FLOOD INSURANCE STUDY

FEDERAL EMERGENCY MANAGEMENT AGENCY

VOLUME 1 OF 1

KING GEORGE COUNTY, VIRGINIA

(ALL JURISDICTIONS)

COMMUNITY NAME	COMMUNITY NUMBER
KING GEORGE COUNTY, UNINCORPORATED AREAS	510312

REVISED:

DECEMBER 2, 2021

FLOOD INSURANCE STUDY NUMBER
51099CV000C
Version Number 2.6.3.6

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FLOOD INSURANCE STUDY REPORT
KING GEORGE COUNTY, VIRGINIA

SECTION 1.0 – INTRODUCTION

1.1 The National Flood Insurance Program

The National Flood Insurance Program (NFIP) is a voluntary Federal program that enables property owners in participating communities to purchase insurance protection against losses from flooding. This insurance is designed to provide an alternative to disaster assistance to meet the escalating costs of repairing damage to buildings and their contents caused by floods.

For decades, the national response to flood disasters was generally limited to constructing flood-control works such as dams, levees, sea-walls, and the like, and providing disaster relief to flood victims. This approach did not reduce losses nor did it discourage unwise development. In some instances, it may have actually encouraged additional development. To compound the problem, the public generally could not buy flood coverage from insurance companies, and building techniques to reduce flood damage were often overlooked.

In the face of mounting flood losses and escalating costs of disaster relief to the general taxpayers, the U.S. Congress created the NFIP. The intent was to reduce future flood damage through community floodplain management ordinances, and provide protection for property owners against potential losses through an insurance mechanism that requires a premium to be paid for the protection.

The U.S. Congress established the NFIP on August 1, 1968, with the passage of the National Flood Insurance Act of 1968. The NFIP was broadened and modified with the passage of the Flood Disaster Protection Act of 1973 and other legislative measures. It was further modified by the National Flood Insurance Reform Act of 1994 and the Flood Insurance Reform Act of 2004. The NFIP is administered by the Federal Emergency Management Agency (FEMA), which is a component of the Department of Homeland Security (DHS).

Participation in the NFIP is based on an agreement between local communities and the Federal Government. If a community adopts and enforces floodplain management regulations to reduce future flood risks to new construction and substantially improved structures in Special Flood Hazard Areas (SFHAs), the Federal Government will make flood insurance available within the community as a financial protection against flood losses. The community's floodplain management regulations must meet or exceed criteria established in accordance with Title 44 Code of Federal Regulations (CFR) Part 60, *Criteria for Land Management and Use*.

SFHAs are delineated on the community's Flood Insurance Rate Maps (FIRMs). Under the NFIP, buildings that were built before the flood hazard was identified on the community's FIRMs are generally referred to as "Pre-FIRM" buildings. When the NFIP was created, the U.S. Congress recognized that insurance for Pre-FIRM buildings would be prohibitively expensive if the premiums were not subsidized by the Federal Government. Congress also recognized that most of these floodprone buildings were built by individuals who did not have sufficient knowledge of the flood hazard to make informed decisions. The NFIP requires that full actuarial rates reflecting the complete flood risk be charged on all buildings constructed or substantially improved on or after the effective date of the initial FIRM for the community or after December 31, 1974, whichever is later. These buildings are generally referred to as “Post-FIRM” buildings.

1.2 Purpose of this Flood Insurance Study Report

This Flood Insurance Study (FIS) Report revises and updates information on the existence and severity of flood hazards for the study area. The studies described in this report developed flood hazard data that will be used to establish actuarial flood insurance rates and to assist communities in efforts to implement sound floodplain management.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive than the minimum Federal requirements. Contact your State NFIP Coordinator to ensure that any higher State standards are included in the community’s regulations.

1.3 Jurisdictions Included in the Flood Insurance Study Project

This FIS Report covers the entire geographic area of King George County, Virginia.

The jurisdictions that are included in this project area, along with the Community Identification Number (CID) for each community and the United States Geological Survey (USGS) 8-digit Hydrologic Unit Code (HUC-8) sub-basins affecting each, are shown in Table 1. The FIRM panel numbers that affect each community are listed. If the flood hazard data for the community is not included in this FIS Report, the location of that data is identified.

Changed conditions in these communities (such as urbanization or annexation) or the availability of new scientific or technical data about flood hazards could make it necessary to determine SFHAs in these jurisdictions in the future.

Table 1: Listing of NFIP Jurisdictions

Community	CID	HUC-8 Sub-Basin(s)	Located on FIRM Panel(s)	If Not Included, Location of Flood Hazard Data
King George County, Unincorporated Areas	510312	02070011, 02080104	51099C0014E 51099C0018E 51099C0019E 51099C0027E[1] 51099C0029E 51099C0031E 51099C0033E 51099C0034E 51099C0050E 51099C0053E 51099C0054E 51099C0056E 51099C0057E 51099C0058E 51099C0059E 51099C0075E 51099C0076E 51099C0077E 51099C0078D 51099C0079E 51099C0081E 51099C0082E 51099C0083E 51099C0084E 51099C0086E 51099C0087E 51099C0090E 51099C0091E 51099C0092E 51099C0093E 51099C0094E 51099C0113E[1] 51099C0150D 51099C0170D 51099C0175D 51099C0190D 51099C0191D 51099C0200D	

[1] Panel Not Printed

1.4 Considerations for using this Flood Insurance Study Report

The NFIP encourages State and local governments to implement sound floodplain management programs. To assist in this endeavor, each FIS Report provides floodplain data, which may include a combination of the following: 10-, 4-, 2-, 1-, and 0.2-percent annual chance flood elevations (the 1-percent-annual-chance flood elevation is also referred to as the Base Flood Elevation (BFE)); delineations of the 1-percent-annual-chance and 0.2-percent-annual-chance floodplains; and 1-percent-annual-chance floodway. This information is presented on the FIRM and/or in many components of the

FIS Report, including Flood Profiles, Floodway Data tables, Summary of Non-Coastal Stillwater Elevations tables, and Coastal Transect Parameters tables (not all components may be provided for a specific FIS).

This section presents important considerations for using the information contained in this FIS Report and the FIRM, including changes in format and content. Figures 1, 2, and 3 present information that applies to using the FIRM with the FIS Report.

- Part or all of this FIS Report may be revised and republished at any time. In addition, part of this FIS Report may be revised by a Letter of Map Revision (LOMR), which does not involve republication or redistribution of the FIS Report. Refer to Section 6.5 of this FIS Report for information about the process to revise the FIS Report and/or FIRM.

  It is, therefore, the responsibility of the user to consult with community officials by contacting the community repository to obtain the most current FIS Report components. Communities participating in the NFIP have established repositories of flood hazard data for floodplain management and flood insurance purposes. Community map repository addresses are provided in Table 30, "Map Repositories," within this FIS Report.

- New FIS Reports are frequently developed for multiple communities, such as entire counties. A countywide FIS Report incorporates previous FIS Reports for individual communities and the unincorporated area of the county (if not jurisdictional) into a single document and supersedes those documents for the purposes of the NFIP.

  The initial Countywide FIS Report for King George County became effective on March 16, 2009. Refer to Table 27 for information about subsequent revisions to the FIRMs.

