvd to Blows Flats Road)	Design Underway
Extended Route 640 (Water Country Parkway) 800 Feet	Preliminary Engineering Underway
Habersham Area Improvements	Preliminary Engineering Underway
Hogan Drive Phase 2	Preliminary Engineering Underway
Independence Boulevard	Preliminary Engineering Underway
Newport News Intelligent Transportation System Upgrades	Preliminary Engineering Underway
Richneck Road Widening	Preliminary Engineering Underway
Warwick Boulevard Widening	Right-of-Way

Note: List finalized April 2018.

Source: VDOT's Final 2018 SYIP, James City County 2035 Comprehensive Plan, James City County FY 2016-2020 Capital Improvement Program, HRTPO FY 2018-2021 Transportation Improvement Program and the 2040 LRTP (James City County, 2015a, 2015b, 2016; HRTPO, 2016, 2017; VDOT, 2018c).

Other local non-transportation projects and projects under construction by private entities or being studied by other state and federal agencies are described in **Table 4-2**. Projects and plans included in the James City County comprehensive planning documents, regardless of zoning or master plan approval, are included, such as the former BASF Property Site and the Peninsula Pentecostal Church developments. Specific permitted impacts to aquatic resources from projects listed in **Table 4-1** and **Table 4-2** were not identified, however, a discussion of overall permits issued by the USACE is discussed in **Section 4.2.2**.

Table 4-2: Present and Reasonably Foreseeable Future Non-Transportation Projects within the Vicinity

Project	Status
Christopher Newport University, Newport News – planning to build a Fine Arts Center	In Design
Patrick Henry Place, Newport News – townhouse development	Multi-phased – several buildings are complete, with others under construction
The Estates at King's Creek Plantation, Williamsburg – vacation houses	Multi-phased – several buildings are complete, with others under construction
James River Commerce Center Virtual Building, James City County	Site Plan Approved
Hertzer Meadows, Newport News – single family development	Under Construction

Project	Status
Huntington Pointe, Newport News – single family and townhouse development	Under Construction
Tech Center Research Park, Newport News – research and office space, retail, restaurants, and apartments	Under Construction
The Woodlands at Fischer’s Creek, Newport News – single family development	Under Construction
Former BASF Property Site, James City County – mixed use development/waterfront resort	Undergoing Joint Land Use Study with Department of Defense ¹
Dominion Energy’s Skiffes Creek Switching Station, James City County (USACE permit notes that the project would impact 0.06 acres of subaqueous river bottom, 0.01 acres of non-tidal wetlands, and convert 0.56 acres of palustrine forested wetlands to scrub shrub non-tidal wetlands)	USACE Permit Approved and approved by James City County Board of Supervisors
Peninsula Pentecostal Church, James City County – place of public assembly and commercial uses	Zoning and Conceptual Plan Approval; No Master Plan Approval

¹ No conceptual plan, master plan, or zoning approval

Note: List finalized April 2018.

Source: Daily Press, 2017a, 2017b, 2017c; HHHunt Homes, 2018; James City County, 2018c; and, City of Newport News, 2018.

4.4 WHAT WERE THOSE IMPACTS?

Cumulative effects consist of the impacts of the alternatives under consideration in the SCC EA and the impacts of the past, present, and reasonably foreseeable future actions. Past, present, and reasonably foreseeable actions have already impacted or have the potential to impact socioeconomic, natural, or historic resources, as does the proposed project. This analysis relies on CEQ guidance to assess the severity of an impact based on context and intensity. Context may be geographic at multiple scales such as society as a whole, an affected region, affected interests, and specific localities (CEQ, 1997). Intensity, as defined by CEQ, is the severity of impact with regard to multiple factors, including:

- Impacts both beneficial and adverse
- Degree of public health and safety impacted
- Unique characteristics of the geographic area
- Degree of controversy surrounding that action and the effect
- Potential to set precedent for future actions
- Cumulative effects which may be significant, even though the action itself would not create significant impacts
- Whether there is a violation of federal, state, or local law or requirements meant to protect the environment

Impacts with respect to each of the intensity criteria can be described in various levels of severity (see **Table 4-3**). The significance or importance of impacts is determined by evaluating the proposed action against existing environmental standards, thresholds, guidelines, or objectives established by federal, state, and local agencies. These impact significance factors are applied to all resource areas.

Table 4-3: General Effects Determination Matrix

Severity	Extent	Duration	Likelihood
Major	Large	Long	Probable
Moderate	Medium	Medium	Possible
Minor	Small	Short	Unlikely

A large extent would be statewide, medium would be regional (Hampton Roads), and small would be local. For most resources, a long duration corresponds to over five years, a medium duration would be one to five years, and a short duration would be less than one year. These potential effects are taken into consideration in the following discussions of cumulative effects of the alternatives to different resources. The following discusses the cumulative effects to land use, socioeconomic, natural and historic resources.

4.4.1 Socioeconomic Resources

The cumulative impacts to socioeconomic resources due to past and present actions are closely related and are described together in the following sections.

Since the 1930s, the actions listed in **Section 4.3.1 - Past Actions** and **Tables 4-1** and **4-2**, have led to rapid residential and commercial development, along with continued industrial growth. Past and present actions have been both beneficial and adverse to socioeconomic resources within the ICE Study Areas, and it is expected reasonably foreseeable future actions could as well. Past and present growth and development has increased the number of communities as well as the standards of living for communities, provided for community cohesion and community and recreational facilities, and economic growth and expansion. Additionally, such growth and development has benefited local economies by improving access to ports, industrial parks, commercial centers, markets, and customers. Although the overall roadway network connectivity and community cohesion has increased, the CSXT railroad and I-64 have and continue to fragment communities and destinations within these areas and subsequently, the past and present community fragmentation has had adverse impacts on community cohesion and standards of living. This growth and development has facilitated the existing land uses, population dynamics, and income levels within the Socioeconomic Resources ICE Study Area today.

The actions listed in **Section 4.3.1 - Past Actions** and **Tables 4-1** and **4-2** have facilitated this growth and/or improved the quality of life within the Socioeconomic Resources ICE Study Area. The Socioeconomic ICE Study Area encompasses limited and general industrial, mixed use, commercial, governmental and open space/recreational, and residential uses. Past and present transportation improvement projects benefit communities and community facilities by improving access. Future transportation projects would continue to improve access to community facilities and businesses. These types of changes benefit all populations, including minority and low income.

4.4.1.1 No Build Alternative

The No Build Alternative would not improve local connectivity, local truck movement connectivity, or enhance emergency evacuation routes. Without a new connection between US 60 and VA 143, population growth and economic development would continue; however, existing and future communities and businesses would continue to be poorly connected, causing negative economic and social consequences.

Therefore, the No Build Alternative would likely have a minor adverse cumulative effect on communities, community cohesion, community facilities, and EJ populations. This lack of improvement would be felt by all residents, including minority populations, and thus would not impact minority populations disproportionately.

4.4.1.2 Build Alternative 1

Past and present actions have led to increases in neighborhoods and community facilities along and adjacent to primary roadways, in addition to fragmentation of communities and community facilities; both enhancing and hindering community cohesion. Access to businesses and destinations has also been hindered by fragmentation throughout the ICE Study Areas. Build Alternative 1 would add some beneficial impacts to otherwise adverse cumulative impacts on community cohesion, by providing additional connections between primary roadways and communities. Build Alternative 1 would have a moderate beneficial long-term cumulative impact by improving access options and connectivity between neighborhoods, enhancing evacuation routes, and improving access to other communities and community facilities located along US 60 and adjacent to VA 143. Build Alternative 1 would provide beneficial effects to minority populations, low-income populations, and other travelers through additional travel choice and access in the study area. Additionally, Build Alternative 1 would provide efficient connectivity for local truck movements, offering a direct connection between VA 143 to origins and destinations on US 60 bypassing existing neighborhoods and community facilities, reducing the potential for vehicle/pedestrian incidents. Present and future local comprehensive planning allows for development and land use strategies that enhance accessible and efficient transportation systems to allow for convenient and efficient movement of people and goods.

4.4.1.3 Build Alternative 2

Similar to Build Alternative 1, Build Alternative 2 would have a moderate beneficial long-term cumulative impact on socioeconomic resources. Although the new intersection and associated turning movements would be proximate to residential communities possibly increasing traffic idling, an adverse cumulative impact on the communities adjacent to the connector is not likely.

4.4.2 Natural Resources

The following analysis is based on review of historic aerials and topographic maps that was conducted in **Section 3.2.2.1**.

Past growth and development actions in the Natural Resources ICE Study Area have led to the degradation and loss of natural resources over time. The majority of conversion of natural areas to developed land has occurred through the creation of reservoirs; expansion of road and rail networks; and industrial, residential, and mixed use land development, with much of this conversion occurring without the benefit of modern stormwater management facilities and/or water quality regulations. Intense land use has resulted in reduced water quality; impairment of waters for human and wildlife use; loss of wetlands, streams, and floodplains; loss of terrestrial wildlife from over-exploitation; and habitat loss, fragmentation, and degradation. Development projects conducted before the 1970s, in the absence of major environmental regulations, were generally more impactful than more recent projects and resulted in much of the current impairment to natural resources. In the 1970s a number of landmark environmental protection laws led to the development of federal, state, and local regulations that have significantly slowed the loss of remaining wildlife and

wildlife habitat, improved wildlife habitat and water quality, and recovered protected species. These regulations generally require avoidance, minimization, and mitigation of adverse impacts to natural resources. Current environmental regulations, natural resource planning, conservation, and restoration efforts have protected and reduced impacts to natural resources more than what would otherwise have continued to occur prior to the 1970s. Future growth and development in the Natural Resources ICE Study Area would be subject to the same or similar environmental regulations that would continue to minimize impacts to natural resources.

4.4.2.1 No Build Alternative

The No Build Alternative would not contribute to cumulative natural resources impacts. Under the No Build Alternative, existing surface water impairments would continue, as well as the continued loss of natural resources due to present and ongoing developments; but would not result from implementation of the No Build Alternative.

4.4.2.2 Build Alternative 1

Past growth and development have diminished natural resources within the Natural Resources ICE Study Area, affecting terrestrial and aquatic habitat and impairing water quality. Additional impacts have included loss of wetlands, streams, and forestland. Aquatic impacts have included stream piping, relocation, channelization, and flow alteration. Further aquatic impacts causing impediments to fish passage have included construction of the Newport News Reservoir and Skiffes Creek Reservoir, as well as raised culverts and other impediments on the Warwick River, Skiffes Creek, Stony Run, King Creek, and Deep Creek. Past development and harvesting of wildlife has led to some wildlife species to be threatened and endangered. However, passage of the Virginia Endangered Species Act and the federal Endangered Species Act requires state and federal agencies to avoid and minimize potential impacts to designated threatened and endangered species and their critical habitat. Build Alternative 1's impacts to water resources, floodplains, wildlife habitat; and threatened, endangered, and special status species would contribute to the cumulative effects that have occurred in the past to natural resources within the study area; although the effects should be minimized by adherence to regulations, implementation of best management practices, and compensatory mitigation. Recent and reasonably foreseeable future actions, as discussed in **Section 4.3.2**, would contribute to the cumulative effects of natural resources within the Natural Resources ICE Study Area.

The impacts to floodplains, wildlife habitat; and threatened, endangered, and special status species from present and reasonably foreseeable projects are difficult to quantify, as there are no comprehensive regulatory mechanisms that track impacts to these resources. In order to infer present and reasonably foreseeable impacts to wetlands and streams, VDOT analyzed data provided by the USACE that reports Section 404 permits issued by the USACE over the last five years (data provided by the USACE to VDOT) within the sub-basin (HUC 02080206) where the project would be constructed. This data is the best available data for the project and is representative of the individual subwatersheds (HUC-12s) that make up the Natural Resources ICE Study Area. From May 7, 2013 through May 7, 2018, the USACE issued Section 404 permits authorizing impacts that resulted in the permanent loss of 69.16 acres of wetlands and 35,060 linear feet of streams within HUC 02080206 (Lower James) (USACE, 2018). Based on current and projected land use and growth in the HUC, it is reasonable to assume that the trend of impacts to wetlands

and streams over the last five years would continue into the reasonably foreseeable future. Therefore, the impact of less than 1 acre of wetlands and 673 linear feet of streams from Build Alternative 1 would have a minor cumulative effect.

Additionally, there may be minimal impacts to the James and York Rivers from the project. The combined area of the York and Lower James sub-basins is 1,733 square miles and has experienced past development similar to the proposed project. Given the relative size of the proposed project in the context of the numerous similar past, present, and reasonably foreseeable future projects constructed in the entire York and Lower James sub-basins, the proposed project would likely have a minor cumulative effect.

However, some present and reasonably foreseeable future actions include infill development, which has the potential to improve water quality if outdated stormwater controls and drainage systems are replaced and updated. All present and future actions would be subject to natural resource protections afforded by federal, state, and local regulations. Additionally, local comprehensive planning natural resource management plans would preserve remaining highly valued wildlife habitat and water quality by directing growth to specific areas and densities, with the goal of being sustainable into the future.

Future federal actions, as well as larger private developments, would be developed within the framework of these regulatory and technological controls, which should reduce impacts to these resources during future development. Two specific controls for checking future impacts are USACE and VDEQ water quality permits and Total Maximum Daily Load (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 No Build Alternative and the Build Alternatives would be subject to these controls to minimize excessive impacts.

Future actions would be subject to federal and state regulations to identify and protect threatened, endangered, and special status species. These regulations reduce threatened, endangered, and special status species impacts from would have been if development had been allowed to continue unabated. The reduction is 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.

4.4.2.3 Build Alternative 2

Due to the close proximity of the Build Alternatives, cumulative impacts to natural resources for Build Alternative 2 are the same as those identified for Build Alternative 1. Additionally, the less than 1 acre of wetlands and 365 linear feet of streams that would be impacted by Build Alternative 2 would, similar to Build Alternative 1, have a minor cumulative effect.

4.4.3 Historic Resources

Damage or loss of historic resources was far more prevalent from actions that occurred prior to the NHPA of 1966. The NHPA of 1966, combined with the establishment of historic resource protection objectives established at the local planning level, have reduced the rates of impacts to historic resources. However, conflicts between the protection of historic properties and development and transportation continue to occur (see the *Archaeological Survey for the Skiffes Creek Connector; August 2013, Revised October 2017* [VDOT, 2017] for more information).

4.4.3.1 No Build Alternative

Under the No Build Alternative, historic resources along US 60 would continue to experience the proximity effects associated with vehicular and truck traffic.

4.4.3.2 Build Alternative 1

Prior to the NHPA and local protective measures, the impact to historic resources through the development of the area was much higher than the potential impacts today. Some historic properties (private and public) may continue to fall into disrepair or be impacted by development in the area. On federal undertakings, implementation of mitigation strategies would be coordinated with the SHPO and Section 106 consulting parties (as necessary), reducing cumulative impacts on historic resources that would otherwise occur.

4.4.3.3 Build Alternative 2

Due to the close proximity of the Build Alternatives, cumulative impacts to historic resources for Build Alternative 2 are the same as those identified for Build Alternative 1.

4.5 WHAT IS THE OVERALL IMPACT ON THESE VARIOUS RESOURCES FROM THE ACCUMULATION OF THE ACTIONS?

Past and present actions have molded the current state of socioeconomic, natural, and historic resources within the respective ICE study areas. Since the 1930s, the ICE study areas have been in a progression of development, and are continuing to progress at a steady pace, as evidenced by potential actions discussed in **Section 4.3.2**. Over time, these actions have been both beneficial and adverse to socioeconomic and historic resources, and primarily adverse to natural resources. Any development in the future would likely result in development, redevelopment or infill development of surrounding undeveloped land.

Although future actions are anticipated in the ICE study areas that could impact socioeconomic resources, development plans are clearly outlined in the James City County, York County and City of Newport News comprehensive plans and the addition of Build Alternative 1 or 2 is not anticipated to create induced growth or accelerate any land use changes beyond what was anticipated without the project. Furthermore, the enhanced connectivity and access resulting from Build Alternative 1 or 2 is expected to benefit the local communities. Therefore, Build Alternative 1 or 2 would result in a beneficial cumulative effect, with beneficial impacts on local socioeconomics that would be in line with locality plans.

Historically, conversion of natural areas to developed land and the creation of reservoirs and modifications of waterbodies have had the greatest impact on the area. This development has helped lead to the degradation and/or loss of the natural resources over time. The degree of degradation was in part due to the lack of strong federal, state, and local protective regulations. 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 the original state.

Prior to the NHPA and local protective measures, the impact to historic resources through the development of the area was much higher than the potential impacts today. Some historic properties (private and public) may continue to fall into disrepair or be impacted by development in the area. Through the implementation of minimization strategies that would be coordinated with local governments and the SHPO, cumulative

impacts on historic resources attributable to implementation of either Build Alternative 1 or 2 are anticipated to be negligible (see the *Archaeological Survey for the Skiffes Creek Connector; August 2013, Revised October 2017* [VDOT, 2017] for more information).

Past and present actions have shaped the current state of socioeconomic, natural, and historic resources within the associated ICE study areas, and future actions would continue to shape these resources irrespective of this project. However, since the region is already developed, protected (e.g., military installations, parkland, and conservation lands) or already expected to be developed by the encompassing localities, overall cumulative effects of the No Build Alternative and Build Alternatives 1 or 2 are expected to be minimal. In addition, current regulatory requirements and planning practices are helping to avoid or minimize the contribution of present and future actions to adverse cumulative effects for socioeconomic, natural, and historic resources.

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Appendix A – Indirect and Cumulative Effects Methodology Memorandum

SKIFFES CREEK CONNECTOR STUDY

Indirect and Cumulative Effects Methodology

Memorandum

Revised 11/30/17

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LIST OF ACRONYMS

APE	Area of Potential Effect
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CWA	Clean Water Act
EA	Environmental Assessment
EIS	Environmental Impact Statement
FHWA	Federal Highway Administration
FY	Fiscal year
GIS	Geographic Information System
HRTPO	Hampton Roads Transportation Planning Organization
HUC	Hydrologic Unit Code
ICE	Indirect and Cumulative Effects
LMI	Labor Market Information
L RTP	Long Range Transportation Plan
NCDOT	North Carolina Department of Transportation
NCHRP	National Cooperative Highway Research Program
NEPA	National Environmental Policy Act
NHD	National Hydrography Dataset
NMFS	National Marine Fisheries Service
NWI	National Wetland Inventory
PIM	Public Information Meeting
SCC	Skiffes Creek Connector
SYIP	Six-Year Improvement Program
TRB	Transportation Research Board
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VCRIS	Virginia Cultural Resource Information System
VDOT	Virginia Department of Transportation

1. INTRODUCTION

The Virginia Department of Transportation (VDOT), in coordination with the Federal Highway Administration (FHWA), has initiated an Environmental Assessment (EA) for the Skiffes Creek Connector Study (SCC) located in James City County. The study corridor is positioned south of Interstate 64 (I-64) between Exits 243 and 247, between existing U.S. Route 60 (Pocahontas Trail) to State Route 143 (Merrimac Trail). The EA is being prepared in accordance with the National Environmental Policy Act of 1969 (NEPA).

The purpose of this memorandum is to document the methodologies and strategies that will be used to identify and assess the potential indirect and cumulative effects potentially resulting from the alternatives being considered in the EA. The results of the analyses will be documented in the *Indirect and Cumulative Effects Technical Report* which will support discussions presented in the EA.

2. REGULATORY CONTEXT

The NEPA legislation does not mention indirect effects or cumulative impacts however, the Council on Environmental Quality (CEQ) regulations for implementing NEPA address federal agency responsibilities applicable to indirect and cumulative 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) (FHWA, 2014). In addition to CEQ's regulations, indirect and cumulative effects assessment is conducted in accordance with the requirements and processes outlined in 23 CFR Part 771, Federal Highway Administration Interim Guidance: Indirect and Cumulative Impacts in NEPA (2003), FHWA Position Paper on Secondary and Cumulative Impact Assessment (1992), FHWA's Questions and Answers on Considering Indirect and Cumulative Impacts in the NEPA Process (2014), the Transportation Research Board's (TRB) National Cooperative Highway Research Program (NCHRP) Report 466: Desk Reference for Estimating the Indirect Effect of Proposed Transportation Projects (TRB, 2002), NCHRP Project 25-25 Task 22: Land Use Forecasting for Indirect Impacts Analysis (TRB, 2007), NCHRP Project 25-25 Task 11: Secondary/Indirect and Cumulative Effects Analysis (TRB, 2006), as well as CEQ's Considering Cumulative Effects under the National Environmental Policy Act (1997) and Guidance on the Consideration of Past Actions in Cumulative Effects Analysis (2005).