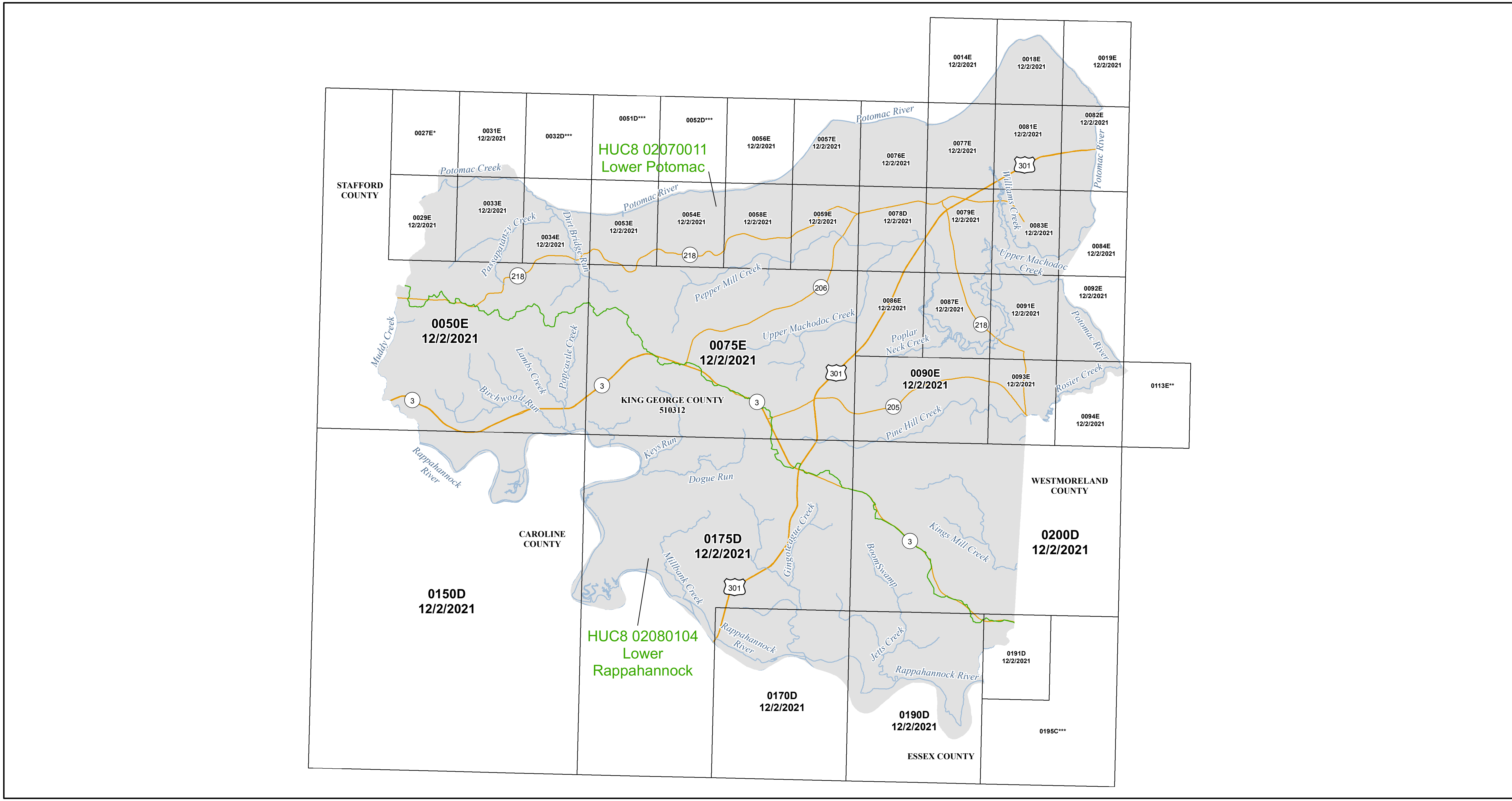
- FEMA does not impose floodplain management requirements or special insurance ratings based on Limit of Moderate Wave Action (LiMWA) delineations at this time. The LiMWA represents the approximate landward limit of the 1.5-foot breaking wave. If the LiMWA is shown on the FIRM, it is being provided by FEMA as information only. For communities that do adopt Zone VE building standards in the area defined by the LiMWA, additional Community Rating System (CRS) credits are available. Refer to Section 2.5.4 for additional information about the LiMWA.

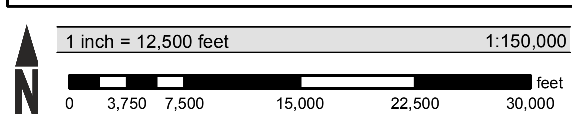
  The CRS is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. Visit the FEMA Web site at www.fema.gov/flood-insurance/rules-legislation/community-rating-system or contact your appropriate FEMA Regional Office for more information about this program.

- FEMA has developed a *Guide to Flood Maps* (FEMA 258) and online tutorials to assist users in accessing the information contained on the FIRM. These include how to read panels and step-by-step instructions to obtain specific information. To obtain this guide and other assistance in using the FIRM, visit the FEMA Web site at www.fema.gov/flood-maps/tutorials.

The FIRM Index in Figure 1 shows the overall FIRM panel layout within King George County, and also displays the panel number and effective date for each FIRM panel in the county. Other information shown on the FIRM Index includes community boundaries, watershed boundaries, and USGS HUC-8 codes.

Figure 1: FIRM Index





1 inch = 12,500 feet 1:150,000

0 3,750 7,500 15,000 22,500 30,000 feet

Map Projection:
Universal Transverse Mercator Zone 18N; North American Datum 1983; Western Hemisphere; Vertical Datum: NAVD88

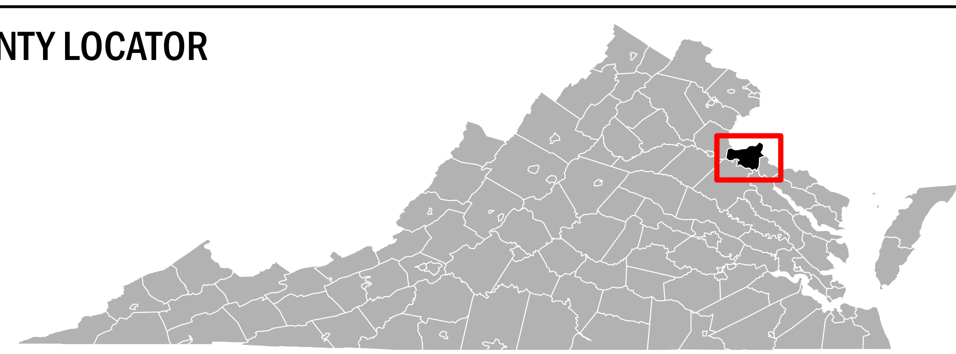
THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT

HTTPS://MSC.FEMA.GOV

SEE FLOOD INSURANCE STUDY FOR ADDITIONAL INFORMATION

* PANEL NOT PRINTED - AREA ALL WITHIN ZONE AE (EL 8)
** PANEL NOT PRINTED - AREA ALL WITHIN ZONE VE (EL 9)
*** PANEL NOT PRINTED - AREA OUTSIDE COUNTY BOUNDARY

COUNTY LOCATOR



NATIONAL FLOOD INSURANCE PROGRAM
FLOOD INSURANCE RATE MAP INDEX

KING GEORGE COUNTY, VIRGINIA (All Jurisdictions)

PANELS PRINTED:

0014, 0018, 0019, 0029, 0031, 0033, 0034, 0050, 0053, 0054, 0056, 0057, 0058, 0059, 0075, 0076, 0077, 0078, 0079, 0081, 0082, 0083, 0084, 0086, 0087, 0090, 0091, 0092, 0093, 0094, 0150, 0170, 0175, 0190, 0191, 0200

FEMA

MAP NUMBER
51099CIND0C
MAP REVISED
DECEMBER 2, 2021

Each FIRM panel may contain specific notes to the user that provide additional information regarding the flood hazard data shown on that map. However, the FIRM panel does not contain enough space to show all the notes that may be relevant in helping to better understand the information on the panel. Figure 2 contains the full list of these notes.