This section will include standard language used in other FHWA/VDOT ICE technical reports including discussion of legislation, CEQ definition of indirect effects in reference to FHWA's Direct vs. Indirect Environmental Impacts figure and the proposed project (40 CFR § 1508(a)) and the CEQ definition of cumulative effects in reference to FHWA's Cumulative Effects figure and the proposed project (40 CFR § 1508.7).

In addition, a description of what a "reasonably foreseeable action" is based on CEQ definitions in relation to indirect and cumulative effects and a discussion on specific past or present actions and whether or not to include them in the indirect and cumulative effects analyses will be included.

3. INDIRECT EFFECTS

Section 3 will present an analysis of the potential indirect impacts related to the alternatives. The methodology prescribed in the Transportation Research Board's (TRB) National Cooperative Highway

Research Program (NCHRP) Report 466, *Desk Reference for Estimating the Indirect Effects of Proposed Transportation Projects* will be followed for analyzing indirect effects (TRB, 2002).

A description of Encroachment-Alteration Impact, Induced Growth Impacts, and Impacts Related to Induced Growth, in addition to the stepwise process TRB recommends in NCHRP Report 466 for assessing indirect effects, including the seven typical steps of the process, will be referenced. Additional reference will be made to the North Carolina Department of Transportation (NCDOT) guidance for the stages of development and how a highway improvement project may influence induced growth impacts, including the FHWA figure Highway Investment on Typical Progress of Urbanization. The indirect effect analysis will utilize NCDOT's *Guidance for Assessing Indirect and Cumulative Impacts of Transportation Projects in North Carolina, Vol. II: Practitioners Handbook* for induced growth characteristics overview (NCDOT, 2001) and reference planning judgment that is described in the NCHRP 25-25 program, Task 22, *Forecasting Indirect Land Use Effects of Transportation Projects* (TRB, 2007).

3.1 STEP 1: SCOPING

A summary of the scoping letters sent to local, state, and federal agencies and non-governmental organizations, as well as responses, will be located here.

A description of additional public scoping outreach that will occur through Public Information Meetings (PIMs) and concurring agency meetings will be included.

3.2 STEP 2: IDENTIFY STUDY AREA'S DIRECTION AND GOALS

Study Areas

The Indirect and Cumulative Effects (ICE) study areas will include individual descriptions and figures. Following are the ICE study areas that are assumed to be developed for each resource:

- **Induced Growth ICE** – NCDOT guidance suggests that induced growth would typically occur within a 1-mile buffer around new interchanges within the study corridor, and all areas within 1,000 feet of major feeder roads for two to five miles from new interchanges. VDOT would approach the new connections between Route 60 and State Route 143 the same way. The Induced Growth ICE Study Area would include a 1-mile buffer around all new intersections and all areas within 1,000 feet of major feeder roads for three miles from all new intersections. The Induced Growth ICE Study Area will be designed to permit the analysis of the potential spread of development in currently developed areas and conversion development in undeveloped areas (refer to **Figure 3-1**).
- **Socioeconomic Resources ICE** (including socioeconomics, environmental justice populations, community facilities, recreational resources, and land use) - The Socioeconomic Resources ICE Study Area includes all Census block groups partially or fully within the Induced Growth ICE Study Area (refer to **Figure 3-2**).

Figure 3-1: Induced Growth Study Area

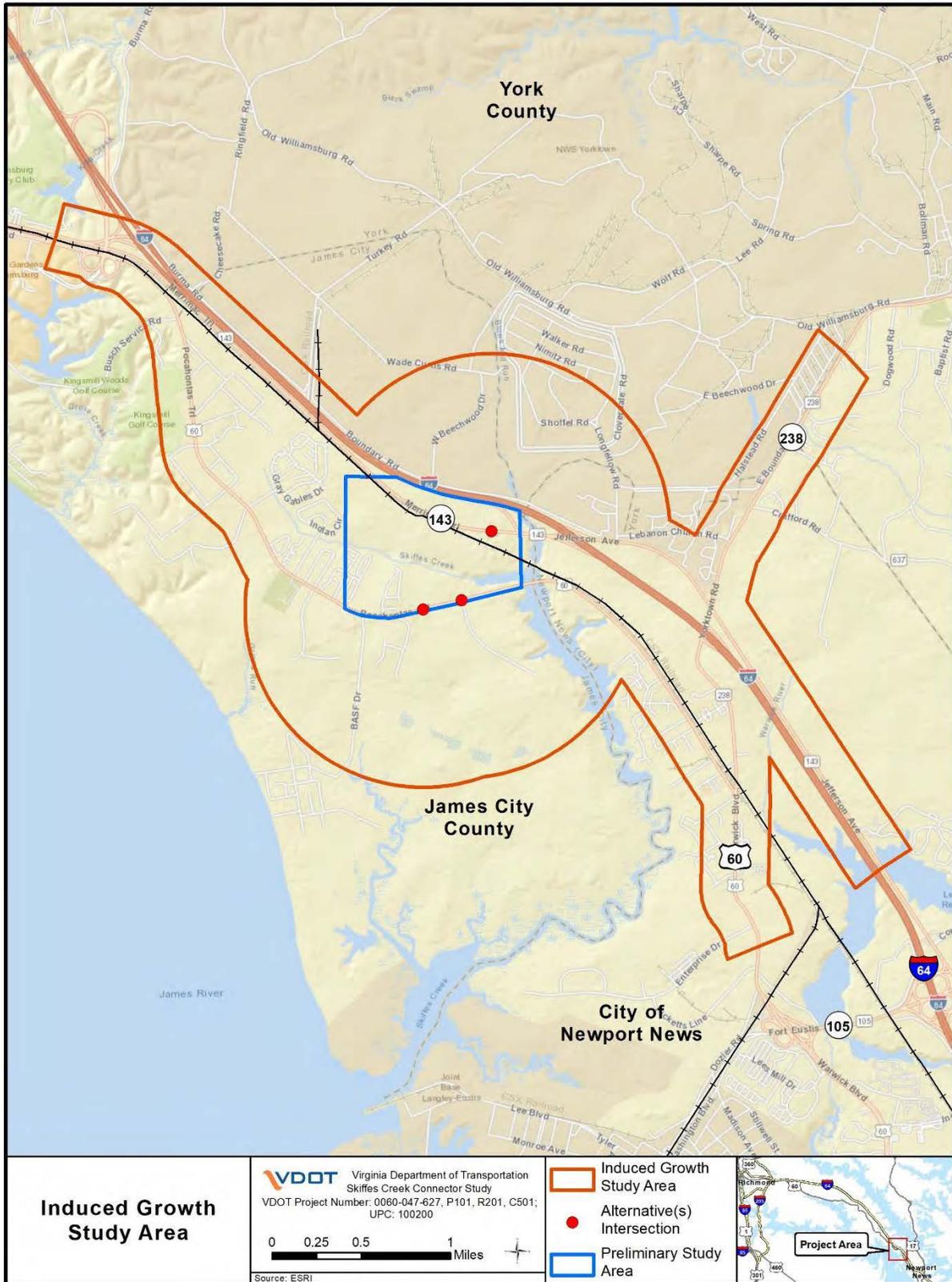
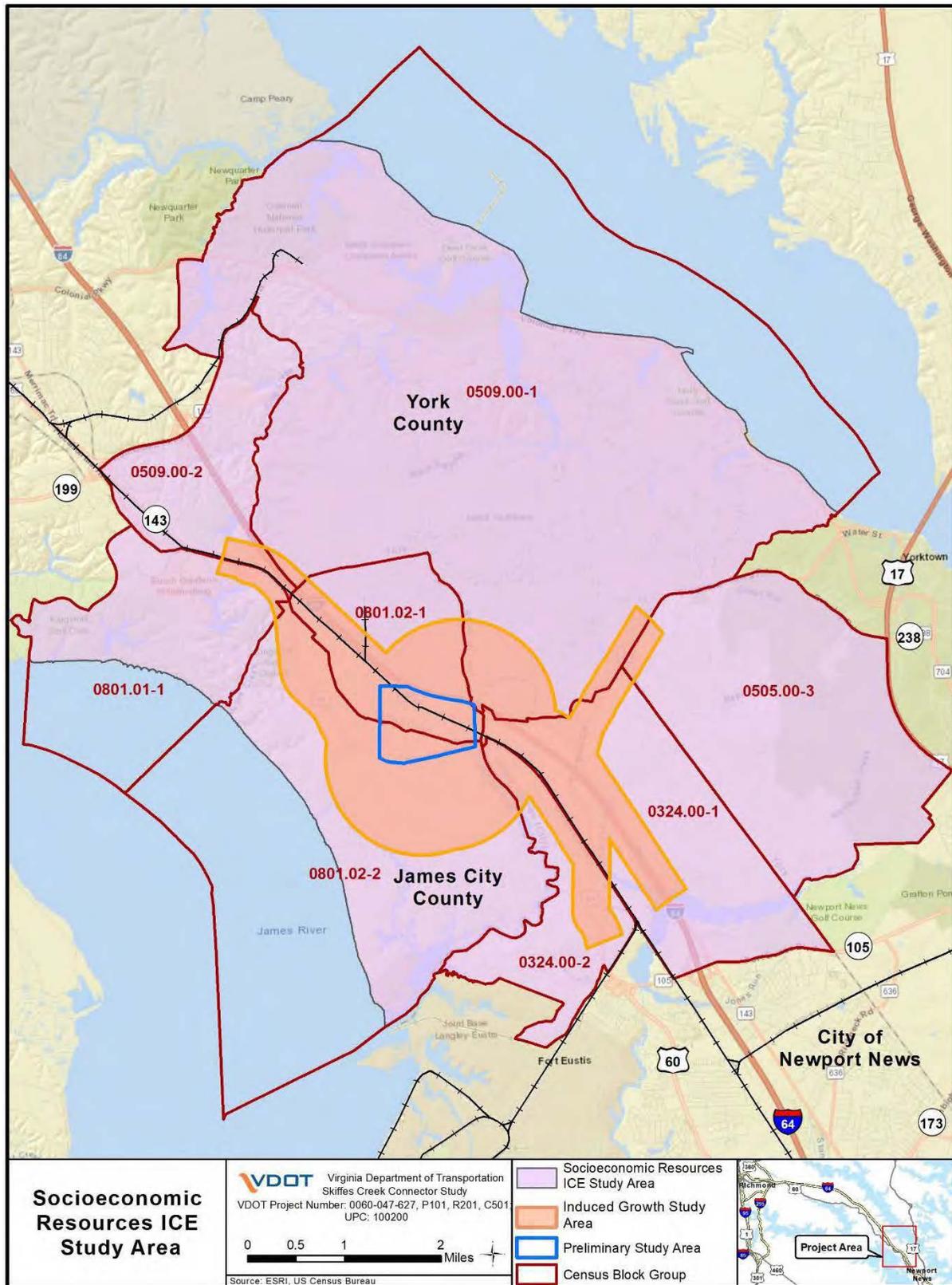


Figure 3-2: Socioeconomic Resources ICE Study Area



- **Natural Resources ICE** (including water resources, floodplains, wildlife habitat, and threatened, endangered, and special status species) – The Natural Resources ICE Study Area will use the U.S. Geological Survey (USGS) subwatershed 12-digit Hydrologic Unit Codes (HUCs) that encompass the Induced Growth Study Area (HUC 020802060802 - Skiffes Creek-James River, HUC 020801070203 - Carter Creek-York River, and HUC 020802060901 - Warwick River). The HUCs were cut at the shoreline of James City County, York County, and the City of Newport News to form the Natural Resources ICE Study Area since it is unlikely that implementation of the project would cause discernable indirect effects to the James River or the York River (refer to **Figure 3-3**).
- **Historic Resources ICE** – Indirect effects such as altering the setting, feeling and association of archaeological and architectural historic properties are considered under Section 106 of the National Historic Preservation Act (NHPA). The types of indirect effects that will be assessed for the ICE analysis would be changes to accessibility or visitation during or after construction. The Historic Resources ICE Study Area will be the same as the Area of Potential Effect (APE) which will be developed in consultation with Virginia Department of Historic Resources (VDHR). The identification of historic resources in the ICE study area would be limited to existing studies previously completed within the study area and a desktop review of the Virginia Cultural Resource Information System (VCRIS) website.

Directions and Goals

Directions and goals considered for the analysis will be discussed, independent of the transportation alternatives being evaluated in the EA. Topics to be discussed include Historic Land Use (from the USGS historic topographic maps and / or historic aerials dating from 1960 to today; qualitative analysis will consider alterations since the 1930s); Land Use Patterns and Local Plans (from James City County's 2035 Comprehensive Plan); Future Population Projections (from the U.S. Census Bureau [Census], Virginia Labor Market Information [LMI] James City County Community Profile, and / or the Weldon Cooper Center for Public Service's Virginia Population Projections); Economic Development and Employment (from the Virginia Labor Market Information James City County Economic Profile); and Natural Resources Protection/Ecosystems (from historic aerials and desktop investigation). Additional data from James City County's Geographic Information System (GIS) data may be utilized.

3.3 STEP 3: INVENTORY NOTABLE FEATURES IN THE STUDY AREA

The final list of notable features will be selected based on the potential for direct effects of the alternatives described in resource-specific technical reports, and potential for their indirect effects in the identified ICE study areas. Subsections for socioeconomic, natural, and historic resources will be included.

3.4 STEP 4: IDENTIFY IMPACT-CAUSING ACTIVITIES OF THE BUILD ALTERNATIVES

The goal of this step is to summarize the potential direct impacts of the proposed alternatives to notable features, and provide consistency with regional direction and goals as presented in **Step 2**. The direct impacts will be described in a table and will be the same as those summarized in the EA.

Figure 3-3: Natural Resources ICE Study Area



3.5 STEP 5: IDENTIFY INDIRECT EFFECTS FOR ANALYSIS

Step 5 will discuss the NCDOT guidance for identifying factors that influence the nature and magnitude of anticipated growth, and explain the magnitude of changes in land use or other project-induced development.

Utilizing the three indirect effect categories in the TRB's NCHRP Report 466, the objective of this step will be to assess whether direct impacts identified above would have the potential to indirectly affect the identified resources. The discussion will provide a summary of potential indirect effects meriting analysis, identifying the indirect effect type, the impact-causing activities (direct effects), indirect effects from direct effects, and a description of the potential change. Subsections for socioeconomic, natural, and historic resources will be included to discuss how the direct effects of the project could lead to indirect effects to each subtopic, and if so, if that subtopic has been advanced to **Step 6** for analysis; however, VDOT does not anticipate dismissing any subtopics.

3.6 STEP 6: ANALYZE INDIRECT EFFECTS AND EVALUATE ANALYSIS RESULTS

Using planning judgment, this step will fully explore the indirect effects and induced growth potentially resulting from each of the alternatives analyzed in the EA.

No Build Alternative

Effects to Socioeconomic Resources

Discussion of any potential indirect effects to socioeconomic resources, such as divided or segmented existing communities and community cohesion interference, changes to access during and / or after construction, temporary impacts associated with construction including traffic, noise, and air.

Effects to Natural Resources

Discussion of habitat loss or fragmentation, impact to wildlife corridors (streams with contiguous forest cover generally greater than 0.25 mile in width), impact to downstream waters, and other potential indirect effects, as well as temporary impacts during construction.

Effects to Historic Resources

Discussion of any indirect effects to historic resources. Some indirect effects could include: changes in the number of visitors due to changing traffic patterns, changes to access, and / or effects on the viewshed of the resource.

Induced Growth

Discussion noting that no induced growth would be expected as there would be no improvements to the study area.

Effects Related to Induced Growth

Discuss that since there would be no induced growth there would be no effects related to induced growth.

Build Alternative(s)

Effects to Socioeconomic Resources

Discussion of any potential indirect effects to socioeconomic resources, such as divided or segmented existing communities and community cohesion interference, changes to access during and / or after construction, temporary impacts associated with construction including traffic, noise, and air.

Effects to Natural Resources

Discussion of habitat loss or fragmentation, impact to wildlife corridors, impact to downstream waters, and other potential indirect effects, as well as temporary impacts during construction.

Effects to Historic Resources

Discussion of any indirect effects to historic resources/districts. Some indirect effects could include: changes in the number of visitors due to changing traffic patterns, changes to access, and / or effects on the viewshed of the resource.

Induced Growth

The induced growth analysis will identify the designated growth areas and the anticipated growth within the Induced Growth ICE Study Area. This analysis will identify the designated growth areas within the Induced Growth ICE Study Area and calculate the acres by land use class that are outside of designated growth areas but within the Induced Growth ICE Study Area. The proportion of undeveloped land outside the designated growth areas within the Induced Growth ICE Study Area establishes a baseline for potential induced growth for the applicable Build Alternative.

The areas of developed lands, wetlands, streams, and floodplains in the Induced Growth Study Area will be generally identified based on available James City County's GIS data, the National Land Cover Dataset (2011), the National Wetlands Inventory (NWI), and the National Hydrography Dataset (NHD), and other tools discussed in the Natural Resources Methodology Memorandum, respectively. Photo-interpretation will not be used for this analysis.

Effects Related to Induced Growth

Discuss the short and long-term effects related to induced growth to surrounding resources.

3.7 STEP 7: ASSESS CONSEQUENCES AND DEVELOP MITIGATION

Step 7 will summarize how the impacts from the Build Alternative identified in the previous section effect the overall resource and / or study area, and will provide a summary of potential mitigation measures (if appropriate). Subsections for socioeconomic, natural, and historic resources will be used to discuss the consequences associated with the indirect effects and identify potential mitigation measures. **Step 7** will note that the No Build Alternative will not have substantial indirect impacts and does not require mitigation.

4. CUMULATIVE IMPACTS

To document cumulative effects for this study, the analysis will follow the evaluation process outlined in *Fritiofson v. Alexander*, 772 F.2d 1225 (5th Cir. 1985), as described in FHWA's Guidance: *Questions and Answers Regarding the Consideration of Indirect and Cumulative Impacts in the NEPA Process* (FHWA, 2014).

4.1 WHAT ARE THE GEOGRAPHIC SCOPE AND TEMPORAL BOUNDARIES FOR THE STUDY

The geographic boundaries for the cumulative impacts analysis will be based on the individual Natural, Socioeconomic, and Historic Resources ICE Study Areas established for the indirect effects analyses.

The Consultant will research the developments and the roadways in the area and present a recommendation of the past temporal boundary to VDOT. The temporal boundary that will be used for the cumulative effects assessment will span from 1930, around when Merrimac Trail (Virginia State Route 143) was built to supplement US Route 60, to 2040, which will be the modeled design year for the Build Alternative(s).

4.2 WHAT ARE THE RESOURCES AFFECTED BY THE STUDY?

The resources affected by the study would be the same as the notable features identified in **Step 3** of the indirect effects analysis.

4.3 WHAT ARE THE OTHER PAST, PRESENT, AND REASONABLY FORESEEABLE ACTIONS THAT HAVE IMPACTED OR MAY IMPACT THESE RESOURCES?

Past Actions

A discussion will summarize how the past actions have transformed the study area by referring to historic documentation of past actions (including development) and their environmental effects gathered in **Step 2**, and consulting information gathered during scoping. Additionally, past notable transportation as well as public and private projects that have occurred proximate to the study area, which may have impacted the development of the region, will be considered. Quantitative data for recent years will be utilized for analysis, if available, in addition to the qualitative discussion and evaluation of past actions.

Present and Reasonably Foreseeable Future Actions

Present and reasonably foreseeable projects proximate to the study area will be presented in a table, and information will be gathered from consulting material gathered during scoping, the VDOT FY 2018 Final Six-Year Improvement Program (SYIP), James City County 2035 Comprehensive Plan, James City County FY 2016-2020 Capital Improvement Program, Hampton Roads Transportation Planning Organization FY 2018-2021 Transportation Improvement Program and the 2040 LRTP (James City County, 2015a, 2015b, 2016; HRTPO, 2016, 2017; VDOT, 2017a, 2017b). Projects will include transportation projects, community enhancement/improvement, public transportation projects, trail creation/improvements, and private developments.

4.4 WHAT WERE THOSE IMPACTS?

A discussion of the cumulative impact of the past, present, and reasonably foreseeable future actions on Socioeconomic Resources, Natural Resources, and Historic Resources will be summarized and detailed. The relative incremental contribution of the proposed alternatives to cumulative impacts to specific resources, both beneficial and adverse, will be documented. The magnitude and significance of cumulative impacts will be evaluated in accordance with CEQ's guidance at 40 CFR § 1502.16.

4.5 WHAT IS THE OVERALL IMPACT ON THESE VARIOUS RESOURCES FROM THE ACCUMULATION OF THE ACTIONS?

The overall impacts to various notable features will be summarized, based on the accumulation of impacts caused by evaluated alternatives in combination with other past, present, and reasonably foreseeable actions. The significance and magnitude of the overall impact of the accumulated actions will be summarized.

5. REFERENCES

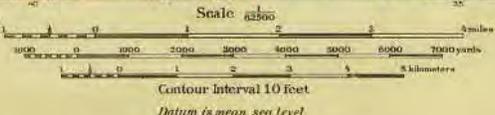
- Council on Environmental Quality (CEQ). (1981). Questions and Answers about the NEPA Regulations. Accessed September 2017: <http://energy.gov/nepa/council-environmental-quality?page=1>.
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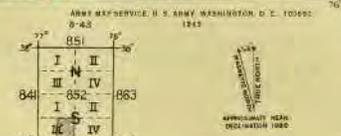
Appendix B – USGS Topographic Maps



Field work and compilation under the direction of
Col. W. M. Brock, Corps of Engineers, U. S. A.
District Engineer, Eastern District.
Oct. 1910 - Jan. 1911.
Field work under the immediate supervision of
1st Lieut. Allison B. Cherry, Jr., U. S. A.
2nd Lieut. W. C. Whitaker, U. S. A.
Base map from U. S. G. S. engraving.
Corrections and additions by Department
Engineer, Eastern District.



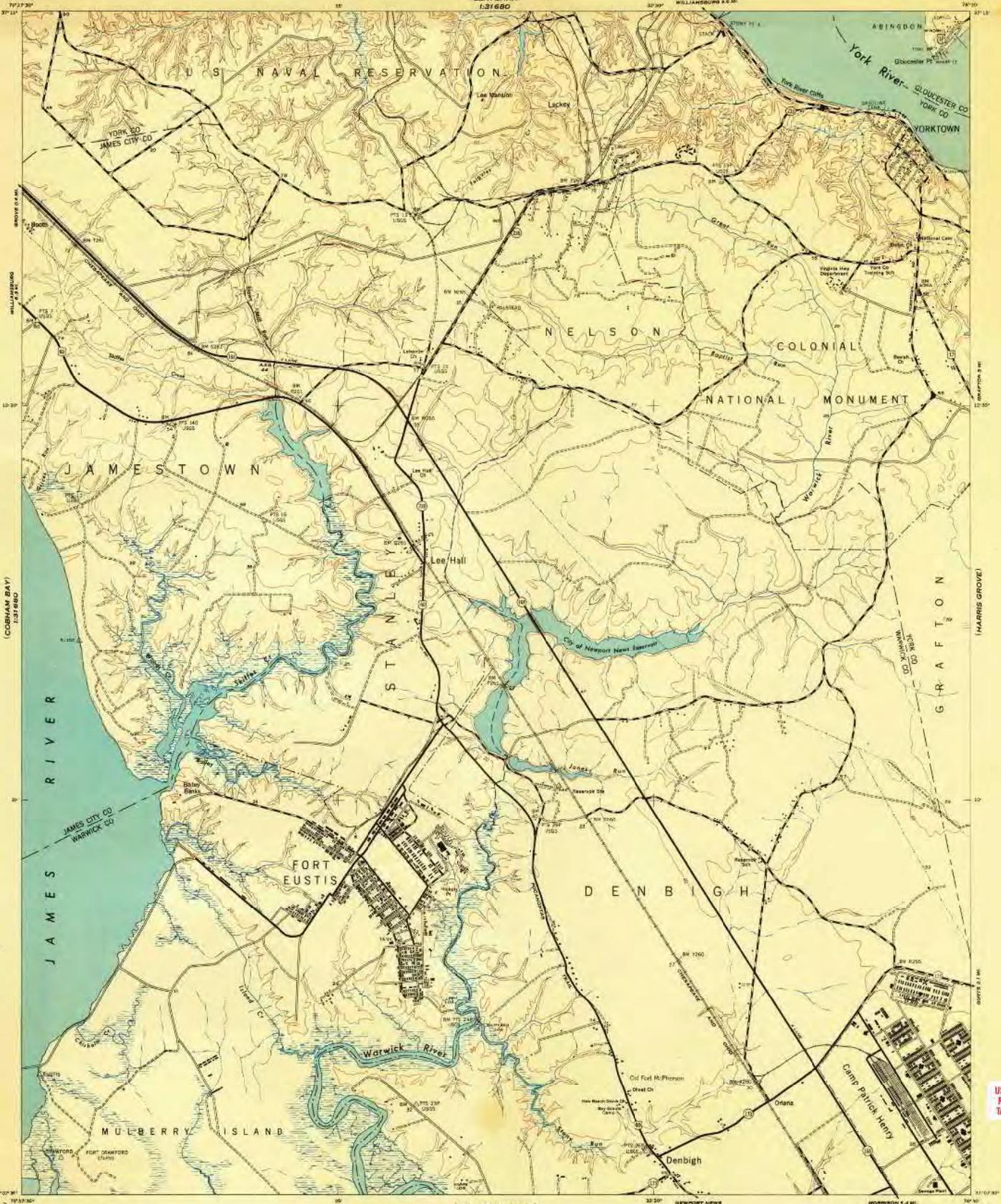
NOTE: OFFICERS USING THIS MAP WILL MAKE NECESSARY CORRECTIONS AND ADJUSTMENTS WHICH COME
TO THEIR ATTENTION AND WILL REPORT TO THE CHIEF OF ENGINEERS, WASHINGTON, D. C.



USCS
Historical File
Topographic Division
YORKTOWN
VA

(CLAYBANK)
1:21680

(ACHILLE)
1:21680



Map of the U. S. Coast and Geodetic Survey under the supervision of the Chief of Engineers, U. S. Army, 1963. Control by U.S.C.G. and U.S.C. & G.S. Photographs by U. S. C. & G. S. from 1942 air photographs. Elevations in feet and feet not for U. S. C. & G. S., 1944. Polythetic projection, North American datum of 1922. Place names in parentheses indicate locations of less than 1000' above sea level and shown in green.

ROAD CLASSIFICATION 1964

Depicting: Interstate highway (red line with red dots) U.S. route (black line with black dots) State route (black line with white dots) U.S. route (black line with black dots) State route (black line with white dots) U.S. route (black line with black dots) State route (black line with white dots)

Scale 1:24000

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

WOODLAND CLASSIFICATION

Small woodlands (green) Dense woods (green) Open fields (green) Pasture (green) Bare ground (green) Low marsh (green) Swamp (green)

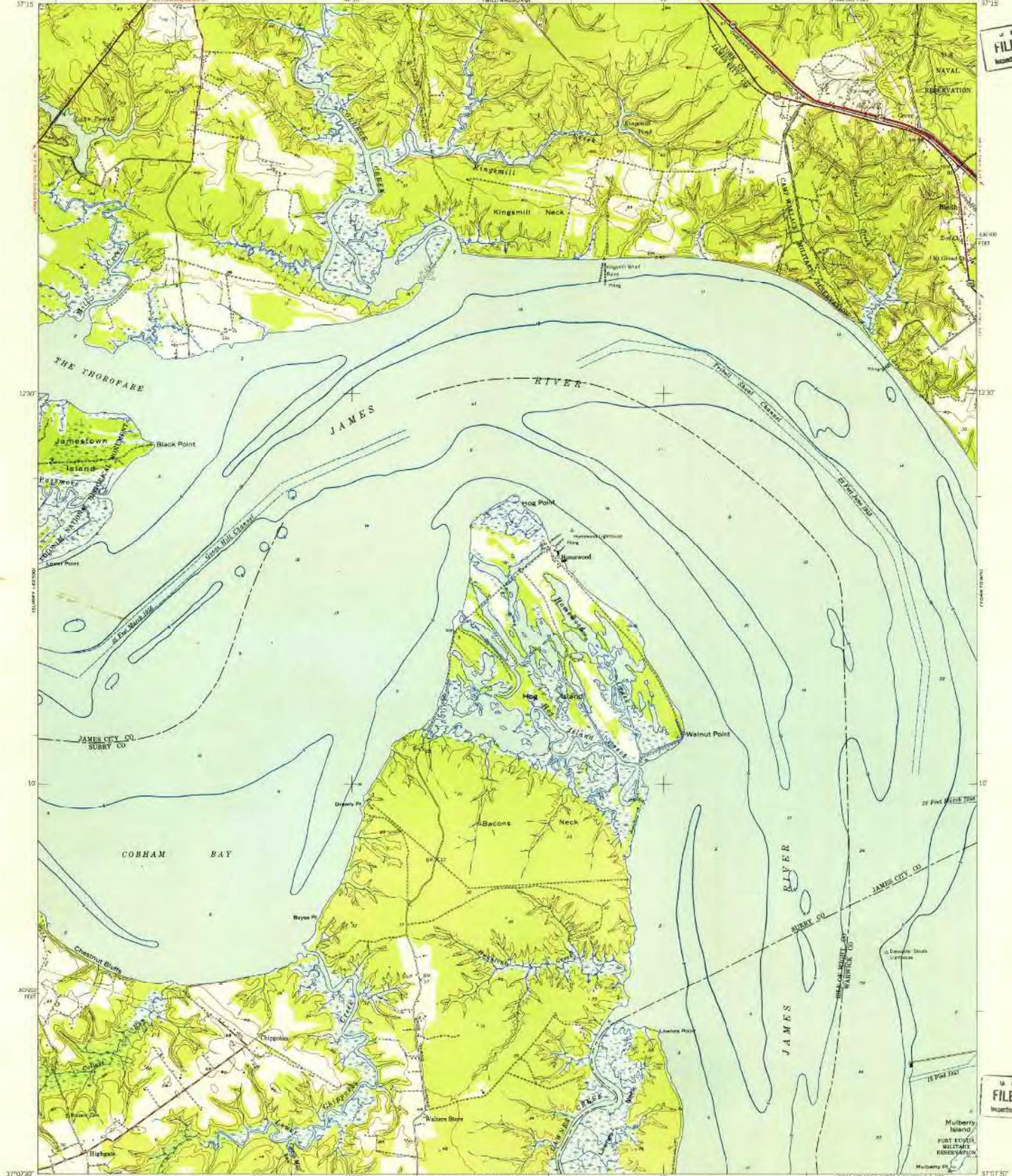
YORKTOWN, VA.
N3707.5-W7630.7.5
SECTION OF 1964

3 1618 00422984 3

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USGS Library
Reston, VA
Topo Archive

U.S.G.S.
FILE COPY
Inoperative and Missing



Map made by the Army Map Service
Published for civil use by the Geological Survey
Control by USGS, USCGS, and USCE
Topography from plane table surveys and
stereo-panoramic methods
Aerial photographs taken 1947-1948. Field check 1950.
Coastal hydrography compiled from USCGS
chart 529, 1944.
Stereographic projection. 1927 North American datum.
30-foot grid ght based on Virginia coordinate system,
south zone.



ROAD CLASSIFICATION

Heavy-duty	Light-duty
Medium-duty	Unimproved dirt
U.S. Route	State Route

USGS
Historical File
Topographic Division

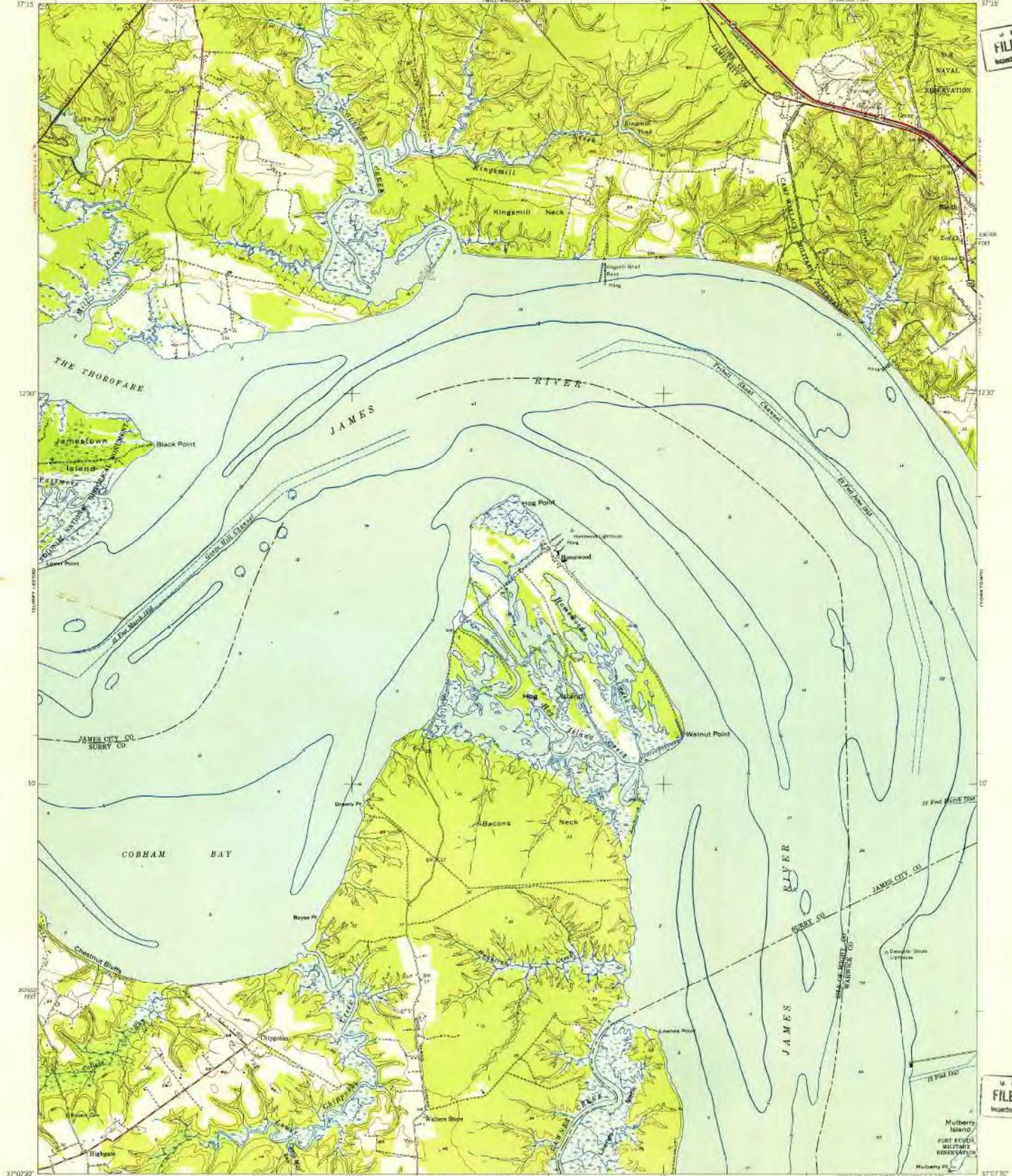
COBHAM BAY, VA.
HWK YORSTOWN 19 QUADRANGLE
N7915-W7637 5/7.5
1950

U.S.G.S.
FILE COPY
Inoperative and Missing

THIS MAP COMPLETES THE NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U.S. GEOLOGICAL SURVEY, WASHINGTON 25, D. C.
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST.

MAY 24 1953

U.S.G.S.
FILE COPY
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Map made by the Army Map Service
Published for civil use by the Geological Survey
Control by USGS, USCGS, and USCE
Topography from plane table surveys and
stereo-photometric methods
Aerial photographs taken 1947-1948. Field check 1950.
Coastal hydrography compiled from USCGS
chart 529, 1944.
Stereographic projection. 1927 North American datum.
30-foot grid ght based on Virginia coordinate system,
south zone.



ROAD CLASSIFICATION

Heavy-duty	Light-duty
Medium-duty	Unimproved dirt
U.S. Route	State Route

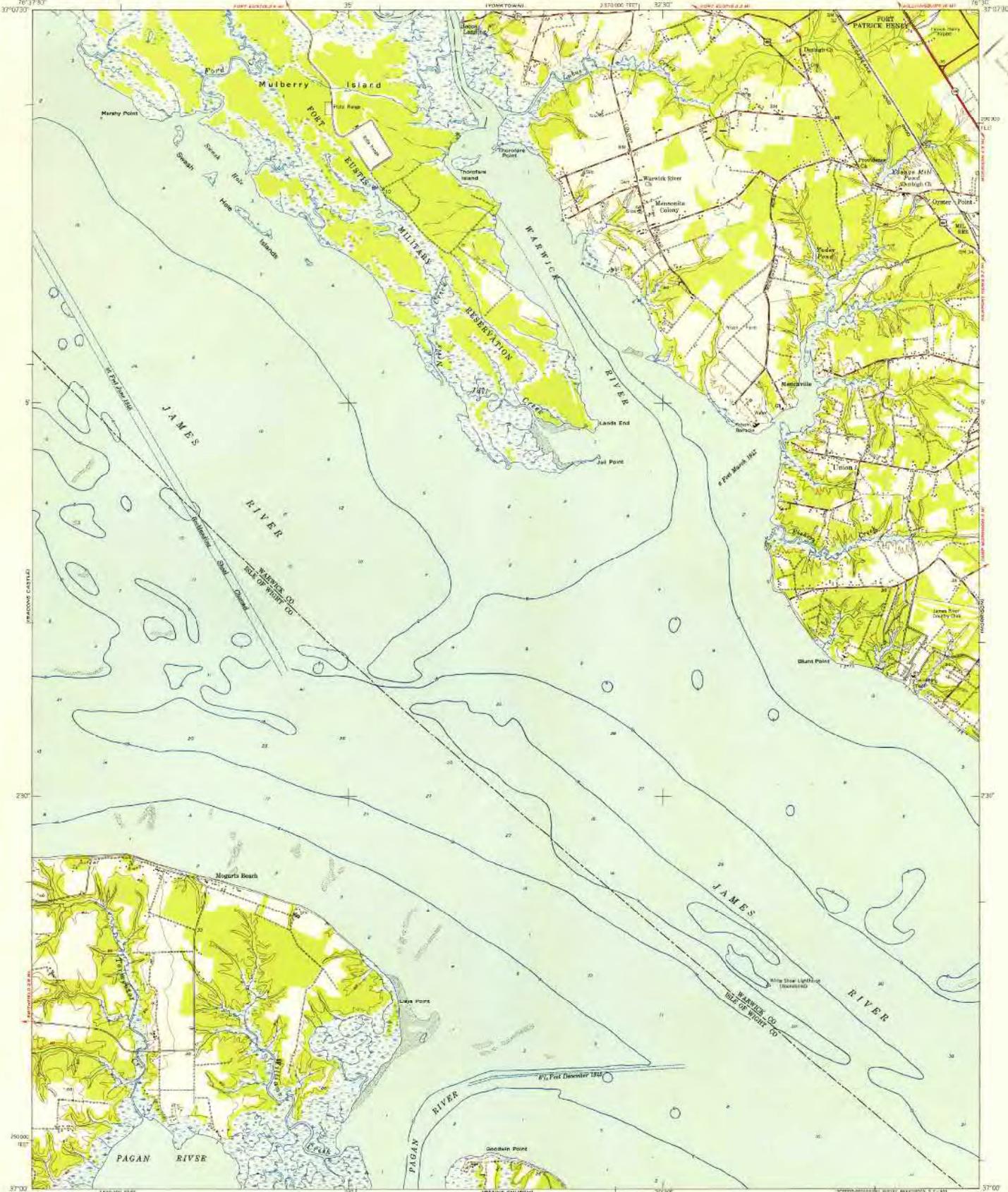
USGS
Historical File
Topographic Division