Figure 2: FIRM Notes to Users

NOTES TO USERS

For information and questions about this Flood Insurance Rate Map (FIRM), available products associated with this FIRM including historic versions of this FIRM, how to order products, or the National Flood Insurance Program in general, please call the FEMA Mapping and Insurance eXchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA Flood Map Service Center website at msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the website. Users may determine the current map date for each FIRM panel by visiting the FEMA Flood Map Service Center website or by calling the FEMA Mapping and Insurance eXchange.

Communities annexing land on adjacent FIRM panels must obtain a current copy of the adjacent panel as well as the current FIRM Index. These may be ordered directly from the Flood Map Service Center at the number listed above.

For community and countywide map dates, refer to Table 27 in this FIS Report.

To determine if flood insurance is available in the community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

The map is for use in administering the NFIP. It may not identify all areas subject to flooding, particularly from local drainage sources of small size. Consult the community map repository to find updated or additional flood hazard information.

BASE FLOOD ELEVATIONS: For more detailed information in areas where Base Flood Elevations (BFEs) and/or floodways have been determined, consult the Flood Profiles and Floodway Data and/or Summary of Non-Coastal Stillwater Elevations tables within this FIS Report. Use the flood elevation data within the FIS Report in conjunction with the FIRM for construction and/or floodplain management.

Coastal Base Flood Elevations shown on the map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD88). Coastal flood elevations are also provided in the Coastal Transect Parameters table in the FIS Report for this jurisdiction. Elevations shown in the Coastal Transect Parameters table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on the FIRM.

FLOODWAY INFORMATION: Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the FIS Report for this jurisdiction.

Figure 2. FIRM Notes to Users

FLOOD CONTROL STRUCTURE INFORMATION: Certain areas not in Special Flood Hazard Areas may be protected by flood control structures. Refer to Section 4.3 "Non-Levee Flood Protection Measures" of this FIS Report for information on flood control structures for this jurisdiction.

PROJECTION INFORMATION: The projection used in the preparation of the map was Universal Transverse Mercator (UTM) Zone 18N. The horizontal datum was the North American Datum of 1983 NAD83, GRS1980 spheroid. Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of the FIRM.

ELEVATION DATUM: Flood elevations on the FIRM are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at www.ngs.noaa.gov.

Local vertical monuments may have been used to create the map. To obtain current monument information, please contact the appropriate local community listed in Table 30 of this FIS Report.

BASE MAP INFORMATION: Base map information shown on the FIRM was derived from digital orthophotography collected under the Virginia Base Mapping Program. This imagery was flown in 2017. For information about base maps, refer to Section 6.2 “Base Map” in this FIS Report.

Corporate limits shown on the map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after the map was published, map users should contact appropriate community officials to verify current corporate limit locations.

NOTES FOR FIRM INDEX

REVISIONS TO INDEX: As new studies are performed and FIRM panels are updated within King George County, Virginia, corresponding revisions to the FIRM Index will be incorporated within the FIS Report to reflect the effective dates of those panels. Please refer to Table 27 of this FIS Report to determine the most recent FIRM revision date for each community. The most recent FIRM panel effective date will correspond to the most recent index date.

Figure 2. FIRM Notes to Users

SPECIAL NOTES FOR SPECIFIC FIRM PANELS

This Notes to Users section was created specifically for King George County, Virginia, effective December 2, 2021.

LIMIT OF MODERATE WAVE ACTION: Zone AE has been divided by a Limit of Moderate Wave Action (LiMWA). The LiMWA represents the approximate landward limit of the 1.5-foot breaking wave. The effects of wave hazards between Zone VE and the LiMWA (or between the shoreline and the LiMWA for areas where Zone VE is not identified) will be similar to, but less severe than, those in Zone VE.

FLOOD RISK REPORT: A Flood Risk Report (FRR) may be available for many of the flooding sources and communities referenced in this FIS Report. The FRR is provided to increase public awareness of flood risk by helping communities identify the areas within their jurisdictions that have the greatest risks. Although non-regulatory, the information provided within the FRR can assist communities in assessing and evaluating mitigation opportunities to reduce these risks. It can also be used by communities developing or updating flood risk mitigation plans. These plans allow communities to identify and evaluate opportunities to reduce potential loss of life and property. However, the FRR is not intended to be the final authoritative source of all flood risk data for a project area; rather, it should be used with other data sources to paint a comprehensive picture of flood risk.

Each FIRM panel contains an abbreviated legend for the features shown on the maps. However, the FIRM panel does not contain enough space to show the legend for all map features. Figure 3 shows the full legend of all map features. Note that not all of these features may appear on the FIRM panels in King George County.

Figure 3: Map Legend for FIRM

SPECIAL FLOOD HAZARD AREAS: The 1% annual chance flood, also known as the base flood or 100-year flood, has a 1% chance of happening or being exceeded each year. Special Flood Hazard Areas are subject to flooding by the 1% annual chance flood. The Base Flood Elevation is the water surface elevation of the 1% annual chance flood. The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights. See note for specific types. If the floodway is too narrow to be shown, a note is shown.

	Special Flood Hazard Areas subject to inundation by the 1% annual chance flood (Zones A, AE, AH, AO, AR, A99, V and VE)
Zone A	The flood insurance rate zone that corresponds to the 1% annual chance floodplains. No base (1% annual chance) flood elevations (BFEs) or depths are shown within this zone.
Zone AE	The flood insurance rate zone that corresponds to the 1% annual chance floodplains. Base flood elevations derived from the hydraulic analyses are shown within this zone.
Zone AH	The flood insurance rate zone that corresponds to the areas of 1% annual chance shallow flooding (usually areas of ponding) where average depths are between 1 and 3 feet. Whole-foot BFEs derived from the hydraulic analyses are shown at selected intervals within this zone.
Zone AO	The flood insurance rate zone that corresponds to the areas of 1% annual chance shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-foot depths derived from the hydraulic analyses are shown within this zone.
Zone AR	The flood insurance rate zone that corresponds to areas that were formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
Zone A99	The flood insurance rate zone that corresponds to areas of the 1% annual chance floodplain that will be protected by a Federal flood protection system where construction has reached specified statutory milestones. No base flood elevations or flood depths are shown within this zone.
Zone V	The flood insurance rate zone that corresponds to the 1% annual chance coastal floodplains that have additional hazards associated with storm waves. Base flood elevations are not shown within this zone.
Zone VE	Zone VE is the flood insurance rate zone that corresponds to the 1% annual chance coastal floodplains that have additional hazards associated with storm waves. Base flood elevations derived from the coastal analyses are shown within this zone as static whole-foot elevations that apply throughout the zone.
	Regulatory Floodway determined in Zone AE.