COBHAM BAY, VA.
HWK YORSTOWN 19 QUADRANGLE
N7905-W7637 5/7.5
1950

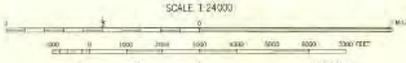
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MAY 24 1953



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Published for civil use by the Geological Survey
Control by USGS, USACE and USCE
Topography from stereoscopic surveys and
altimetric methods
Aerial photographs taken 1947. Field check 1960
Coastal hydrography compiled from USCGS
Chart 529, 1946
Magnetic declination: 1927 North American datum
10,000 feet and level in Virginia coordinate system,
south pole



CONTOUR INTERVAL, 20 FEET
DATUM IS MEAN SEA LEVEL
VERTICAL CURVES IN 20 FEET INTERVALS OF MEAN LOW WATER

ROAD CLASSIFICATION
Heavy-duty Light-duty
Medium-duty Unimproved dirt
U.S. Route State Route

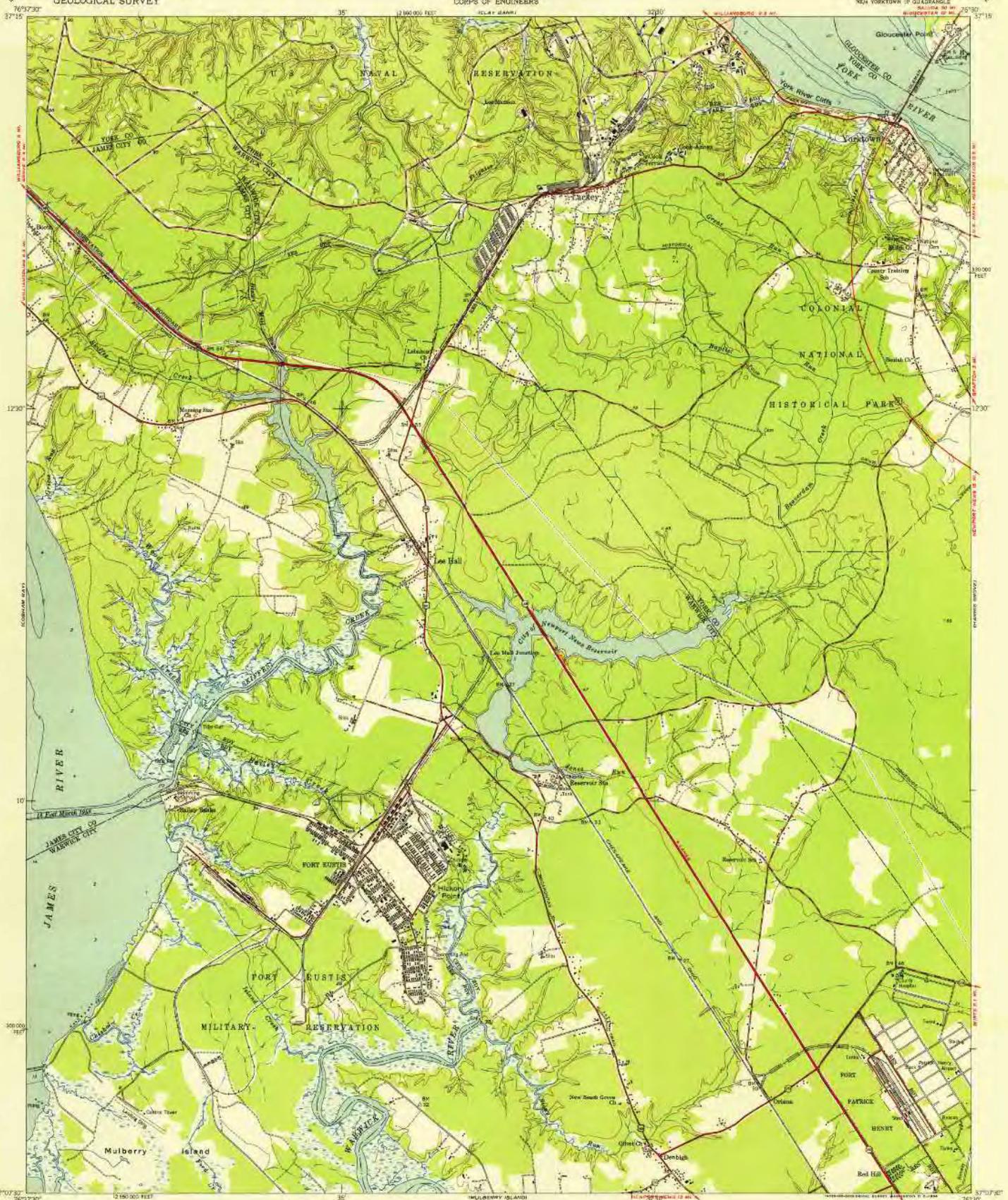


FILE COPY
Inches on Edition

MULBERRY ISLAND, VA.
SEA LEVEL DATUM
N 37° 00' - W 76° 30' E 5

1950

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Published for their use by the Geological Survey
Control by USGS and USACE
Topography by plane table surveys and photogrammetric methods
Aerial photographs taken 1947. Field check 1950
Coastal hydrography compiled from USCGS Charts 492, 1947,
and 529, 1944
Polyconic projection. 1927 North American datum
1:50,000 scale based on Virginia coordinate system,
south zone

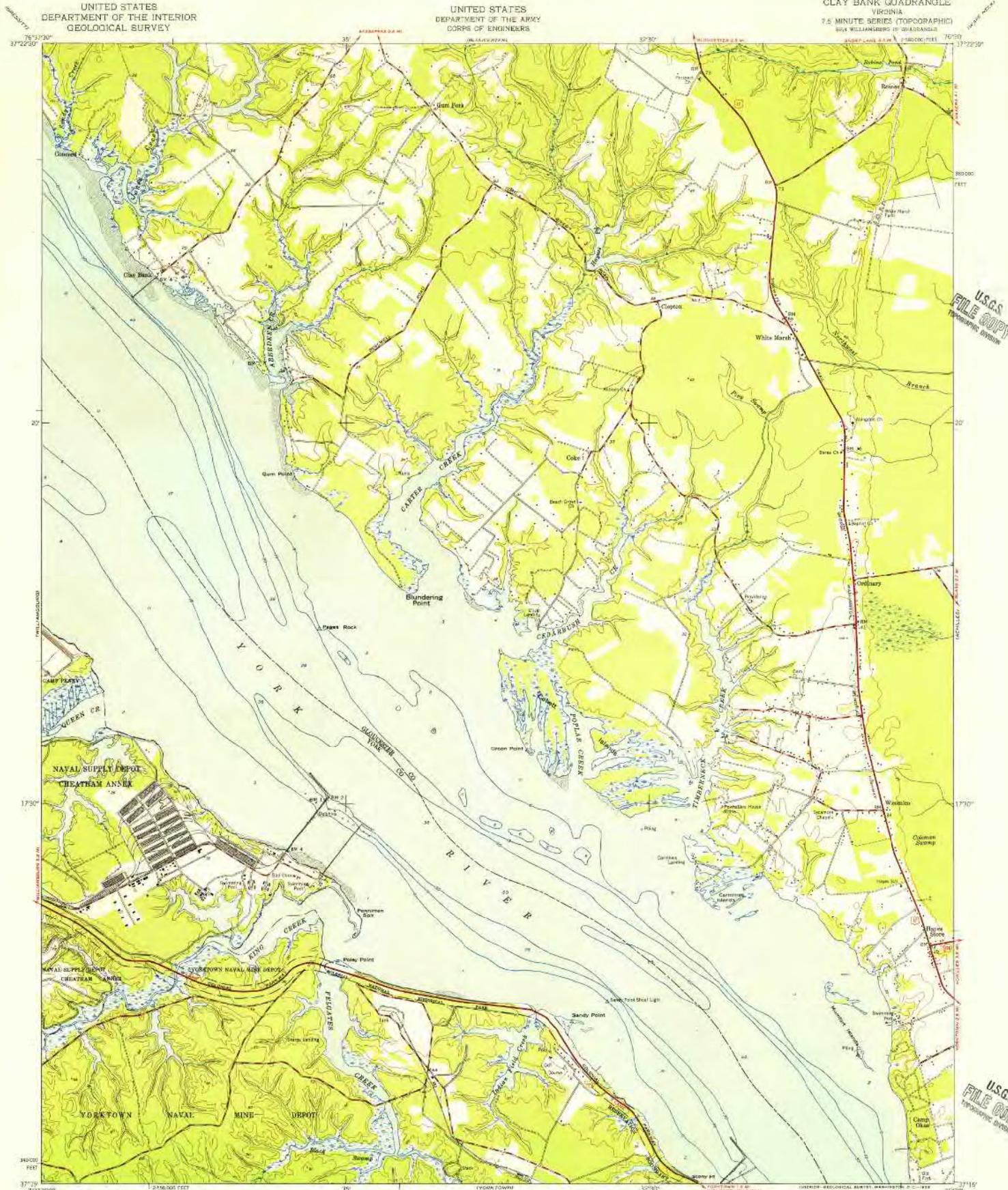


CONTOUR INTERVAL 20 FEET
DEPTH SURVES AND SOUNDINGS IN FEET - 10 FEET IS MEAN LOW WATER
TEMPERATURE SURVES APPROXIMATELY THE PREVIOUS YEAR (LIST OF DATA ON MAP)
ELEVATION SURVES APPROXIMATELY THE PREVIOUS YEAR (LIST OF DATA ON MAP)

ROAD CLASSIFICATION
Heavy duty — Solid Line Light duty — Dashed Line
Medium duty — Double Line Unimproved dirt — Dotted Line

USGS Historical File
Topographic Edition
YORKTOWN, VA.
NE4 YORKTOWN 19 QUADRANGLE
N3705-N7500/T.E.
1950

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Mapped by the Army Map Service
Published for civil use by the Geological Survey
Derived by USACE
Topographic from aerial photographs by photogrammetric methods
Aerial photographs taken 1948, 1951 and 1952. Field check 1952
Coastal hydrography compiled from USCGS Chart 495
Photocopy projection: 1927 North American datum
12,000-foot grid based on Virginia coordinate system,
SICP zone
Unchecked elevations are shown in brown



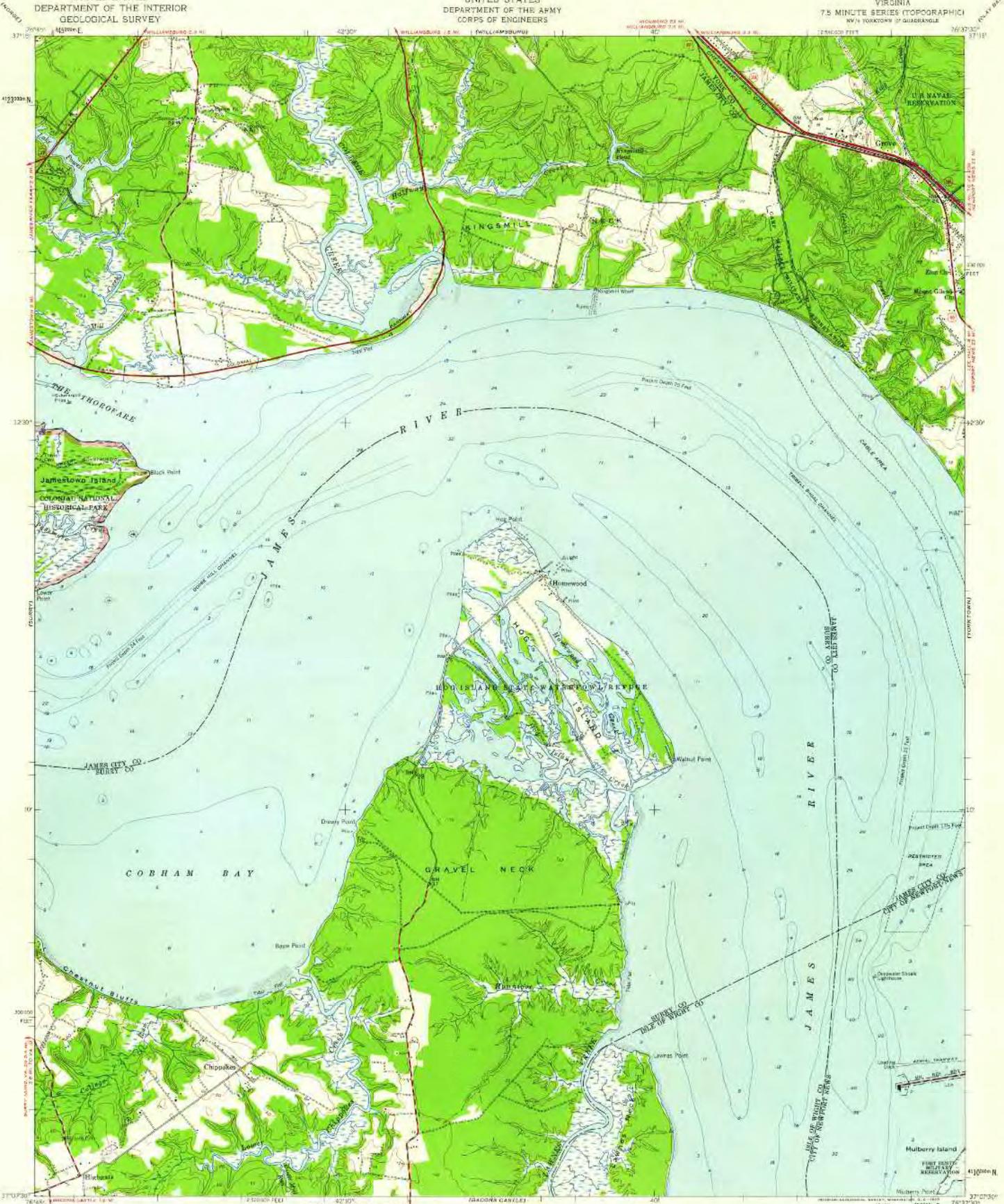
ROAD CLASSIFICATION

Heavy-duty	Light-duty
Medium-duty	Unimproved dirt
U.S. Route	State Route



DRUGS
Militarized File
Topographic Division

CLAY BANK, VA.
804 WILLIAMSBURG BY QUADRANGLE
N3715-W-053112



Mapped by the Army Map Service
Published for civil use by the Geological Survey
Control by USGS, USCGAS, and USACE
Topography from aerial photographs by photogrammetric methods
and by stadia surveys 1944. Aerial photographs taken 1942.
Culture and drainage from aerial photographs taken 1935
and 1946. Field work 1955
Hydrography compiled from USCGAS chart 529 (1956)
Projection, 1327 North American datum
10,000-foot grid based on Virginia coordinate system, south zone
1000-meter Universal Transverse Mercator and tops,
zone 18, shown in blue



CONTOUR INTERVAL 20 FEET
CONTINUED TO NEAR SEA LEVEL
NOTHING SHOWN FOR ELEVATIONS IN FEET EXCEPT IN 10-FOOT LOW-TIDE
DEPTH SOUNDINGS APPROXIMATE TO THE APPROXIMATE ELEVATION OF MEAN HIGH WATER
THE HIGHEST POINT OF THE QUADRANGLE IS 1077

USGS
Historical File
Topographic Division

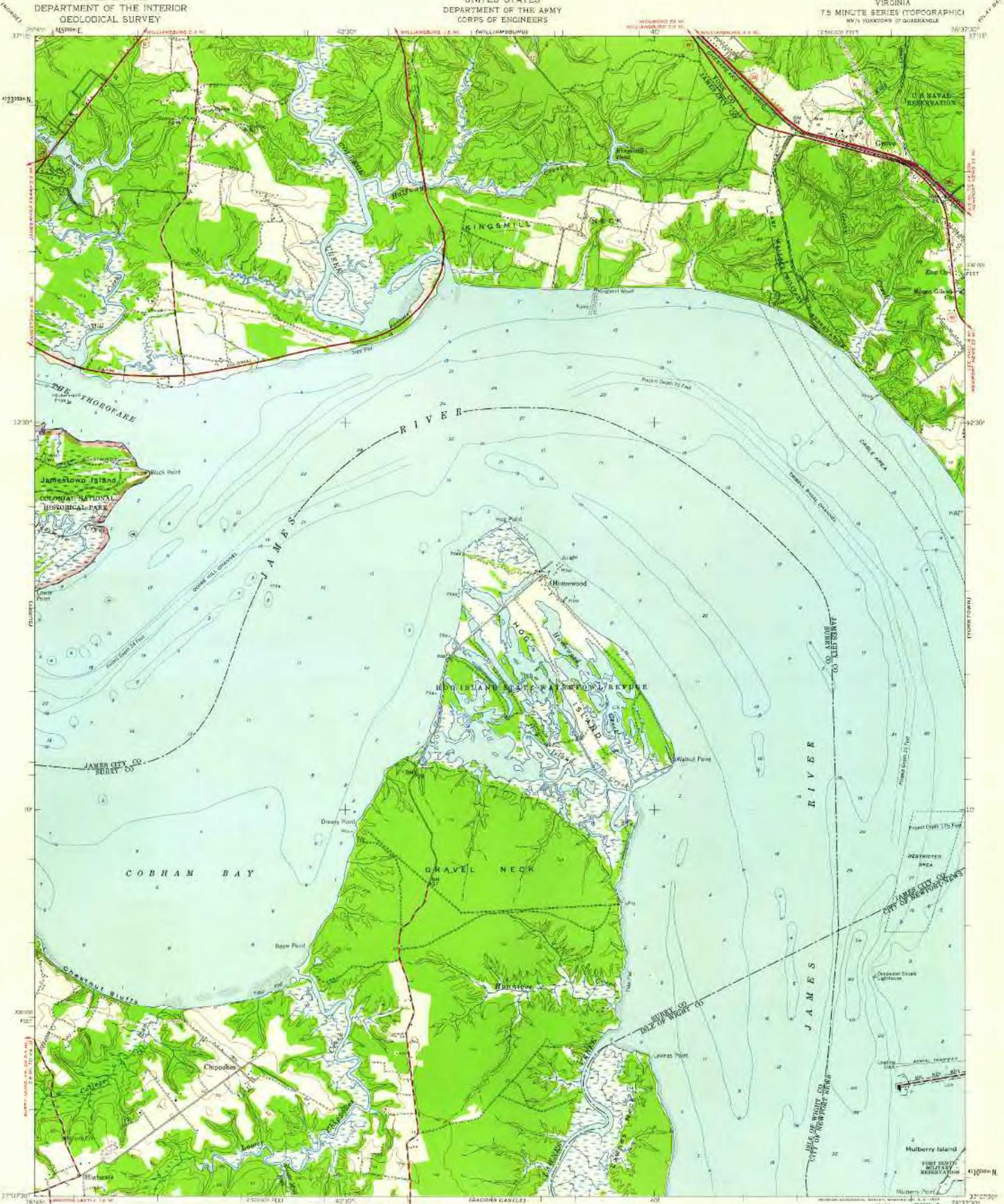
ROAD CLASSIFICATION
 Heavy-duty
 Medium-duty
 Light-duty
 Unimproved dirt
 U.S. Route
 State Route

U.S.G.S.
FILE COPY
Topographic

COBHAM BAY, VA.
NW 1/4 YORKTOWN 1" QUADRANGLE
N 3707.5 W 7657.5175

FEB 1957

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Published for civil use by the Geological Survey
Control by USGS, USCGAS, and USACE
Topography from aerial photographs by photogrammetric methods
and by stroboscopic surveys 1944. Aerial photogrammetry taken 1942.
Culture and drainage: revised from aerial photographs taken 1935
and 1946. Field work 1955
Hydrography compiled from USCGAS chart 529 (1956)
Projection: projection, 1327 North American datum
10,000-foot grid based on Virginia coordinate system, south zone
1000-meter Universal Transverse Mercator and tops,
zone 18, shown in blue



ROAD CLASSIFICATION

Heavy Sub	Light duty
Major duty	Unimproved dirt
U.S. Route	State Route

USGS
Historical File
Topographic Division

FILE COPY

U.S.G.S. COBHAM BAY, VA.
NW 1/4 YORKTOWN 1" QUADRANGLE
N 3707 E. W 7637 S 17 E

1957

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FEB - 1960
FEB 14 1960



Mapped, edited, and published by the Geological Survey
Control on 1:100,000 and 1:50,000
Topography by photogrammetric methods from aerial
photographs taken 1953. Field checked 1965.
Supplemental Army Map Service Control Map (map scale 1:50,000)
Selected topographic data compiled from 1:50,000 Chart 529 (1962)
Map information is not intended for navigational purposes.
Elevation projection - 1927 North American datum.
10,000-foot grid based on Virginia coordinate system, north-south
1:250,000 scale Universal Transverse Mercator grid taken
zone 18, datum is 2011.
The red dashed lines indicate affected areas and lines that were
generally visible on aerial photographs. This information is published



CONTOUR INTERVAL 10 FEET
ELEVATION INTERVAL 10 FEET
ELEVATION IS MEAN SEA LEVEL
DITCHES AND SOUNDINGS IN FEET - DATUM IS MEAN LOW WATER
ELEVATION IS MEAN SEA LEVEL
THE PROJECTIONS IN THIS MAP ARE AS FOLLOWS:
FOR SALE BY U.S. GEOLOGICAL SURVEY, WASHINGTON, D. C. 20242
AND VIRGINIA DIVISION OF MINERAL RESOURCES, CHARLOTTESVILLE, VIRGINIA
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

USGS
TOPOGRAPHIC DIVISION

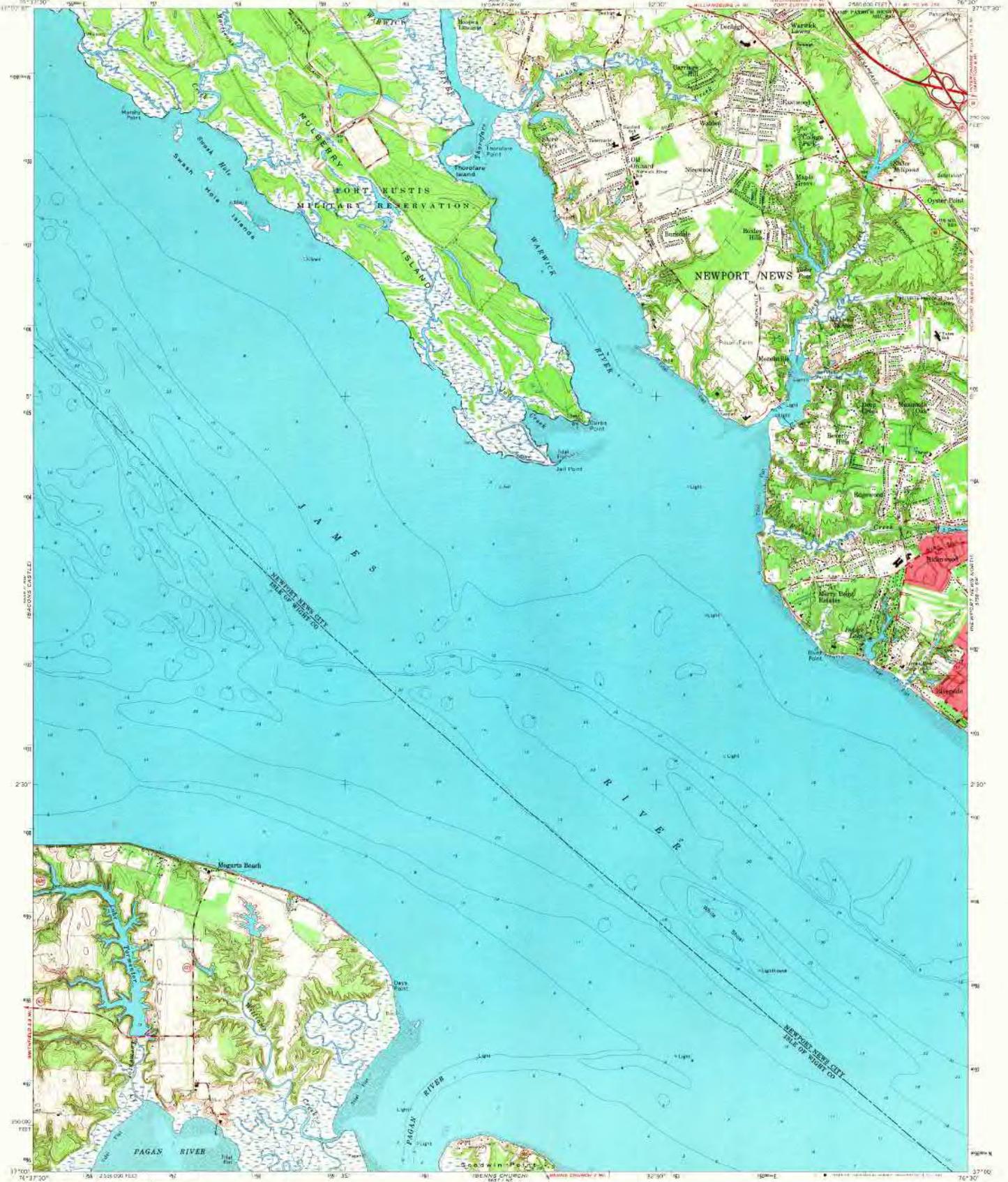
HOG ISLAND, VA
757078 - 757079
1:50,000

AMS 5610 (11-75) SERIES 5964

ROAD CLASSIFICATION
Light duty
Unimproved dirt
Interstate Road
U.S. Route
State Route

USGS
Historical File
Topographic Division

USGS
Historical File
Topographic Division



Map edited, added, and published by the Geological Survey
Control by USGS, USCGS, and USPO
Topography by photogrammetry, modified from aerial photographs
taken 1950. Field checked 1960
Supersedes Army Map Service map dated 1957
Selected hydrographic data compiled from USCGS Chart 629 (1964);
This information is not intended for navigational purposes.
Elevation projection: 1927 North American Datum
112,000-foot grid based on Virginia coordinate system. Contour interval
100 feet. Contour interval: 20 feet. Contour interval: 10 feet. 10
shown in blue
Five red dashed lines indicate railroad lines and field lines where
generally visible on aerial photographs. This information is unclassified.
Red hatched areas in which only landmark buildings are shown

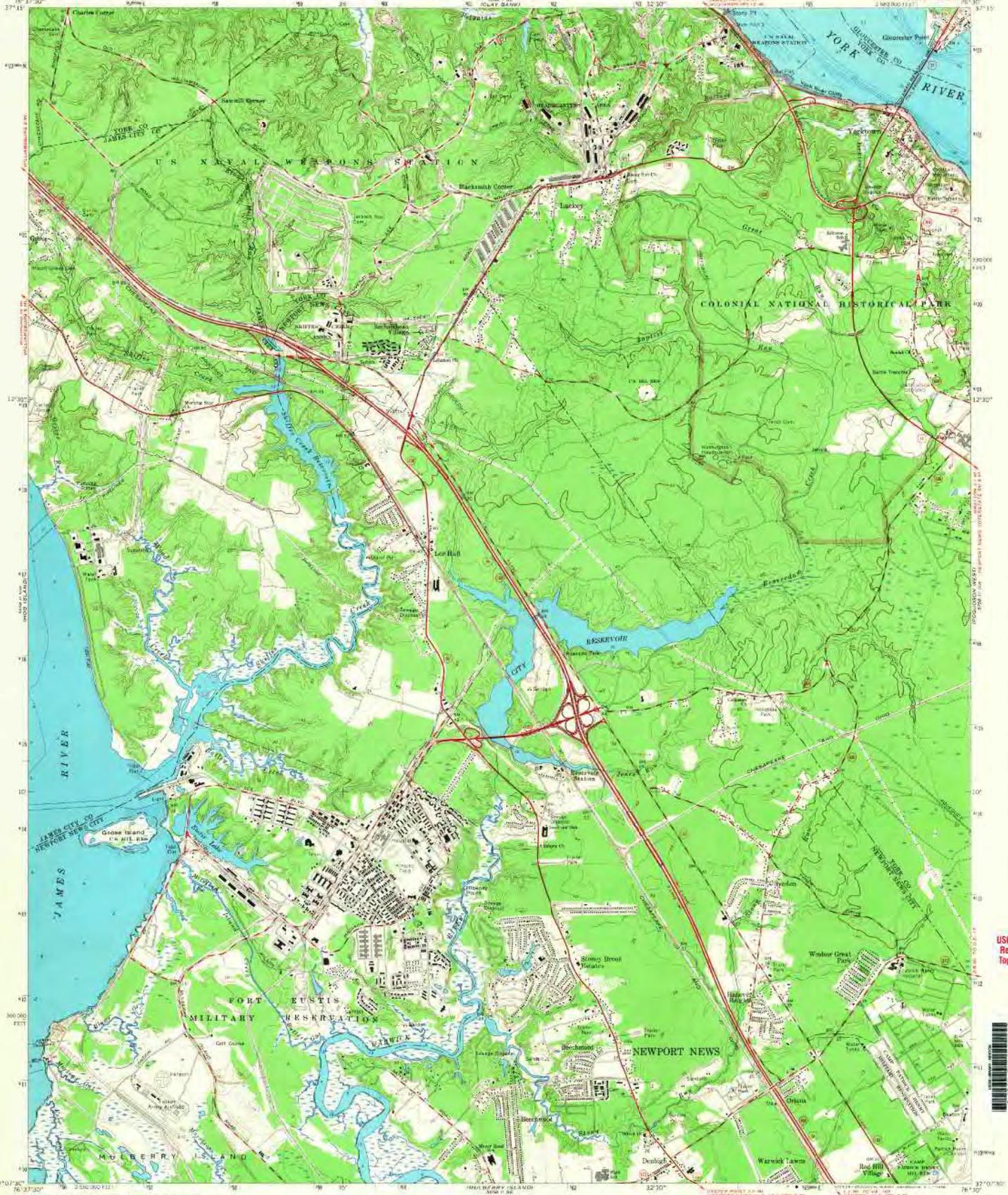


U.S.G.S. TOPOGRAPHIC DIVISION

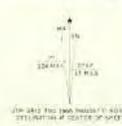
MULBERRY ISLAND, VA.
SEA LEVEL TO QUADRANGLE
1:24,000
1965
ANS 5081 II 25—SERIES 1/14

U.S.G.S. Topographic Symbols	ROAD CLASSIFICATION
Highway	Light duty
Medium duty	Light and dirt
Interstate Route	U.S. Route
State Road	State Road

THIS MAP CONFORMS WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U.S. GEOLOGICAL SURVEY, WASHINGTON, D. C. 20542
AND VIRGINIA DIVISION OF MINERAL RESOURCES, CHARLOTTESVILLE, VIRGINIA 22901
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST



Maplet, edited and published by the Geological Survey
Conform to USGS and USGS(2)
Topography by photogrammetric methods from aerial photographs
taken 1963. Photo checked 1965.
Supersedes Army Map Service map sheet 1947.
Special hydrographic data compiled from USGS Charts
492 (1964) and 503 (1964). This information is not intended for
navigational purposes.
Vertical projection: 1927 North American datum.
10,000-foot grid based on Virginia coordinate system, south zone.
Datum: 1884 Universal Transverse Mercator grid datum.
Scale: 1:50,000 at date.
This red dashed line indicates selected fence and field lines whose
general location is shown on aerial photographs. This information is uncorrected.



CONTOUR INTERVAL 10 FEET
BOTTED LINES REPRESENT 500' CONTOURS
BIRTH CURVES AND SOUNDINGS IN FEET—DATUM IS MEAN LOW WATER
SOUNDING SURVEY ADJUSTED TO THE DATUM OF MEAN LOW WATER
THIS MAP COMPARED WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U.S. GEOLOGICAL SURVEY, WASHINGTON, D. C. 20549
AND VIRGINIA DIVISION OF MINERAL RESOURCES, CHARLOTTESVILLE, VIRGINIA 22903.
A FOLDER OF SPECIAL TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST.

ROAD CLASSIFICATION

Heavy duty	Light duty
Medium duty	Unimproved dirt
Substate Road	U.S. Route
	State Route

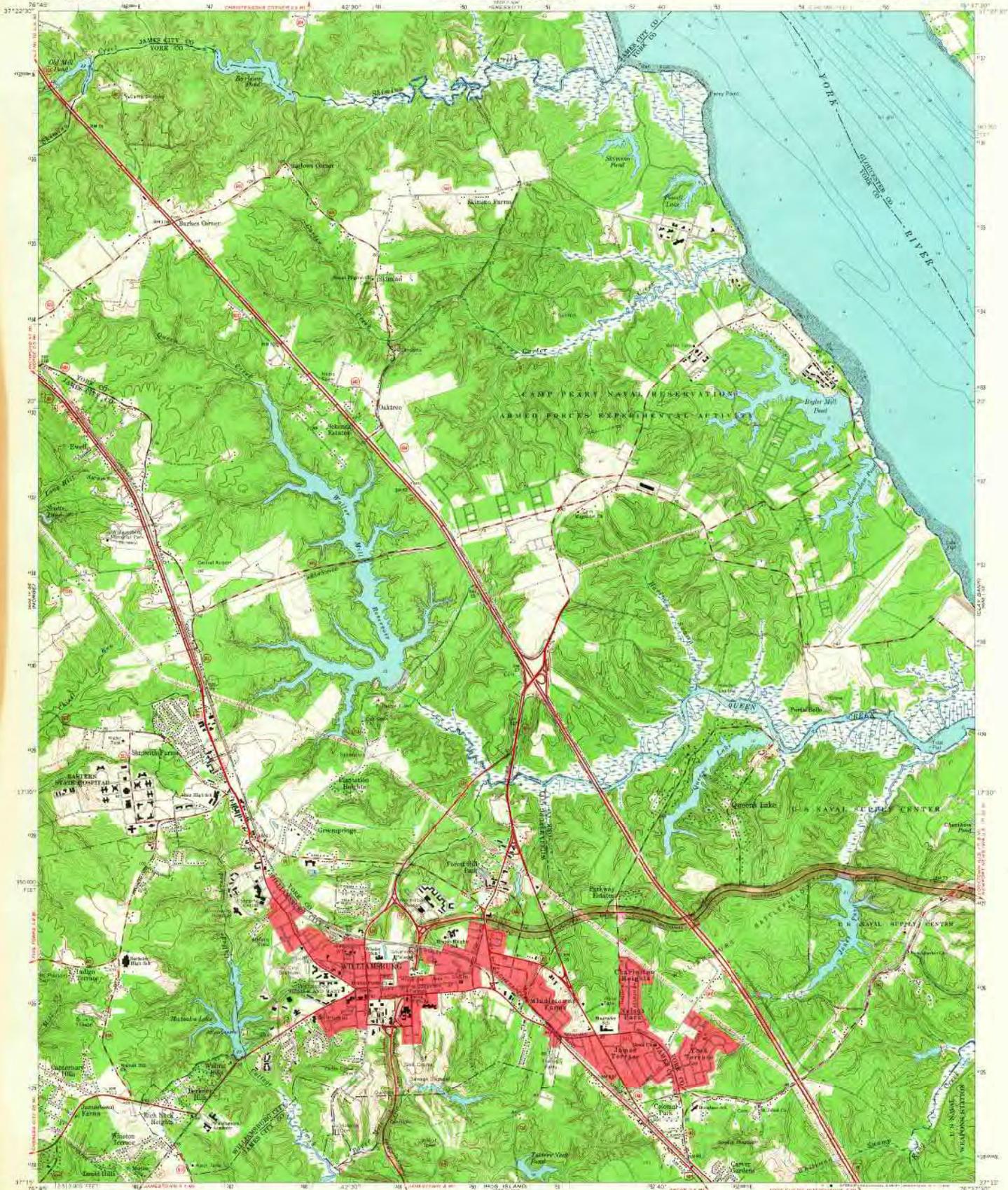
U.S.G.S.
FILE COPY
TOPOGRAPHIC DIVISION

YORKTOWN, VA.
NEAR YORKTOWN 15 QUADRANGLE
1965
AND 1956 (1:50,000) 1965

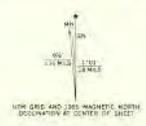
USGS Library
Reston, VA
Topo Archive



44545
1965



Mapped, edited, and published by the Geological Survey
Control by USGS and USC835
Topography by printing arithmetic methods from aerial
photographs taken 1953. Folds checked 1955.
Supervisory Army Map Service map dated 1952.
Sector hydrographic data supplied from USCGS Chart 456 (1946).
This information is not intended for navigational purposes.
Point-of-projection 1927 North American datum.
10,000-foot grid based on Virginia coordinate system, south zone.
1000-meter Universal Transverse Mercator grid, zone 18, shown in blue.
Five red dashed lines indicate selected fence and field lines shown
generally visible on aerial photographs. This information is unattached
Red and black areas in which only features buildings are shown



SCALE 1:24,000
CONTOUR INTERVAL 20 FEET
DATUM: U.S. MEAN SEA LEVEL
DEPTH CURVES AND SOUNDINGS IN FEET - LATHE IS MEAN LOW WATER
DEPTH IN FEET - LATHE IS MEAN LOW WATER

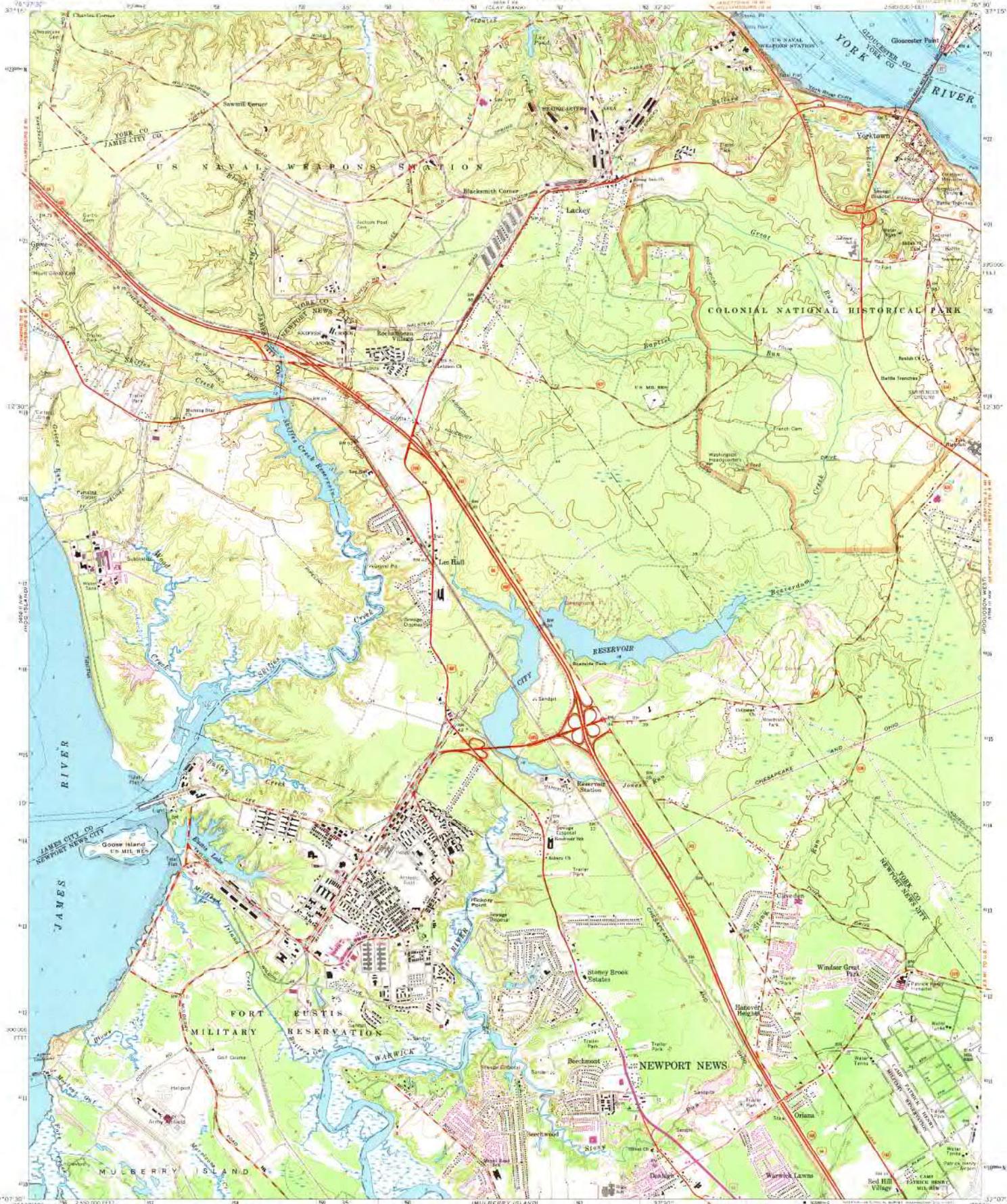
THIS MAP CONFORMS WITH NATIONAL MAP ACCOUNT STANDARDS
FOR SALE BY U.S. GEOLOGICAL SURVEY WASHINGTON, D. C. 20540
AND VIRGINIA DIVISION OF MINERAL RESOURCES, CHARLOTTESVILLE, VIRGINIA
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

USGS
TOPOGRAPHIC DIVISION

ROAD CLASSIFICATION
Light duty
Unimproved dirt
Interstate Route
U.S. Route
State Route

USGS
Historical File
Topographic Division

WILLIAMSBURG, VA.
NO. 1 WILLIAMSBURG QUADRANGLE
43718-46753-5075
1965
ANS 5658-1 (REV. SERIES 958)



Mapped, edited, and published by the Geological Survey

Control by USGS and USCGS

Topography by photogrammetric methods from aerial photographs

taken 1963. Base checked 1962

Signature Army Map Service map dated 1957

Selected hydrographic data compiled from USCGS Charts

4921 (1964) and 5071 (1964). This information is not intended for

navigation purposes.