Figure 3: Map Legend for FIRM

OTHER AREAS OF FLOOD HAZARD	
	Shaded Zone X: Areas of 0.2% annual chance flood hazards and areas of 1% annual chance flood hazards with average depths of less than 1 foot or with drainage areas less than 1 square mile.
	Future Conditions 1% Annual Chance Flood Hazard – Zone X: The flood insurance rate zone that corresponds to the 1% annual chance floodplains that are determined based on future-conditions hydrology. No base flood elevations or flood depths are shown within this zone.
	Area with Reduced Flood Risk due to Levee: Areas where an accredited levee, dike, or other flood control structure has reduced the flood risk from the 1% annual chance flood.
	Area with Flood Risk due to Levee: Areas where a non-accredited levee, dike, or other flood control structure is shown as providing protection to less than the 1% annual chance flood.
OTHER AREAS	
	Zone D (Areas of Undetermined Flood Hazard): The flood insurance rate zone that corresponds to unstudied areas where flood hazards are undetermined, but possible.
NO SCREEN	Unshaded Zone X: Areas of minimal flood hazard.
FLOOD HAZARD AND OTHER BOUNDARY LINES	
(ortho) (vector)	Flood Zone Boundary (white line on ortho-photography-based mapping; gray line on vector-based mapping)
	Limit of Study
	Jurisdiction Boundary
	Limit of Moderate Wave Action (LiMWA): Indicates the inland limit of the area affected by waves greater than 1.5 feet
GENERAL STRUCTURES	
Aqueduct *Channel* *Culvert* *Storm Sewer*	Channel, Culvert, Aqueduct, or Storm Sewer
Dam *Jetty* *Weir*	Dam, Jetty, Weir
	Levee, Dike, or Floodwall
Bridge	Bridge

Figure 3: Map Legend for FIRM

REFERENCE MARKERS	
22.0 ●	River mile Markers
CROSS SECTION & TRANSECT INFORMATION	
(B) 20.2	Lettered Cross Section with Regulatory Water Surface Elevation (BFE)
(5280) 21.1	Numbered Cross Section with Regulatory Water Surface Elevation (BFE)
17.5	Unlettered Cross Section with Regulatory Water Surface Elevation (BFE)
(8) - - - - - - -	Coastal Transect
——-·————	Profile Baseline: Indicates the modeled flow path of a stream and is shown on FIRM panels for all valid studies with profiles or otherwise established base flood elevation.
——--——— --	Coastal Transect Baseline: Used in the coastal flood hazard model to represent the 0.0-foot elevation contour and the starting point for the transect and the measuring point for the coastal mapping.
~~ 513 ~~~	Base Flood Elevation Line
ZONE AE (EL 16)	Static Base Flood Elevation value (shown under zone label)
ZONE AO (DEPTH 2)	Zone designation with Depth
ZONE AO (DEPTH 2) (VEL 15 FPS)	Zone designation with Depth and Velocity
BASE MAP FEATURES	
Missouri Creek	River, Stream or Other Hydrographic Feature
(234)	Interstate Highway
(234)	U.S. Highway
(234)	State Highway
[234]	County Highway
MAPLE LANE	Street, Road, Avenue Name, or Private Drive if shown on Flood Profile
RAILROAD	Railroad

Figure 3: Map Legend for FIRM

______________	Horizontal Reference Grid Line
___	Horizontal Reference Grid Ticks
+	Secondary Grid Crosshairs
Land Grant	Name of Land Grant
7	Section Number
R. 43 W. T. 22 N.	Range, Township Number
$^{42}\mathbf{76}^{000m}\mathbf{E}$	Horizontal Reference Grid Coordinates (UTM)
365000 FT	Horizontal Reference Grid Coordinates (State Plane)
80° 16’ 52.5”	Corner Coordinates (Latitude, Longitude)

SECTION 2.0 – FLOODPLAIN MANAGEMENT APPLICATIONS

2.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1-percent-annual-chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2-percent-annual-chance (500-year) flood is employed to indicate additional areas of flood hazard in the community.

Each flooding source included in the project scope has been studied and mapped using professional engineering and mapping methodologies that were agreed upon by FEMA and King George County as appropriate to the risk level. Flood risk is evaluated based on factors such as known flood hazards and projected impact on the built environment. Engineering analyses were performed for each studied flooding source to calculate its 1-percent-annual-chance flood elevations; elevations corresponding to other floods (e.g. 10-, 4-, 2-, 0.2-percent annual chance, etc.) may have also been computed for certain flooding sources. Engineering models and methods are described in detail in Section 5.0 of this FIS Report. The modeled elevations at cross sections were used to delineate the floodplain boundaries on the FIRM; between cross sections, the boundaries were interpolated using elevation data from various sources. More information on specific mapping methods is provided in Section 6.0 of this FIS Report.

Depending on the accuracy of available topographic data (Table 22), study methodologies employed (Section 5.0), and flood risk, certain flooding sources may be mapped to show both the 1-percent and 0.2-percent-annual-chance floodplain boundaries, regulatory water surface elevations (BFEs), and/or a regulatory floodway. Similarly, other flooding sources may be mapped to show only the 1-percent-annual-chance floodplain boundary on the FIRM, without published water surface elevations. In cases where the 1-percent and 0.2-percent-annual-chance floodplain boundaries are close together, only the 1-percent-annual-chance floodplain boundary is shown on the FIRM. Figure 3, “Map Legend for FIRM”, describes the flood zones that are used on the FIRMs to account for the varying levels of flood risk that exist along flooding sources within the project area. Table 2 and Table 3 indicate the flood zone designations for each flooding source and each community within King George County, respectively.

Table 2, “Flooding Sources Included in this FIS Report,” lists each flooding source, including its study limits, affected communities, mapped zone on the FIRM, and the completion date of its engineering analysis from which the flood elevations on the FIRM and in the FIS Report were derived. Descriptions and dates for the latest hydrologic and hydraulic analyses of the flooding sources are shown in Table 12. Floodplain boundaries for these flooding sources are shown on the FIRM (published separately) using the symbology described in Figure 3. On the map, the 1-percent-annual-chance floodplain corresponds to the SFHAs. The 0.2-percent-annual-chance floodplain shows areas that, although out of the regulatory floodplain, are still subject to flood hazards.

Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data. The procedures to remove these areas from the SFHA are described in Section 6.5 of this FIS Report.

Table 2: Flooding Sources Included in this FIS Report

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Birchwood Run	King George County, Unincorporated Areas	At Confluence with Rappahannock River	1 square mile drainage area	02080104	4.5	N	A	11/30/2017
Black Swamp Branch	King George County, Unincorporated Areas	At Zone Break to Coastal AE	1 square mile drainage area	02070011	1.9	N	A	11/30/2017
Boom Swamp	King George County, Unincorporated Areas	At Confluence with Jetts Creek	1 square mile drainage area	02080104	1.6	N	A	11/30/2017
Bristol Mine Run	King George County, Unincorporated Areas	At Confluence with Rappahannock River	1 square mile drainage area	02080104	1.4	N	A	11/30/2017
Dirt Bridge Run	King George County, Unincorporated Areas	At Confluence with Passapatanzy Creek	1 square mile drainage area	02070011	2.3	N	A	11/30/2017
Dogue Run	King George County, Unincorporated Areas	At Confluence with Keys Run	1 square mile drainage area	02080104	4.6	N	A	11/30/2017
Gingoteague Creek	King George County, Unincorporated Areas	At Confluence with Rappahannock River	1 square mile drainage area	02080104	5.7	N	A	11/30/2017
Jetts Creek	King George County, Unincorporated Areas	At Confluence with Rappahannock River	1 square mile drainage area	02080104	2.9	N	A	11/30/2017
Keys Run	King George County, Unincorporated Areas	At Confluence with Rappahannock River	1 square mile drainage area	02080104	3.3	N	A	11/30/2017
Kings Mill Creek	King George County, Unincorporated Areas	At Confluence with Mattox Creek	1 square mile drainage area	02070011	1.5	N	A	11/30/2017
Lambs Creek	King George County, Unincorporated Areas	At Confluence with Birchwood Run	1 square mile drainage area	02080104	2.9	N	A	11/30/2017
Mason Mill Pond	King George County, Unincorporated Areas	At Confluence with Upper Machodoc Creek	1 square mile drainage area	02070011	1.6	N	A	11/30/2017
Mattox Creek	King George County, Unincorporated Areas	At Zone Break to Coastal AE	1 square mile drainage area	02070011	4.9	N	A	11/30/2017

Table 2: Flooding Sources Included in this FIS Report – continued

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Millbank Creek	King George County, Unincorporated Areas	At Confluence with Rappahannock River	1 square mile drainage area	02080104	4.4	N	A	11/30/2017
Muddy Creek	King George County, Unincorporated Areas	At Confluence with Rappahannock River	Zone Break to A	02080104	1.7	N	AE	12/17/2018
Muddy Creek	King George County, Unincorporated Areas	At Confluence with Rappahannock River	1 square mile drainage area	02080104	3.5	N	A	11/30/2017
Passapatanzy Creek	King George County, Unincorporated Areas	At Zone Break to Coastal AE	1 square mile drainage area	02070011	2.6	N	A	11/30/2017
Pepper Mill Creek	King George County, Unincorporated Areas	At Confluence with Upper Machodoc Creek	1 square mile drainage area	02070011	7.7	N	A	11/30/2017
Pine Hill Creek	King George County, Unincorporated Areas	At Zone Break to Coastal AE	1 square mile drainage area	02070011	7.7	N	A	11/30/2017
Popcastle Creek	King George County, Unincorporated Areas	At Confluence with Lambs Creek	1 square mile drainage area	02080104	2.3	N	A	11/30/2017
Poplar Neck Creek	King George County, Unincorporated Areas	At Zone Break to Coastal AE	1 square mile drainage area	02070011	2.1	N	A	11/30/2017
Potomac River	King George County, Unincorporated Areas	King George/Stafford County Boundary	North bank, mouth of Upper Machodoc Creek	02070011	40.2	N	VE, AE	06/05/2013
Potomac River	King George County, Unincorporated Areas	South bank, mouth of Upper Machodoc Creek	King George/ Westmoreland County Boundary	02070011	11.4	N	VE, AE, AO	06/05/2013
Rappahannock River	King George County, Unincorporated Areas	Zone Break to Coastal AE	Zone Break to AE	02080104	31.2	N	A	11/30/2017

Table 2: Flooding Sources Included in this FIS Report – continued

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Rappahannock River	King George County, Unincorporated Areas	King George/Essex/ Westmoreland County Boundary	Approximately 1,180 feet downstream of confluence with Gingoteague Creek	02080104	7.4	N	AE	06/05/2013
Rosier Creek	King George County, Unincorporated Areas	At Zone Break to Coastal AE	1 square mile drainage area	02070011	0.2	N	A	11/30/2017
Tributary No.1 to Birchwood Run	King George County, Unincorporated Areas	At Confluence with Birchwood Run	1 square mile drainage area	02080104	2.3	N	A	11/30/2017
Tributary No.1 to Dirt Bridge Run	King George County, Unincorporated Areas	At Confluence with Dirt Bridge Run	1 square mile drainage area	02070011	1.3	N	A	11/30/2017
Tributary No.1 to Dogue Run	King George County, Unincorporated Areas	At Confluence with Dogue Run	1 square mile drainage area	02080104	0.5	N	A	11/30/2017
Tributary No.1 to Gingoteague Creek	King George County, Unincorporated Areas	At Confluence with Gingoteague Creek	1 square mile drainage area	02080104	1.8	N	A	11/30/2017
Tributary No.1 to Mason Mill Pond	King George County, Unincorporated Areas	At Confluence with Mason Mill Pond	1 square mile drainage area	02070011	0.7	N	A	11/30/2017
Tributary No.1 to Passapatanzy Creek	King George County, Unincorporated Areas	At Confluence with Passapatanzy Creek	1 square mile drainage area	02070011	1.9	N	A	11/30/2017
Tributary No.1 to Pepper Mill Creek	King George County, Unincorporated Areas	At Confluence with Pepper Mill Creek	1 square mile drainage area	02070011	0.8	N	A	11/30/2017
Tributary No.1 to Pine Hill Creek	King George County, Unincorporated Areas	At Confluence with Pine Hill Creek	1 square mile drainage area	02070011	0.5	N	A	11/30/2017
Tributary No.1 to Tributary No.2 to Birchwood Run	King George County, Unincorporated Areas	At Confluence with Tributary No.2 to Birchwood Run	1 square mile drainage area	02080104	0.6	N	A	11/30/2017

Table 2: Flooding Sources Included in this FIS Report – continued

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Tributary No.1 to Tributary No.2 to Gingoteague Creek	King George County, Unincorporated Areas	At Confluence with Gingoteague Creek Tributary 2	1 square mile drainage area	02080104	0.4	N	A	11/30/2017
Tributary No.1 to Tributary No.2 to Rappahannock River	King George County, Unincorporated Areas	At Confluence with Rappahannock River	1 square mile drainage area	02080104	0.9	N	A	11/30/2017
Tributary No.1 to Upper Machodoc Creek	King George County, Unincorporated Areas	At Confluence with Upper Machodoc Creek	1 square mile drainage area	02070011	0.3	N	A	11/30/2017
Tributary No.2 to Birchwood Run	King George County, Unincorporated Areas	At Confluence with Birchwood Run	1 square mile drainage area	02080104	2.6	N	A	11/30/2017
Tributary No.2 to Gingoteague Creek	King George County, Unincorporated Areas	At Confluence with Gingoteague Creek	1 square mile drainage area	02080104	3.4	N	A	11/30/2017
Tributary No.2 to Jetts Creek	King George County, Unincorporated Areas	At Confluence with Jetts Creek	1 square mile drainage area	02080104	2.7	N	A	11/30/2017
Tributary No.2 to Mattox Creek	King George County, Unincorporated Areas	At Confluence with Mattox Creek	1 square mile drainage area	02070011	0.2	N	A	11/30/2017
Tributary No.2 to Muddy Creek	King George County, Unincorporated Areas	At Confluence with Muddy Creek	1 square mile drainage area	02080104	0.5	N	A	11/30/2017
Tributary No.2 to Pepper Mill Creek	King George County, Unincorporated Areas	At Confluence with Pepper Mill Creek	1 square mile drainage area	02070011	0.5	N	A	11/30/2017
Tributary No.2 to Rappahannock River	King George County, Unincorporated Areas	At Confluence with Rappahannock River	1 square mile drainage area	02080104	1.3	N	A	11/30/2017
Tributary No.2 to Tributary No.2 to Gingoteague Creek	King George County, Unincorporated Areas	At Confluence with Gingoteague Creek Tributary 2	1 square mile drainage area	02080104	0.5	N	A	11/30/2017
Tributary No.3 to Gingoteague Creek	King George County, Unincorporated Areas	At Confluence with Gingoteague Creek	1 square mile drainage area	02080104	0.7	N	A	11/30/2017
Tributary No.3 to Jetts Creek	King George County, Unincorporated Areas	At Confluence with Jetts Creek	1 square mile drainage area	02080104	1.2	N	A	11/30/2017

Table 2: Flooding Sources Included in this FIS Report – continued

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Upper Machodoc Creek	King George County, Unincorporated Areas	At Zone Break to Coastal AE	1 square mile drainage area	02070011	8.6	N	A	11/30/2017
Upper Machodoc Creek	King George County, Unincorporated Areas	North bank, mouth of Upper Machodoc Creek	South bank, mouth of Upper Machodoc Creek	02070011	37.9	N	VE, AE	06/05/2013