Geographic projection: 1927 North American datum

10,000-foot grid based on Virginia coordinate system. Each mile and

1000-foot interval Transverse Mercator grid lines. Zone 18. Shows in blue.

Forest dashed lines indicate unlogged forest and full lines where

generally, with an aerial photograph. This information is unchecked.



SCALE 1:24,000

CONTOUR INTERVAL IN FEET
DOTTED LINES REPRESENT 20-FT. CONTOURS
JANUARY IS MEAN SEA LEVEL
100-FT. CONTOURS AND SOUNDINGS IN FEET. MEAN IS MEAN LOW WATER
USGS. THE SOURCE OF THE DATA IS THE NATIONAL SYSTEM OF MEAN LOW WATER
FOR THE AREA OF THE QUADRANGLE AS INDICATED.

THE U.S. GEOLOGICAL SURVEY HAS ACCURATELY DETERMINED
FOR SALE BY U.S. GEOLOGICAL SURVEY, WASHINGTON, D.C. 20508
AND VIRGINIA DIVISION OF MINERAL RESOURCES, CHARLOTTESVILLE, VIRGINIA 22904
A FOLDER OF VIRGINIA TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST.

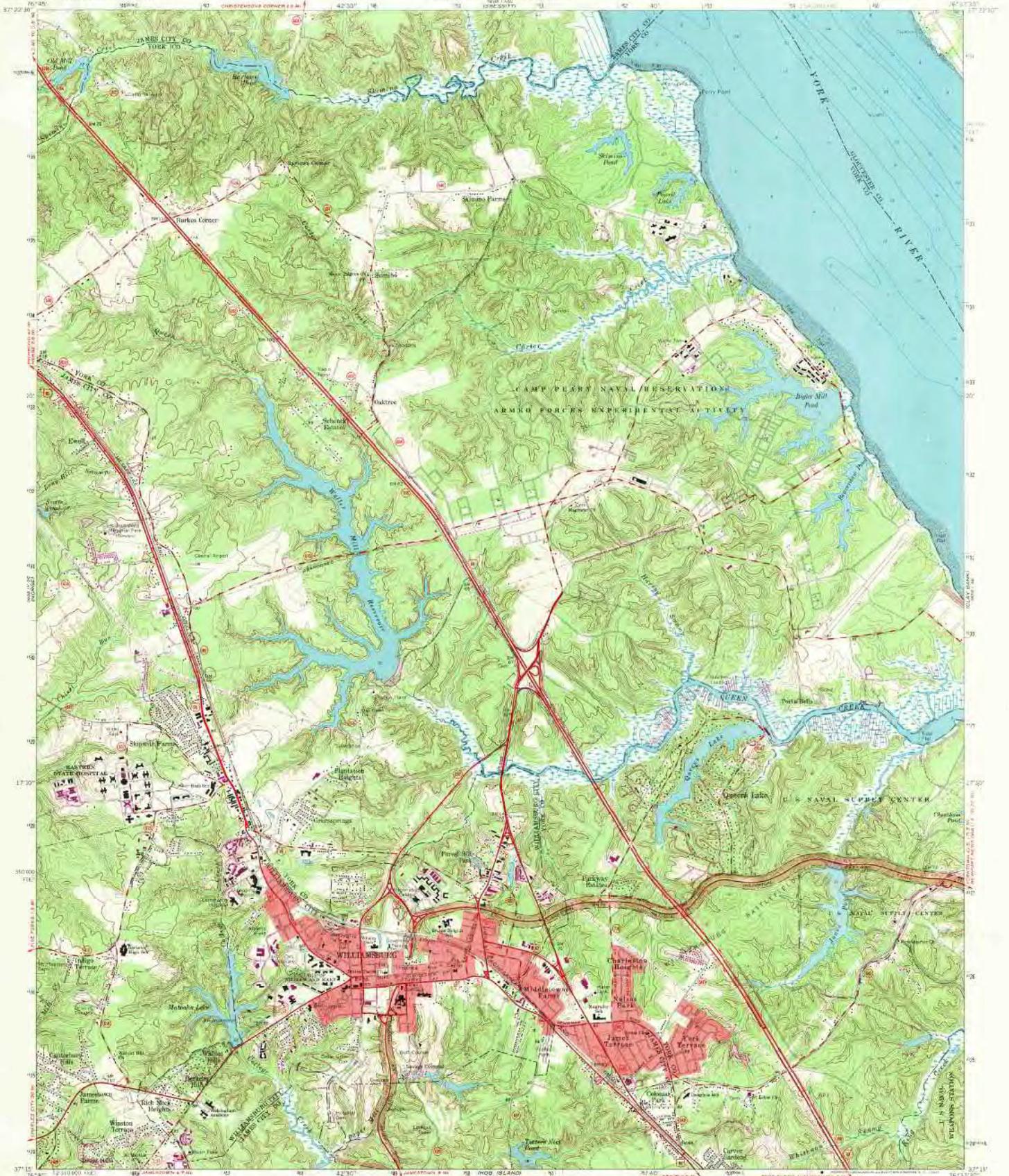
G & M Division
4 NOV 1971
Library of Congress

ROAD CLASSIFICATION

Heavy-duty	Light-duty
Medium-duty	Unimproved dirt
Interstate Route	U.S. Route
	State Route

YORKTOWN, VA.
864 YORKTOWN 15 QUADRANGLE
N3707 5 - W7630 7.5

1965
PHOTOGRAPHED 1963
AND 1968 BY RE-SEARCH 5334



Mapped, edited, and published by the Geological Survey
Controlled by USGS and USCGS
Topography by stereographic methods from aerial
photographs taken 1952. Field checked 1955
Superseded Army Map Service map dated 1952
Selected hydrographic data compiled from MSC-625 Chart 495 (1961)
This information is not intended for navigational purposes
Projection: pseudo-cylindrical (1827 North American datum)
Scale: 1:25,000 (at level of Virginia coordinate system, south of
3000 meters Universal Transverse Mercator grid line,
zone 18, zone 18N)
The red double line indicates selected fence and field lines which
generally coincide on actual photographs. This information is uncorrected
Red line indicates areas in which any landmark buildings are shown

SCALE 1:25,000
CENTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL
DEPTH CURVES AND SOUNDINGS IN FEET—(DATUM IS MEAN SEA LEVEL)
THIS MAP CONFORMS WITH NATIONAL MAP ACTUARY STANDARDS
FOR SALE BY U.S. GEOLOGICAL SURVEY WASHINGTON, D.C. 20242
AND VIRGINIA DIVISION OF MINERAL RESOURCES, CHARLOTTESVILLE, VIRGINIA
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

ROAD CLASSIFICATION
Heavy-duty
Medium-duty
Light-duty
Unimproved 3m.
U.S. Route
State Route

U.S.G.S.
FILE COPY
TOPOGRAPHIC DIVISION

WILLIAMSBURG, VA.
DATE WILLIAMSBURG QUADRANGLE
82715—84727 7.5' S

USGS 1965
PHOTODUPLICATION SERVICE
TOPOGRAPHIC DIVISION

Williamsburg in purple (printed in cooperation with Commonwealth of Virginia agencies from aerial photographs taken 1970. This information not checked)

JUN 13 1977



Mapped, edited, and published by the Geological Survey

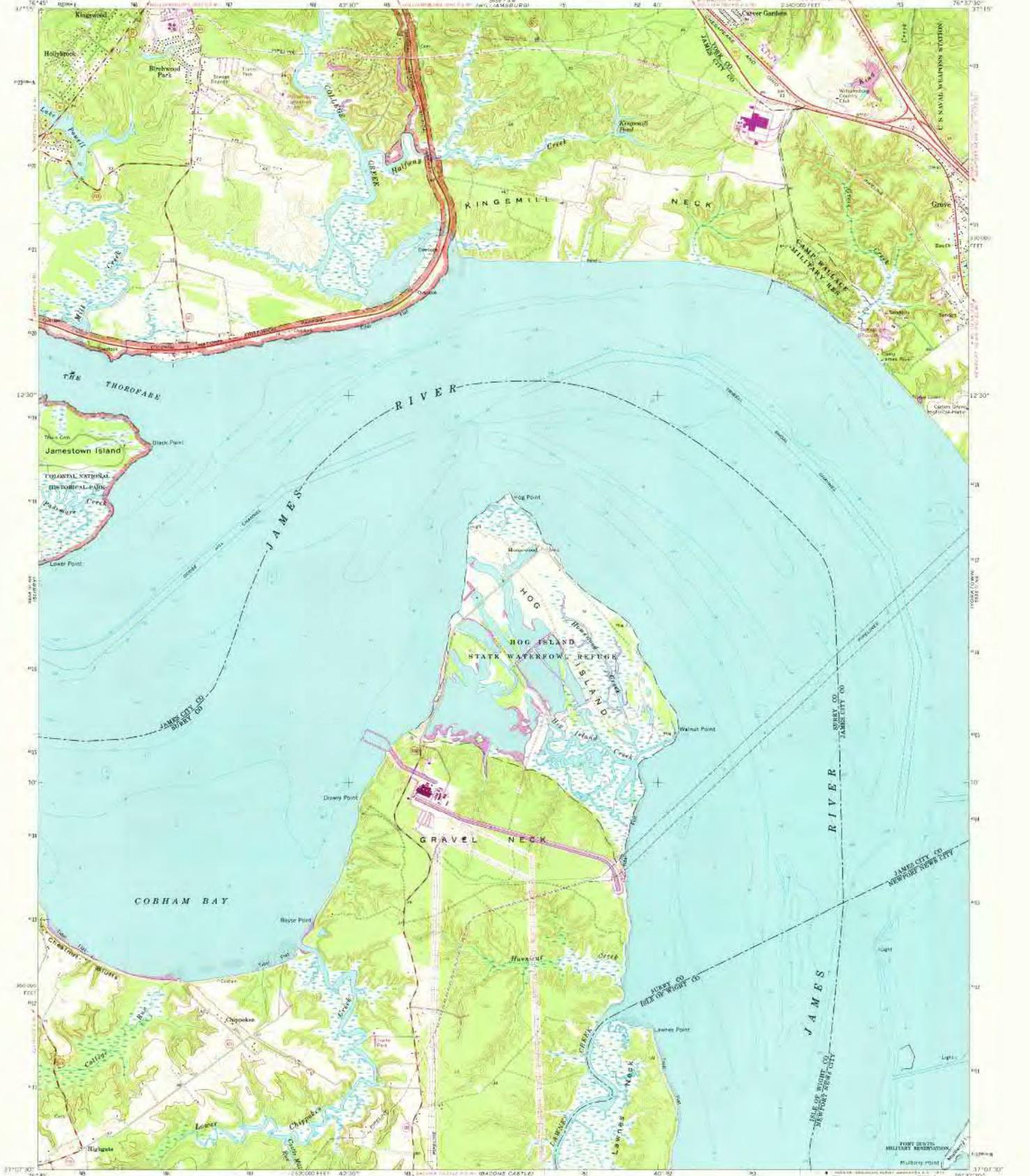
Revised by 1955 and 1965
Topography by photogrammetric methods from aerial photographs taken 1951. Field checked 1955
Supplemental Army Map Service map dated 1952
Selected hydrographic data compiled from USCGC charts 432 (Line Lane 439 (1911))
This information is not intended for navigational purposes
Reference meridian: 1927 North American datum
CONTINENTAL GRID based on Virginia coordinate system, south zone
1000meters Universal Transverse Mercator 810 916, zone 18, station 4116
The red dashed lines might represent selected roads and water features visible on aerial photographs. This information is crucial.



FOR SALE BY U.S. GEOLOGICAL SURVEY, WASHINGTON, D. C. 20542
AND VIRGINIA DIVISION OF MINERAL RESOURCES, CHARLOTTESVILLE, VIRGINIA 22901
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

ROAD CLASSIFICATION
 Heavy-duty Single-lane
 Medium-duty Impassable dirt
 U.S. Route State Route

CLAY BANK, VA.
 1971S-18765Q/7.5
 1965
 IMPROVED 1972
 145,259 1 88 - SERIES 7911



Mapped, written, and published by the Geological Survey
Controlled by USGS and USCGS
Topography by photogrammetric methods; base maps
photographic base: 1963. Photo checked: 1965
Supersedes Army Map Service Dupont Bay Map Sheet 1957
Selected topographic data compiled from USCGS Chart 529 (1964)
This information is not intended for navigational purposes
Datum: mean sea level, 1929 Mean Mean Sea Level
10,000-foot grid based on Virginia horizontal datum, which uses
1000 meter Universal Transverse Mercator grid code
and U.S. datum in State
Five red dashed lines indicate steepest slope and field lines where
generally visible on aerial photographs. This information is unclassified.

SCALE: 1:24,000

CONTOUR INTERVAL: 10 FEET
BOTTED LINES REPRESENT 5 FOOT CONTOURS
DIPSLIP CURVES AND SCOURINGS IN FEET—DARTON IS MEAN LOW WATER
DOTTED LINES INDICATE ELEVATION OF 100 FEET ABOVE MEAN SEA LEVEL
FOR SALES BY U.S. GEOLOGICAL SURVEY, WASHINGTON, D.C. 20542
AND VIRGINIA DIVISION OF MINERAL RESOURCES, CHARLOTTESVILLE, VIRGINIA 22903
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

1:24,000

1" = 2000 FEET

1" = 2000 FEET

HOG CLASSIFICATION

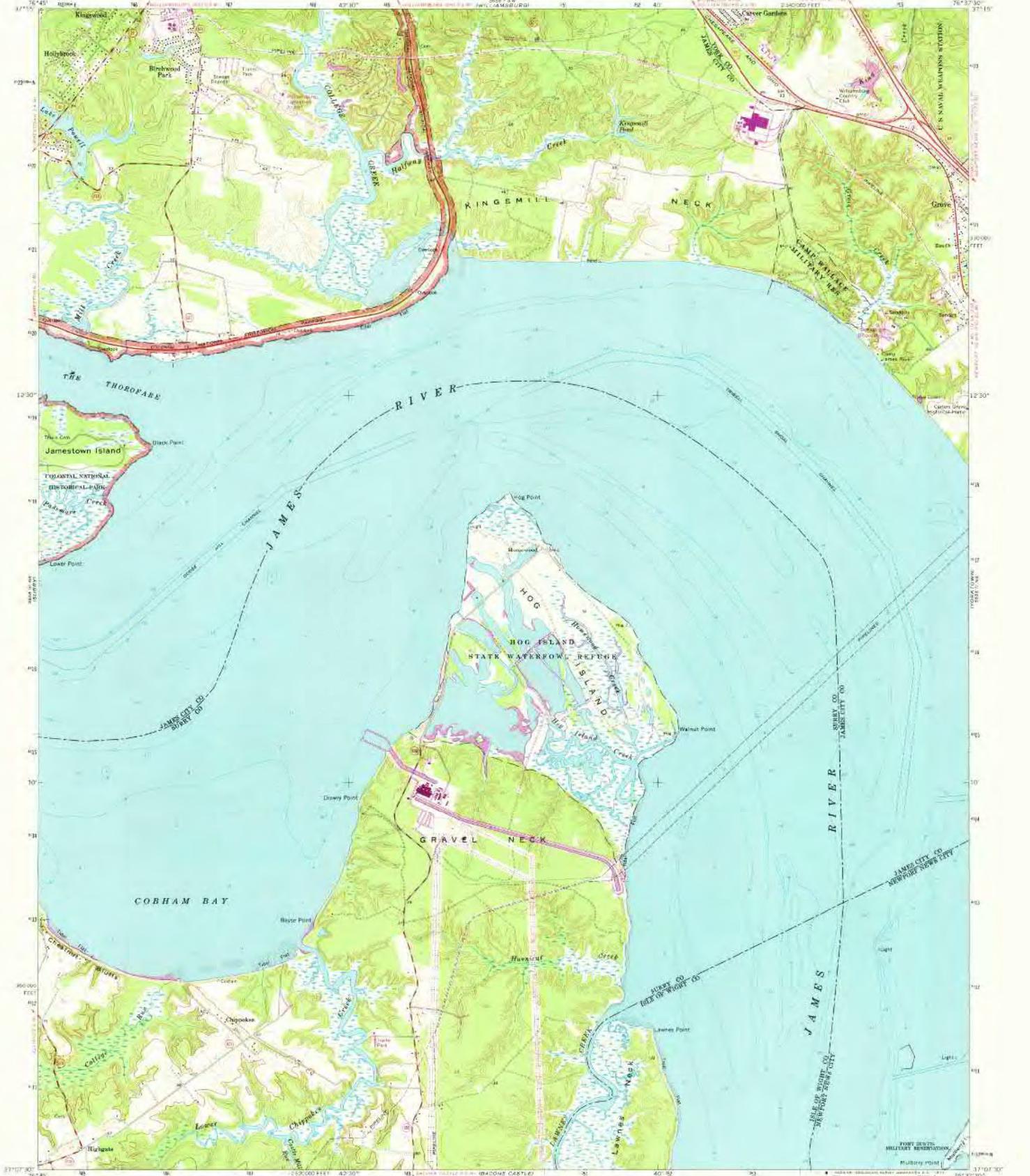
- Headlands: Light Blue
- Marshlands: Unchecked Blue
- Wetlands: Checked Blue
- Wetlands: Checked Blue
- Wetlands: Checked Blue
- Wetlands: Checked Blue

USGS HISTORICAL FILE TOPOGRAPHIC DIVISION

HOG ISLAND, VA.
93771—97637 5/7.5
1965
PHOTOREPRODUCED
AMS 5651 1 NW-SERIES 9384

FIG. 1

Revisions shown in light colors in this map are in cooperation with
Commonwealth of Virginia agencies from aerial photographs
taken 1972. This information has been checked.



Maped, edited, and published by the Geological Survey
Controlled by USGS and USCGS
Topography by photogrammetric methods; base maps
photographic base: 1963. Photo checked: 1965
Superseded Army Map Service Dappled Bay Map Sheet 1957
Selected topographic data compiled from USCGS Chart 529 (1964)
This information is not intended for navigational purposes
Distance in miles: 1927 NAD 83 datum; scale 1:250,000
10,000-foot grid based on Virginia coordinate system, south zone
1000 meter Universal Transverse Mercator grid code
and U.S. datum in State
Five red dashed lines indicate steepest slope and field lines where
generally visible on aerial photographs. This information is unclassified.