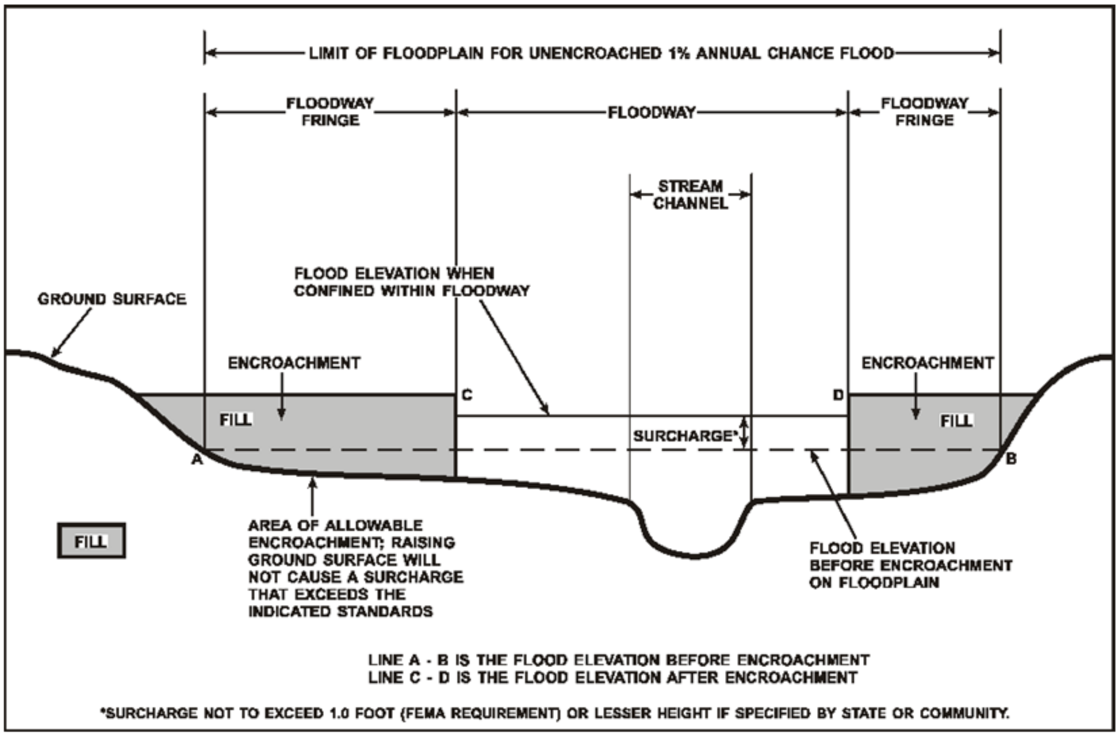
2.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard.

For purposes of the NFIP, a floodway is used as a tool to assist local communities in balancing floodplain development against increasing flood hazard. With this approach, the area of the 1-percent-annual-chance floodplain on a river is divided into a floodway and a floodway fringe based on hydraulic modeling. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment in order to carry the 1-percent-annual-chance flood. The floodway fringe is the area between the floodway and the 1-percent-annual-chance floodplain boundaries where encroachment is permitted. The floodway must be wide enough so that the floodway fringe could be completely obstructed without increasing the water surface elevation of the 1-percent-annual-chance flood more than 1 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 4.

To participate in the NFIP, Federal regulations require communities to limit increases caused by encroachment to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this project are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway projects.

Figure 4: Floodway Schematic



2.3 Base Flood Elevations

The hydraulic characteristics of flooding sources were analyzed to provide estimates of the elevations of floods of the selected recurrence intervals. The BFE is the elevation of the 1-percent-annual-chance flood. These BFEs are most commonly rounded to the whole foot, as shown on the FIRM, but in certain circumstances or locations they may be rounded to 0.1 foot. Cross section lines shown on the FIRM may also be labeled with the BFE rounded to 0.1 foot. Whole-foot BFEs derived from engineering analyses that apply to coastal areas, areas of ponding, or other static areas with little elevation change may also be shown at selected intervals on the FIRM.

BFEs are primarily intended for flood insurance rating purposes. Cross sections with BFEs shown on the FIRM correspond to the cross sections shown in the Floodway Data table and Flood Profiles in this FIS Report. For construction and/or floodplain management purposes, users are cautioned to use the flood elevation data presented in this FIS Report in conjunction with the data shown on the FIRM. For example, the user may use the FIRM to determine the stream station of a location of interest and then use the profile to determine the 1-percent annual chance elevation at that location. Because only selected cross sections may be shown on the FIRM for riverine areas, the profile should be used to obtain the flood elevation between mapped cross sections. Additionally, for riverine areas, whole-foot elevations shown on the FIRM may not exactly reflect the elevations derived from the hydraulic analyses; therefore, elevations obtained from the profile may more accurately reflect the results of the hydraulic analysis.

2.4 Non-Encroachment Zones

This section is not applicable to this Flood Risk Project.

2.5 Coastal Flood Hazard Areas

For most areas along rivers, streams, and small lakes, BFEs and floodplain boundaries are based on the amount of water expected to enter the area during a 1-percent-annual-chance flood and the geometry of the floodplain. Floods in these areas are typically caused by storm events. However, for areas on or near ocean coasts, large rivers, or large bodies of water, BFE and floodplain boundaries may need to be based on additional components, including storm surges and waves.

Coastal flooding sources that are included in this Flood Risk Project are shown in Table 2.

2.5.1 Water Elevations and the Effects of Waves

Specific terminology is used in coastal analyses to indicate which components have been included in evaluating flood hazards.

The stillwater elevation (SWEL or still water level) is the surface of the water resulting from astronomical tides, storm surge, and freshwater inputs, but excluding wave setup contribution or the effects of waves.

- *Astronomical tides* are periodic rises and falls in large bodies of water caused by the rotation of the earth and by the gravitational forces exerted by the earth, moon and sun.
- *Storm surge* is the additional water depth that occurs during large storm events. These events can bring air pressure changes and strong winds that force water up against the shore.
- *Freshwater inputs* include rainfall that falls directly on the body of water, runoff from surfaces and overland flow, and inputs from rivers.

The 1-percent-annual-chance stillwater elevation is the stillwater elevation that has been calculated for a storm surge from a 1-percent-annual-chance storm. The 1-percent-annual-chance storm surge can be determined from analyses of tidal gage records, statistical study of regional historical storms, or other modeling approaches. Stillwater elevations for storms of other frequencies can be developed using similar approaches.

The total stillwater elevation (also referred to as the mean water level) is the stillwater elevation plus wave setup contribution but excluding the effects of waves.

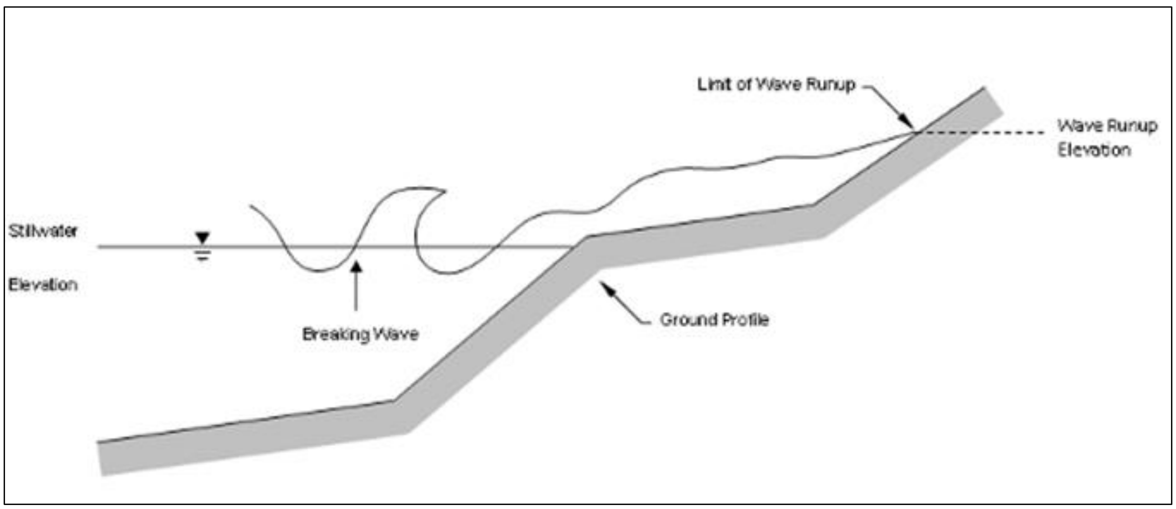
- *Wave setup* is the increase in stillwater elevation at the shoreline caused by the reduction of waves in shallow water. It occurs as breaking wave momentum is transferred to the water column.

Like the stillwater elevation, the total stillwater elevation is based on a storm of a particular frequency, such as the 1-percent-annual-chance storm. Wave setup is typically estimated using standard engineering practices or calculated using models, since tidal gages are often sited in areas sheltered from wave action and do not capture this information.

Coastal analyses may examine the effects of overland waves by analyzing storm-induced erosion, overland wave propagation, wave runup, and/or wave overtopping.

- *Storm-induced erosion* is the modification of existing topography by erosion caused by a specific storm event, as opposed to general erosion that occurs at a more constant rate.
- *Overland wave propagation* describes the combined effects of variation in ground elevation, vegetation, and physical features on wave characteristics as waves move onshore.
- *Wave runup* is the uprush of water from wave action on a shore barrier. It is a function of the roughness and geometry of the shoreline at the point where the stillwater elevation intersects the land.
- *Wave overtopping* refers to wave runup that occurs when waves pass over the crest of a barrier.

Figure 5: Wave Runup Transect Schematic



2.5.2 Floodplain Boundaries and BFEs for Coastal Areas

For coastal communities along the Atlantic and Pacific Oceans, the Gulf of Mexico, the Great Lakes, and the Caribbean Sea, flood hazards must take into account how storm surges, waves, and extreme tides interact with factors such as topography and vegetation. Storm surge and waves must also be considered in assessing flood risk for certain communities on rivers or large inland bodies of water.

Beyond areas that are affected by waves and tides, coastal communities can also have riverine floodplains with designated floodways, as described in previous sections.

Floodplain Boundaries

In many coastal areas, storm surge is the principle component of flooding. The extent of the 1-percent-annual-chance floodplain in these areas is derived from the total stillwater elevation (stillwater elevation including storm surge plus wave setup) for the 1-percent-annual-chance storm. The methods that were used for calculation of total stillwater elevations for coastal areas are described in Section 5.3 of this FIS Report. Location of total stillwater elevations for coastal areas are shown in Figure 8, "1% Annual Chance Total Stillwater Levels for Coastal Areas."

In some areas, the 1-percent-annual-chance floodplain is determined based on the limit of wave runup or wave overtopping for the 1-percent-annual-chance storm surge. The methods that were used for calculation of wave hazards are described in Section 5.3 of this FIS Report.

Table 25 presents the types of coastal analyses that were used in mapping the 1-percent-annual-chance floodplain in coastal areas.

Coastal BFEs

Coastal BFEs are calculated as the total stillwater elevation (stillwater elevation including storm surge plus wave setup) for the 1-percent-annual-chance storm plus the additional flood hazard from overland wave effects (storm-induced erosion, overland wave propagation, wave runup and wave overtopping).

Where they apply, coastal BFEs are calculated along transects extending from offshore to the limit of coastal flooding onshore. Results of these analyses are accurate until local topography, vegetation, or development type and density within the community undergoes major changes.

Parameters that were included in calculating coastal BFEs for each transect included in this FIS Report are presented in Table 16, "Coastal Transect Parameters." The locations of transects are shown in Figure 9, "Transect Location Map." More detailed information about the methods used in coastal analyses and the results of intermediate steps in the coastal analyses are presented in Section 5.3 of this FIS Report. Additional information on specific mapping methods is provided in Section 6.4 of this FIS Report.

2.5.3 Coastal High Hazard Areas

Certain areas along the open coast and other areas may have higher risk of experiencing structural damage caused by wave action and/or high-velocity water during the 1-percent-annual-chance flood. These areas will be identified on the FIRM as Coastal High Hazard Areas.

- *Coastal High Hazard Area (CHHA)* is a SFHA extending from offshore to the inland limit of the primary frontal dune (PFD) or any other area subject to damages caused by wave action and/or high-velocity water during the 1-percent-annual-chance flood.

- *Primary Frontal Dune (PFD)* is a continuous or nearly continuous mound or ridge of sand with relatively steep slopes immediately landward and adjacent to the beach. The PFD is subject to erosion and overtopping from high tides and waves during major coastal storms.

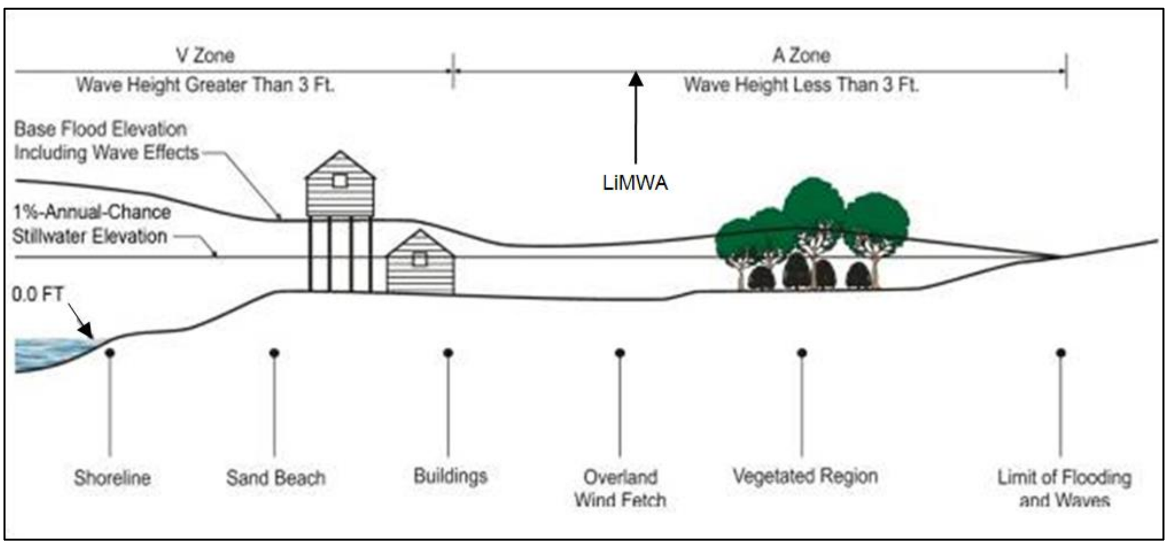
CHHAs are designated as "V" zones (for "velocity wave zones") and are subject to more stringent regulatory requirements and a different flood insurance rate structure. The areas of greatest risk are shown as VE on the FIRM. Zone VE is further subdivided into elevation zones and shown with BFEs on the FIRM.

The landward limit of the PFD occurs at a point where there is a distinct change from a relatively steep slope to a relatively mild slope; this point represents the landward extension of Zone VE. Areas of lower risk in the CHHA are designated with Zone V on the FIRM. More detailed information about the identification and designation of Zone VE is presented in Section 6.4 of this FIS Report.

Areas that are not within the CHHA but are SFHAs may still be impacted by coastal flooding and damaging waves; these areas are shown as "A" zones on the FIRM.

Figure 6, "Coastal Transect Schematic," illustrates the relationship between the base flood elevation, the 1-percent-annual-chance stillwater elevation, and the ground profile as well as the location of the Zone VE and Zone AE areas in an area without a PFD subject to overland wave propagation. This figure also illustrates energy dissipation and regeneration of a wave as it moves inland.

Figure 6: Coastal Transect Schematic



Methods used in coastal analyses in this Flood Risk Project are presented in Section 5.3 and mapping methods are provided in Section 6.4 of this FIS Report.