SCALE: 1:240,000

CONTOUR INTERVAL: 10 FEET
DOTTED LINES REPRESENT 5 FOOT CONTOURS
ELEVATION IN FEET - SEA LEVEL
DEPTH CURVES AND SOUNDINGS IN FEET - MEAN LOW WATER
DOTTED LINES INDICATE DEPTH OF 10 FEET AT MEAN LOW WATER
THE AREA SHOWN ON THIS IS A PHOTOGRAPHIC SURVEY
THIS MAP COMPLETES WITH ADJACENT MAPS INCLUDING STRIPED BOUNDARIES
FOR SALE BY U.S. GEOLOGICAL SURVEY, WASHINGTON, D.C. 20542
AND VIRGINIA DIVISION OF MINERAL RESOURCES, CHARLOTTESVILLE, VIRGINIA 22903
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

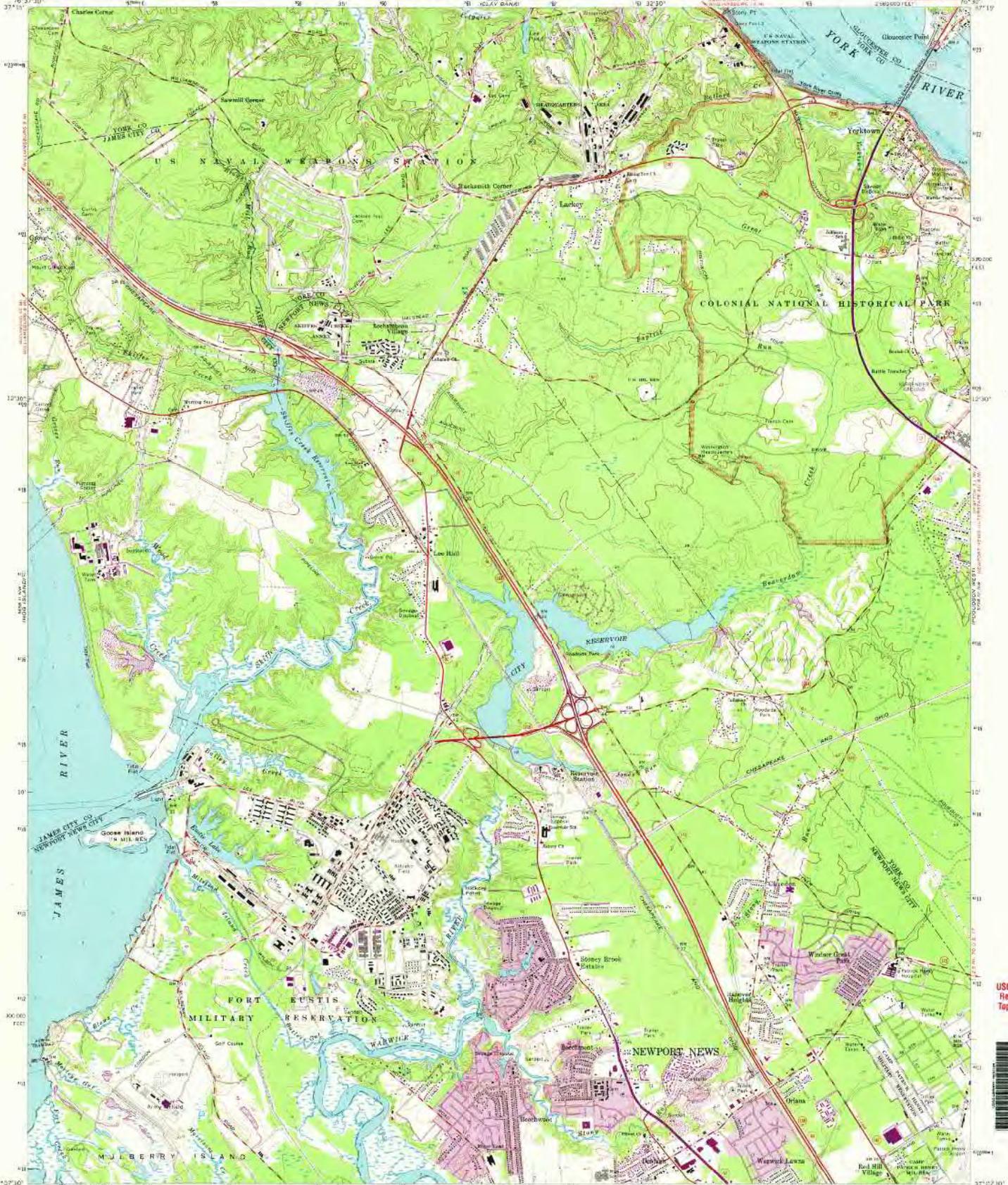
HOG CLASSIFICATION

Headlands	Light Bay
Mouthlands	Unworked Bay
Inside Roads	U.S. Bays
	State Roads

USGS
HISTORICAL FILE
TOPOGRAPHIC DIVISION

HOG ISLAND, VA.
93771-4-7637 3/1.5
1965
PHOTOREVISED 1972
ANS 556.1 NW-SERIES 934

FIG. 1. 207



Mapped, edited, and published by the Geological Survey
Control is USGS and USACE
Topography by photogrammetry, methods from aerial photographs
taken 1963. Field checked 1965
Supervising Army Map Service map dated 1967
Selected topographic data compiled from USGAS Charts
492 (1964) and 529 (1964). This information is not intended for
navigation purposes.
Polyconic projection. 1927 North American datum.
1:50,000 scale based on Virginia coordinate system, scale error
1:50,000 meter. Universal Transverse Mercator grid ticks,
zone 18, shown at 1:50,000.
The red dashed lines indicate selected fence and field lines where
generally visible on aerial photographs. This information is uncorrected.

SCALE 1:40,000
CONTOUR INTERVAL 20 FEET
DOTTED LINES REPRESENT 1:500 CONTOURS
ELEVATION IS MEAN SEA LEVEL
CROWN CORNERS AND BOUNDING POINTS SHOWN AT 1:50,000
BOUNDING POINTS SHOWN AT 1:50,000
THIS MAP COMPLETES THE NATIONAL MAP ACQUISITION PROGRAM
FOR SALE BY U.S. GEOLOGICAL SURVEY, WASHINGTON, D. C. 20542
AND VIRGINIA DIVISION OF MINERAL RESOURCES, CHARLOTTE HAVILLE, VIRGINIA 22901
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

ROAD CLASSIFICATION
Heavy-duty, Medium-duty, Interstate Road, Light-duty, Unimproved dirt, U.S. Road, State Road, Sign Road
USGS Historical File Topographic
YORKTOWN, VA.
N 3705.5 - W 7632.7.5
1965
PHOTOGRAPHICALLY CORRECTED
AND REPRODUCED FROM THE 1965
AND 1966 SERIES 1:50,000

USGS Library
Reston, VA
Topo Archive



5120



Mapped, edited, and published by the Geological Survey.
Control by USGS and USNGS.
Topographic information sources have varied
throughout time. 1862 Field notes, 1905
Supplies Army Map Service/Continental Army map, 1907
Special topographic data compiled from USGS 05 (44) (1904).
This information is not intended for navigation purposes.
Elevation, position, 1927 North American datum
11,000 feet at all points on Virginia coastline; modern method for a
1000 meter contour. Elevation, position, and date
may vary. 1862-1905.
In place on the published North American datum (1983)
was the coordinate lines (1 meter scale) and
23 meter scale as shown by dashed contour lines.
This information was not included before 1983 and thus, unless
otherwise noted, is not included in this edition.
This information is not intended for navigation purposes.

There may be errors in the map.
The National or State information shown on the map.

SCALE 1:25000
CENTIMETER TO FEET
CONVERSION TABLE
NATIONAL BUREAU OF METROLOGY, 1955
NORTH CURVES AND HORIZONTALS IN FEET - CONVERSION TO METER LOW WATER
THE HORIZONTALS SHOW THE HIGHEST WATER LEVEL
RANGE FROM 1900 TO 1905. THE HIGHEST WATER LEVEL IS 1905.
THE HIGHEST WATER LEVEL IS 1905.
THE HIGHEST WATER LEVEL IS 1905.
FOR SALE BY U.S. GEOLOGICAL SURVEY, RESTON, VIRGINIA 20192
AND VIRGINIA DIVISION OF MINERAL RESOURCES, CHARLOTTESVILLE, VIRGINIA 22903
A SELLER'S PUBLISHED TOPOGRAPHIC MAPS AND SURVEYS IS AVAILABLE ON REQUEST

ROAD CLASSIFICATION
Highways
Interstates
U.S. Routes
State Routes
Light Rail
Unimproved Roads
Railroads
USGS
Geographic Names
HOG ISLAND, VA
MAY - 1 1980
137675 - W2875 (2)
1985
PHOTOREPRODUCED FROM
DMA 488 (1) RW-2875 (2) (2)

2793



Mapped, edited, and published by the Geological Survey
 derived by USGS, USGS/NSIS, and USCE
 Topography is photogrammetric, with minor adjustments
 from 1962. First checked 1965.
 Supplemental data from State was dated 1967.
 Specialized hydrographic data compiled from USGS/SCS Chart 1274 (1964).
 This information is not intended for navigational purposes.
 Publication projection: 1983 North American Datum
 U.S. Geological Survey, Reston, Virginia 20192
 U.S. Government Printing Office: Washington, D.C. 20540
 1983

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 IT IS NOT TO BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS
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 THE DIVISION OF MINERAL RESOURCES IS NOT RESPONSIBLE FOR ANY DAMAGE TO
 PERSONS OR PROPERTY THAT MAY OCCUR AS A RESULT OF THE USE OF THIS MAP

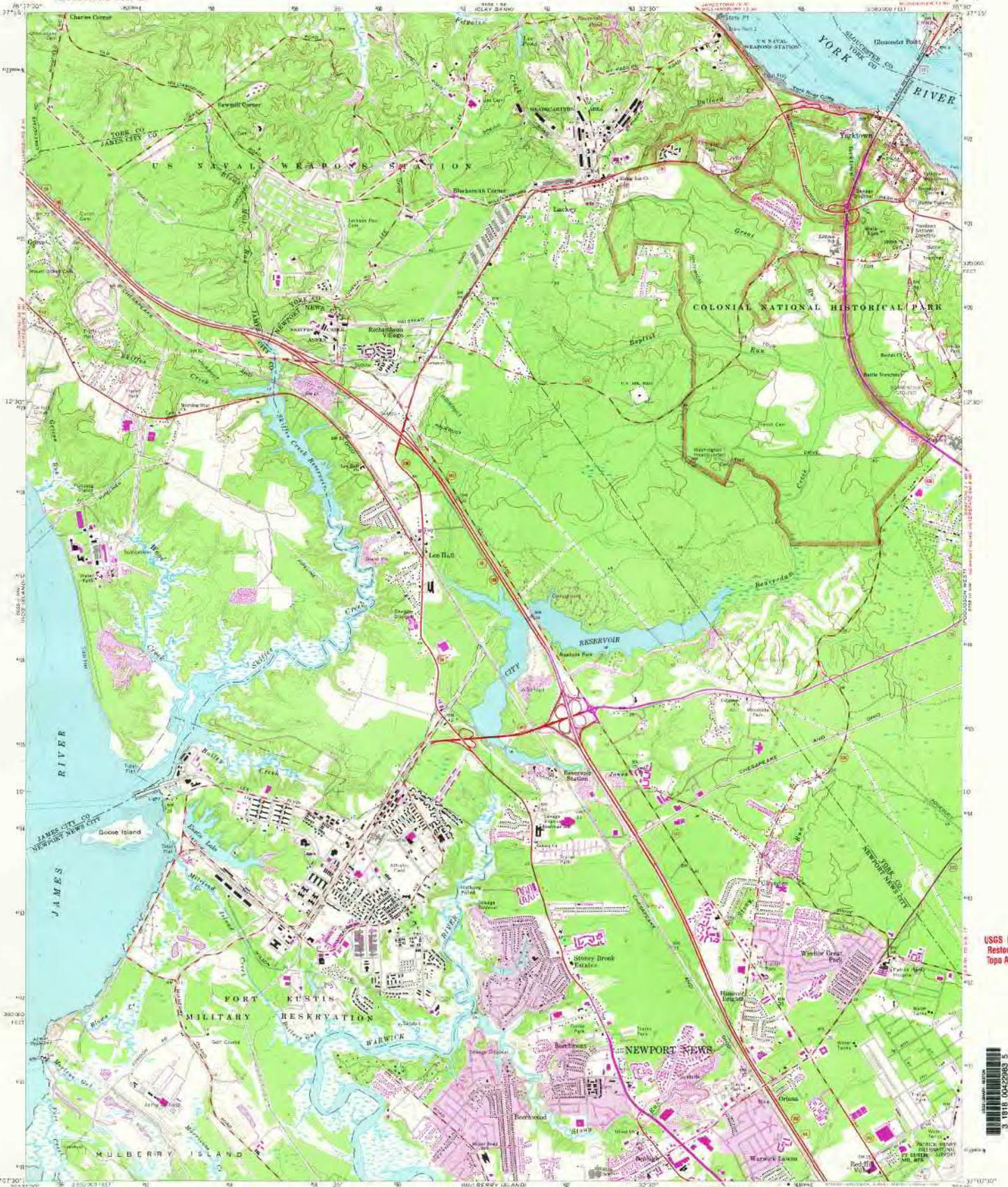
SCALE 1:25,000
 NATIONAL GEODESIC SURVEY DATUM OF 1983
 DEPTH CURVES AND SOUNDINGS IN FEET (BASED ON MEAN LOW WATER)
 THE RELATIONSHIP BETWEEN THE TWO DATUMS IS VARIABLE
 OVER THE SURFACE SHOWN (FOR APPROXIMATE) 1 METER HIGH WATER
 IS ABOUT 1.1 METERS (3.6 FEET) DIFFERENCE
 THIS MAP COMPLETES WITH NATIONAL MAP ACQUISITION STANDARDS
 ON SCALE BY U.S. GEOLOGICAL SURVEY RESTON, VIRGINIA 20192
 VIRGINIA DIVISION OF MINERAL RESOURCES CHARLOTTEVILLE, VIRGINIA 22902
 A FULLY DESCRIBED TOPOGRAPHIC MAP AND SYMBOLS IS AVAILABLE ON REQUEST

ROAD CLASSIFICATION
 Boundary
 Main Road
 Interstate Route
 U.S. Route
 State Route
 - 40 ft. dia.
 - 18 in. dia.
 - 12 in. dia.
 - 6 in. dia.

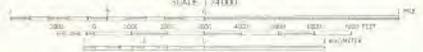
USGS
 Historical File
 Topographic Database

MULBERRY ISLAND, VIRGINIA 1:25,000
 1965
 PHOTOGRAPHIC
 DATA 1964 1:25,000 SERIES 1964

2650



Mapped, edited, and published by the Geological Survey
Control by USGS and NOS/NOAA
Topography by photogrammetric methods from aerial
photographs taken 1953. Photo checked 1960.
Supersedes Army Map Service map 8100 1957.
Selected hydrographic data compiled from NOS/NOAA Charts
492 (1964) and 529 (1964). The information is not intended for
navigational purposes.
Projection: UTM, 18Q, for grid based on
Virginia coordinate system, south zone.
1000-meter UTM grid. Transverse Mercator and UTM,
zone 18, datum: NAD 83. 1987 North American Datum
To scale on the projected North American Datum 1983
move the projection lines 11 meters south and
20 centimeters west or eleven by ten centimeter ticks.



CONTOUR INTERVAL 10 FEET
DOTTED LINES REPRESENT 10 FOOT CONTOURS
NATIONAL GEODETIC SURVEY DATUM OF 1983
ELEVATION DATA SOURCES: AS SET FORTH IN LOCAL LAW WATER
RESOURCES DIVISION, DIVISION OF MINERAL RESOURCES, VIRGINIA
DIVISION OF MINERAL RESOURCES, CHARLOTTEVILLE, VIRGINIA 22902
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

ROAD CLASSIFICATION
Heavy-duty highway
Medium-duty highway
Light-duty highway
Interstate Route
U.S. Route
State Route

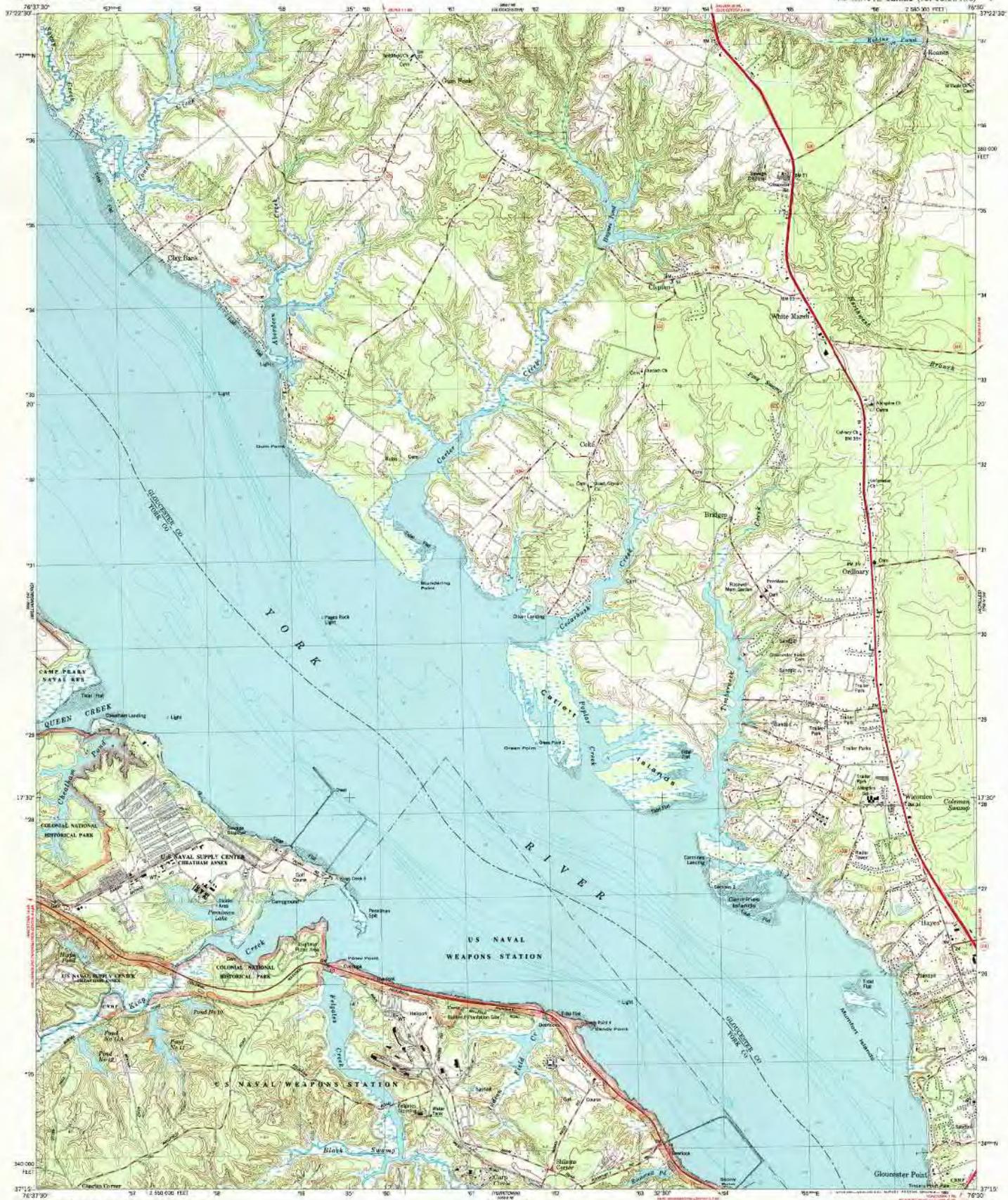
USGS
Historical File
Topographic Division

OCT 29 2010
YORKTOWN, VA.
147975-17650-1E
PHOTOCOPIED 1986
DMA 300 17-SEP-86 5454

USGS Library
Reston, VA.
Topo Archive



3600



Map made, edited, and published by the Geological Survey in cooperation with the Commonwealth of Virginia agencies. Data by USGS and NOAA. Topography by photogrammetry... 1982. 1:24,000. 7.5 MINUTE SERIES (TOPOGRAPHIC). This information is not intended for navigation. U.S. GEOLOGICAL SURVEY, DENVER, COLORADO 80202, OR RESTON, VIRGINIA 22092



SCALE 1:24,000
CONTOUR INTERVAL 10 FEET
SUPPLEMENTARY DENVER MILING 6 FEET
NATIONAL GRID OF SPHERICAL DATUM OF 1983
DEPTH CURVES AND SOUNDINGS IN FEET-DATUM IS MEAN LOW WATER
ELEVATION SOUNDINGS IN METERS-DATUM IS MEAN LOW WATER
THIS MAP COMPLETES THE NATIONAL MAP ACTUALS SERIES
FOR SALE BY U.S. GEOLOGICAL SURVEY, DENVER, COLORADO 80202, OR RESTON, VIRGINIA 22092
AND VIRGINIA DIVISION OF MINERAL RESOURCES, CHARLOTTESVILLE, VIRGINIA 22903
A TOUCH SCREEN TOPOGRAPHIC MAP AND SYMBOLS IS AVAILABLE ON REQUEST

ROAD CLASSIFICATION
Primary highways, hard surface
Secondary highways, hard surface
Interstate Route
U.S. Route
State Route
Light-duty road, hard or improved surface
Unimproved road

RECEIVED MAY 27 2003
RECEIVED APR 2003

CLAY BANK, VA. 37676-05-7F024
1984
3 1816 00417644 0
37676-05-7F024
37676-05-7F024



Mapped, edited, and published by the Geological Survey in cooperation with Commonwealth of Virginia agencies. Control by USGS and NOS/NOAA.

Topography by photogrammetric methods from aerial photographs taken 1963. First checked 1965. Revised from aerial photographs base 1972. Field checked 1982. Area checked 1983.

Supersedes Army Map Service Cobham Bay map dated 1967. Specified hydrographic data compiled from NOS chart 12248 (1962). This information is not intended for navigational purposes.

Population projection: 10,000 foot and links based on Virginia coordinate system, datum 1983.

1000-meter Universal Transverse Mercator grid, zone 18 (20° North American Datum).

1:250,000 projection North American Datum 1983 shows the projection lines 11 inches apart and 400 or more feet as shown by dashed corner ticks.

There may be private holdings within the boundaries of the National State reservations shown on this map.



SCALE 1:24,000

CONTOUR INTERVAL 10 FEET
SUPPLEMENTARY CONTOUR INTERVAL 5 FEET
VERTICAL DATUM OF 1983
DEPTH CHARTS AND SOUNDINGS IN FEET - DATUM IS MEAN LOW WATER
MESHES ON WATER BODIES ARE APPROXIMATE LINES OF MEAN HIGH WATER
THE BOUNDARY OF THE 1:250,000 PROJECTION IS 1:24,000

THIS MAP COMPLETES THE NATIONAL MAP ACCURACY PROGRAM
FOR SALE BY U.S. GEOLOGICAL SURVEY, CENTER FOR GEOGRAPHIC INFORMATION
OR REGION, VIRGINIA 22002
AND VIRGINIA DIVISION OF MINERAL RESOURCES, CHARLOTTESVILLE, VIRGINIA 22902
A HOLDER DESCRIBING TOPOGRAPHIC MAPS AND SOUNDINGS IS AVAILABLE ON REQUEST

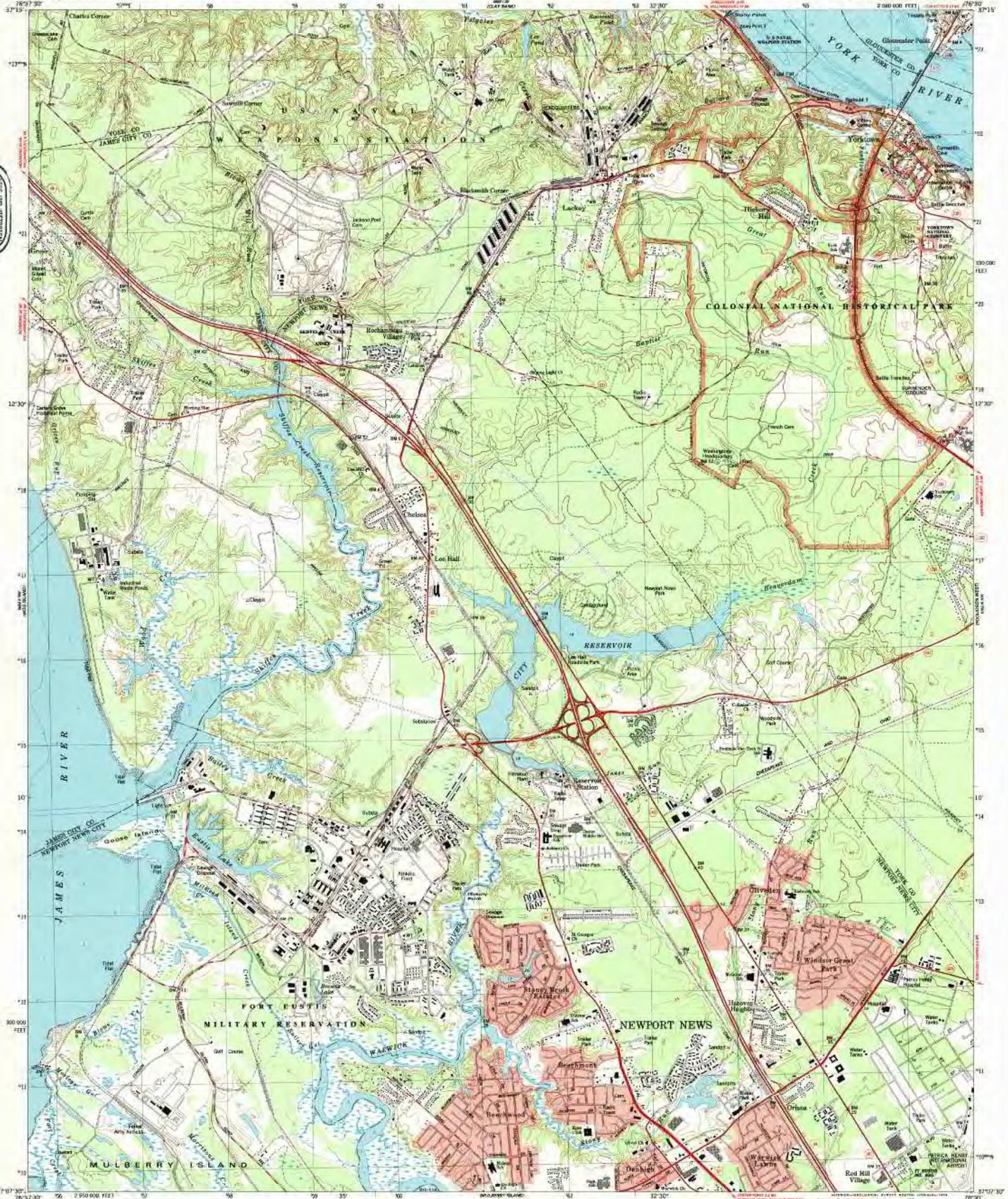
ROAD CLASSIFICATION

- Primary highway
- Hard surface
- Secondary/highway
- Hard surface
- Interstate Route
- U.S. Route
- State Route
- Light duty road, hard to improved surface
- Unimproved road

USGS AND HISTORICAL MAP ARCHIVES
JUL 25 1996
REC'D FILE COPY

HOG ISLAND, VA.
31075 14 71 024
1004
DATA 5623 11 14V-52002 1024





APR 17 1986
GCS INTRODUCTION
86700 FILE 009

Mapped, edited, and published by the Geological Survey in cooperation with Commonwealth of Virginia agencies. Control by USGS and NOS/NOAA. Topography by photogrammetric methods from aerial photographs taken 1963. Field checked 1965. Revised from aerial photographs taken 1978. Field checked 1982. Map edited 1984. Supervision: Army Map Service, map called 1967. Selected photographic data compiled from NOS charts 12241 (1979) and 12246 (1982). This information is not intended for navigational purposes. Polyconic projection. 10,000-foot grid based on Virginia coordinate system, south zone. 100-foot Linear Transverse Mercator (NAD 83) zone 38. 1967 North American Datum. 7 meters on the specified North American Datum 1983 zone (the maximum level 1 meter southward). 20 meters scale as shown by dashed center lines. Red line indicates areas in which only landmark buildings are shown. There may be private relocations within the boundaries of the National or State reservations shown on this map.



SCALE 1:24,000
CONTOUR INTERVAL 10 FEET
DOTTER LINES REPRESENT 3-FOOT SPACING
NATIONAL GEODETIC SYSTEM, DATUM OF 1929
DEPTH CURVES AND SOUNDINGS IN FEET—GATHIN IS MEAN LOW WATER
SOUNDING SYMBOLS REPRESENT THE APPROXIMATE LINE OF MEAN HIGH WATER
THE MEAN RANGE OF TIDE IS INDICATED BY A DOTTED LINE
THIS MAP COMPLETES THE NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U.S. GEOLOGICAL SURVEY, DENVER, COLORADO 80275
ON RESTON, VIRGINIA 22082
A FOLDER CONTAINING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

ROAD CLASSIFICATION

Primary highway	Light-duty road, hard or improved surface
Secondary highway	Hard surface
Interstate Route	U.S. Route
State Route	State Route

YORKTOWN, VA
1:24,000
1984
DMA 2859 II FILE SERIES 1604





Mapped, edited, and published by the Geological Survey
Control by USGS, USCGAS, and USACE
Topography by photogrammetric methods from aerial photographs
taken 1963 - Fall checked 1965
Supplements by Plan Service Map Series 1957
Selected hydrographic data compiled from USCGAS Chart 118 (1964)
This information is not intended for navigational purposes
Geoid elevation, 1927 North American datum
10,000-foot or 4-hairer on Virginia coordinate system, 200 ft zone
MAGNETIC declination, 1965, 11° 08' 00" W
To place on the projected North American datum 1983
from the projected (zone 1) zones south and
30 meters west as shown by dashed center line.
* This map may be placed in the hands of the
of the National or State authorities under the following

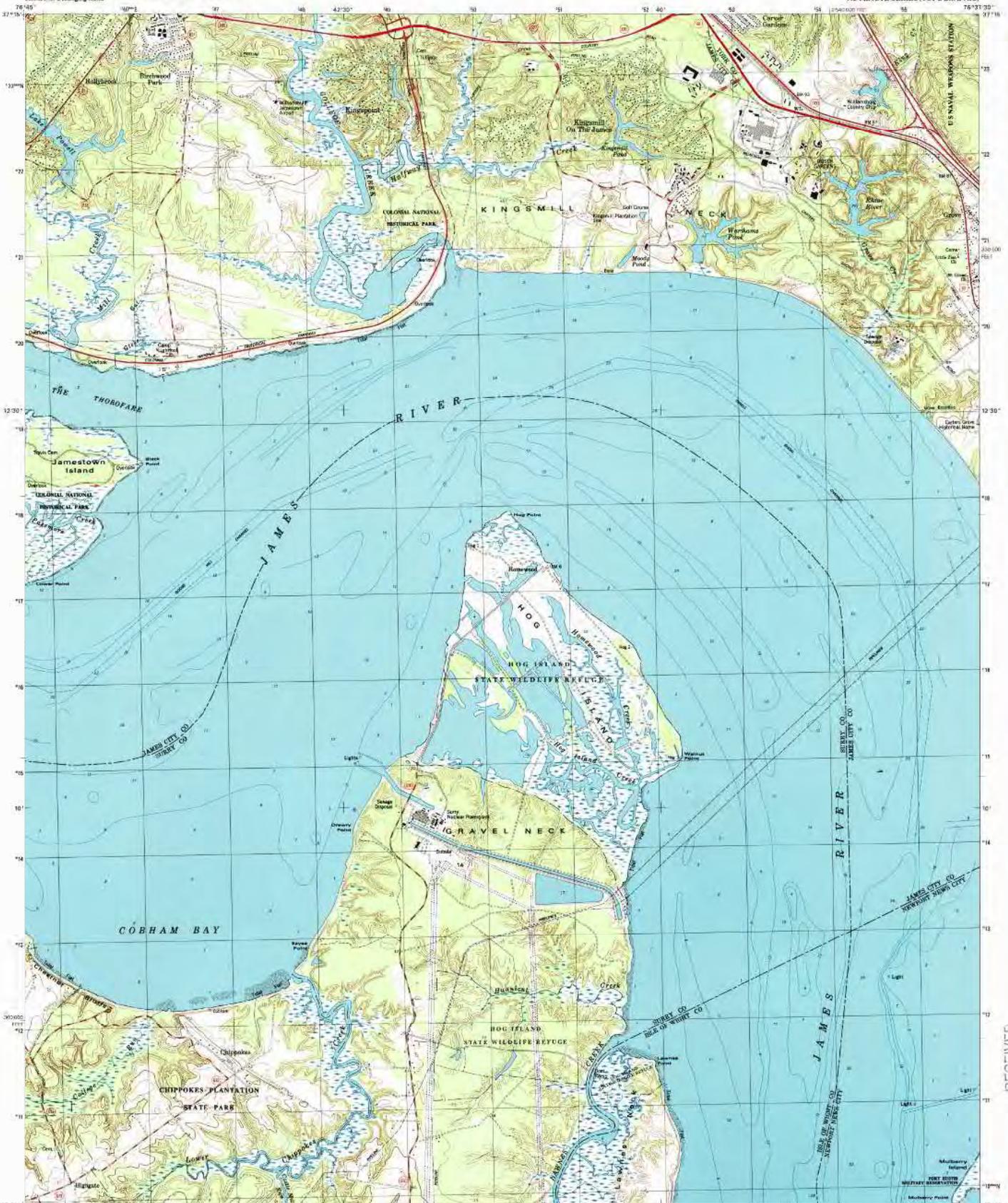
CONTOUR INTERVAL 5 FEET
NATIONAL GEODESIC REFERENCE DATUM OF 1929
DEPTH CURVES AND SOUNDINGS IN FEET, CURVES IN METERS, LOW WATER
THE RELATIONSHIP BETWEEN THE TWO SCALING IS INDICATED
SOUNDING CURVES INDICATE THE APPROXIMATE LINE OF SHIP WAYS
THIS MAP PORTION OF THE 1:50,000 SERIES IS A 1:50,000
TO BE MADE CONSISTENT WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U.S. GEOLOGICAL SURVEY, RESTON, VIRGINIA 20192
AND VIRGINIA DIVISION OF MINERAL RESOURCES, CHARLOTTESVILLE, VIRGINIA 22902
* PLACES DISCLOSED TO THE PUBLIC ARE INDICATED BY A STAR

SCALE 1:50,000
NATIONAL GEODESIC REFERENCE DATUM OF 1929
DEPTH CURVES AND SOUNDINGS IN FEET, CURVES IN METERS, LOW WATER
THE RELATIONSHIP BETWEEN THE TWO SCALING IS INDICATED
SOUNDING CURVES INDICATE THE APPROXIMATE LINE OF SHIP WAYS
THIS MAP PORTION OF THE 1:50,000 SERIES IS A 1:50,000
TO BE MADE CONSISTENT WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U.S. GEOLOGICAL SURVEY, RESTON, VIRGINIA 20192
AND VIRGINIA DIVISION OF MINERAL RESOURCES, CHARLOTTESVILLE, VIRGINIA 22902
* PLACES DISCLOSED TO THE PUBLIC ARE INDICATED BY A STAR

BOUND CLASSIFICATION
Heavy-duty Light-duty
Medium-duty Unimproved or
Interstate Route U.S. Route State Route

MULBERRY ISLAND, VA.
37076-45-1F-024
1965
PHOTOGRAPHED 1965
DRAWN BY GE-56125 1965





Produced by the United States Geological Survey
Derived from imagery taken 1978 and other sources. Photorevised
imagery originates from 1999, as shown. Update to this version complete
observed. Survey control current as of 1992.
Boundaries updated 2001.
Satellite hydrographic data compiled from NOAA chart 12248 (1992)
This is identical to the information for hydrographic purposes.
North American Datum of 1983 (NAD 83). Projection used
30 000-foot scale. Virginia coordinate system, north zone.
Elevation contour interval
300-foot interval. Transverse Mercator, zone 18.
North American Datum of 1983 (NAD 83) is shown by dashed
county lines. The values of the data between NAD 27 and NAD 83
by 7.5-minute quadrangles are available from "North of South".
Survey NAD 83/2011 software.
Translations of place names are shown on this map.
The boundary of State boundaries shown on this map.



SCALE: 1:24 000

CONTOUR INTERVAL: 10 FEET

SUPPLEMENTARY CONTOUR INTERVAL: 5 FEET
NATIONAL GEODESIC SURVEY DATA OF 1983
TO CORRECT ERRORS TO THE NORTH AMERICAN VERTICAL DATUM OF 1988, SUBJECT TO FOOT
COURTESY OF THE U.S. GEOLOGICAL SURVEY, WASHINGTON, D.C.

THE BOUNDARIES BETWEEN THE TWO DATUMS IS VARIABLE.
THE MEAN DIFFERENCE OF THEM IS APPROXIMATELY 1.1 METERS.
TO CORRECT VERTICAL DATA TO MEANS, SEE USGS 1-82-004.

THIS MAP COMPLETES THE NATIONAL MAP ACTIVITY STANDARDS
FOR SCALE BY U.S. GEOLOGICAL SURVEY'S 7.5-MINUTE SERIES. OVERLAYS 2002
AND VIRGINIA DIVISION OF MINERAL RESOURCES, CHARLOTTESVILLE, VIRGINIA 22901
A FOLDER INCLUDING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST.

CHANGING LOCATION

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
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ROAD CLASSIFICATION

Primary highway
Secondary highway
Unimproved road

Interstate Road
U.S. Route
State Route

Light
Light

Mulberry Island
FOREST RESERVE

HOG ISLAND, VA
1999

NOAA 5516-P-NAL-GEN-1004

RECEIVED
JAN 31 2002
HISTORICAL MAP ARCHIVE

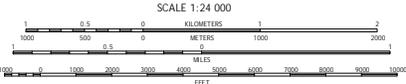
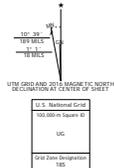




Produced by the United States Geological Survey
 North American Datum of 1983 (NAD83)
 World Geodetic System of 1984 (WGS84) Projection and
 1000-meter grid. Universal Transverse Mercator, Zone 18S
 10 000-foot ticks. Virginia Coordinate System of 1983 (south
 zone)

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 generalized for this map scale. Private lands with government
 reservations may not be shown. Obtain permission before
 using the private lands.

Imagery: NAIP, June 2014
 Bathymetry: U.S. Coast Survey, 2010-2014
 Names: National Hydrography Dataset, 2014
 Contours: National Elevation Dataset, 2011
 Boundaries: Multiple sources; see metadata file 1972-2014
 Wetlands: FWS National Wetlands Inventory 1977-2014



1	2	3	1 Norge
4	5	6	2 Williamsburg
7	8	9	3 Clay Bank
			4 Surry
			5 Yorktown
			6 Runnymede
			7 Bacon Castle
			8 Mulberry Island

ADJOINING QUADRANGLES

ROAD CLASSIFICATION	
Expressway	Local Connector
Secondary Hwy	Local Road
Ramp	4WD
Interstate Route	US Route
	State Route

HOG ISLAND, VA
2016





U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY



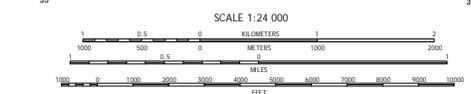
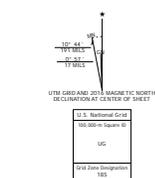
YORKTOWN QUADRANGLE
VIRGINIA
7.5-MINUTE SERIES



Produced by the United States Geological Survey
North American Datum of 1983 (NAD83)
World Geodetic System of 1984 (WGS84) Projection and
1000-meter grid. Universal Transverse Mercator, Zone 18S
10 000-foot ticks. Virginia Coordinates System of 1983 (pocm
zone)

This map is not a legal document. Boundaries may be
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reservations may not be shown. Obtain permission before
entering private lands.

Imagery NMAP, July 2014
Roads U.S. Census Bureau, 2010
Names National Hydrography Dataset, 2016
Hydrography National Hydrography Dataset, 2016
Contours National Elevation Dataset, 2015
Boundaries Multiple sources; see metadata file 1972 - 2016
Wetlands FWS National Wetlands Inventory 1977 - 2014



ADJOINING QUADRANGLES

1	2	3
4	5	6
7	8	

1 Williamsburg
2 Clay Bank
3 Acadia
4 Hog Island
5 Progress Hill
6 Bacon's Castle
7 Mulberry Island
8 Newport News North

YORKTOWN, VA
2016