Coastal floodplains are shown on the FIRM using the symbology described in Figure 3, "Map Legend for FIRM." In many cases, the BFE on the FIRM is higher than the stillwater elevations shown in Table 16 due to the presence of wave effects. The higher elevation should be used for construction and/or floodplain management purposes.

2.5.4 Limit of Moderate Wave Action

Laboratory tests and field investigations have shown that wave heights as little as 1.5 feet can cause damage to and failure of typical Zone AE building construction. Wood-frame, light gage steel, or masonry walls on shallow footings or slabs are subject to damage when exposed to waves less than 3 feet in height. Other flood hazards associated with coastal waves (floating debris, high velocity flow, erosion, and scour) can also damage Zone AE construction.

Therefore, a LiMWA boundary may be shown on the FIRM as an informational layer to assist coastal communities in safe rebuilding practices. The LiMWA represents the approximate landward limit of the 1.5-foot breaking wave. The location of the LiMWA relative to Zone VE and Zone AE is shown in Figure 6.

The effects of wave hazards in Zone AE between Zone VE (or the shoreline where Zone VE is not identified) and the limit of the LiMWA boundary are similar to, but less severe than, those in Zone VE where 3-foot or greater breaking waves are projected to occur during the 1-percent-annual-chance flooding event. Communities are therefore encouraged to adopt and enforce more stringent floodplain management requirements than the minimum NFIP requirements in the LiMWA. The NFIP Community Rating System provides credits for these actions.

SECTION 3.0 – INSURANCE APPLICATIONS

3.1 National Flood Insurance Program Insurance Zones

For flood insurance applications, the FIRM designates flood insurance rate zones as described in Figure 3, "Map Legend for FIRM." Flood insurance zone designations are assigned to flooding sources based on the results of the hydraulic or coastal analyses. Insurance agents use the zones shown on the FIRM and depths and base flood elevations in this FIS Report in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

The 1-percent-annual-chance floodplain boundary corresponds to the boundary of the areas of special flood hazards (e.g. Zones A, AE, V, VE, etc.), and the 0.2-percent-annual-chance floodplain boundary corresponds to the boundary of areas of additional flood hazards.

Table 3 lists the flood insurance zones in King George County.

Table 3: Flood Zone Designations by Community

Community	Flood Zone(s)
King George County, Unincorporated Areas	A, AE, AO, VE, X

SECTION 4.0 – AREA STUDIED

4.1 Basin Description

Table 4 contains a description of the characteristics of the HUC-8 sub-basins within which each community falls. The table includes the main flooding sources within each basin, a brief description of the basin, and its drainage area.

Table 4: Basin Characteristics

HUC-8 Sub-Basin Name	HUC-8 Sub-Basin Number	Primary Flooding Source	Description of Affected Area	Drainage Area (square miles)
Lower Potomac	02070011	Lower Potomac	The Lower Potomac subbasin is one of seven USGS hydrologic units of the Chesapeake-Bay Small Coastal Basin. The watershed covers the northern half of the county.	562.7
Lower Rappahannock	02080104	Lower Rappahannock	The Lower Rappahannock subbasin is one of seven USGS hydrologic units of the Chesapeake-Bay Small Coastal Basin. The watershed covers the southern half of the county.	1079.7

4.2 Principal Flood Problems

Table 5 contains a description of the principal flood problems that have been noted for King George County by flooding source.

Table 5: Principal Flood Problems

Flooding Source	Description of Flood Problems
Potomac River	The coastal areas of King George County along the Potomac River are vulnerable to tidal flooding from major storms such as hurricanes and northeasters. Both storms produce winds that push large volumes of water against the shore. The mean range of tide varies from approximately 1.6 feet at Dahlgreen, Upper Machodoc Creek, to approximately 1.2 feet at Mathias Point, to approximately 1.1 feet near the confluence of Potomac Creek.

Table 5: Principal Flood Problems – continued

Flooding Source	Description of Flood Problems
Potomac River - continued	Estuaries of the Potomac River are subject to tidal flooding in its lower reaches, but fluvial flooding on the upper reaches. Flooding on the upper reaches of these streams may be caused by heavy rains occurring at any time during the year. Flooding may also occur as a result of intense rainfall produced by local thunderstorms or tropical disturbances such as hurricanes, which move into the area from the Gulf or Atlantic coasts. All development in the floodplain is subject to water damage. Some areas, depending upon exposure, are subject to high-velocity wave action that can cause structural damage and severe erosion along beaches. Waves are generated by the action of wind on the surface of the water. Portions of the Potomac River shoreline of King George County are vulnerable to wave damage.
Rapahannock River	The mean range of tide in the Rappahannock River in the vicinity of Port Royal is approximately 1.9 feet (FEMA 2015). The range of tide may be somewhat less in the connecting bays and inlets. Estuaries of the Rappahannock River are subject to tidal flooding in their lower reaches, but fluvial flooding on the upper reaches. Flooding on the upper reaches of these streams may be caused by heavy rains occurring at any time during the year. Flooding may also occur as a result of intense rainfall produced by local thunderstorms or tropical disturbances such as hurricanes, which move into the area from the Gulf or Atlantic coasts.

Table 6 contains information about historic flood elevations in the communities within King George County.

Table 6: Historic Flooding Elevations

[Not Applicable to this Flood Risk Project]

4.3 Non-Levee Flood Protection Measures

Table 7 contains information about non-levee flood protection measures within King George County such as dams, jetties, and or dikes. Levees are addressed in Section 4.4 of this FIS Report.

Table 7: Non-Levee Flood Protection Measures

[Not Applicable to this Flood Risk Project]

4.4 Levees

This section is not applicable to this Flood Risk Project.

Table 8: Levees

[Not Applicable to this Flood Risk Project]

SECTION 5.0 – ENGINEERING METHODS

For the flooding sources in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude that are expected to be equaled or exceeded at least once on the average during any 10-, 25-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 25-, 50-, 100-, and 500-year floods, have a 10-, 4-, 2-, 1-, and 0.2-percent-annual-chance, respectively, of being equaled or exceeded during any year.

Although the recurrence interval represents the long-term, average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood that equals or exceeds the 100-year flood (1-percent chance of annual exceedance) during the term of a 30-year mortgage is approximately 26 percent (about 3 in 10); for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

5.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak elevation-frequency relationships for floods of the selected recurrence intervals for each flooding source studied. Hydrologic analyses are typically performed at the watershed level. Depending on factors such as watershed size and shape, land use and urbanization, and natural or man-made storage, various models or methodologies may be applied. A summary of the hydrologic methods applied to develop the discharges used in the hydraulic analyses for each stream is provided in Table 12. Greater detail (including assumptions, analysis, and results) is available in the archived project documentation.

A summary of the discharges is provided in Table 9. Frequency Discharge-Drainage Area Curves used to develop the hydrologic models may also be shown in Figure 7 for selected flooding sources. A summary of stillwater elevations developed for non-coastal flooding sources is provided in Table 10. (Coastal stillwater elevations are discussed in Section 5.3 and shown in Table 16.) Stream gage information is provided in
Table 11.

Table 9: Summary of Discharges

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)				
			10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Birchwood Run	38.250567, -77.258474	13.75	1,053	1,621	2,164	2,630	4,566
Birchwood Run	38.252233, -77.259922	8.40	1,053	1,621	2,164	2,630	4,566
Birchwood Run	38.253583, -77.264582	7.82	1,006	1,551	2,070	2,516	4,389
Birchwood Run	38.259478, -77.275077	5.26	784	1,211	1,619	1,971	3,513
Birchwood Run	38.260224, -77.288958	1.67	250	401	548	658	1,209
Birchwood Run	38.262022, -77.296641	1.24	250	401	548	658	1,209
Black Swamp Branch	38.339194, -77.330262	3.20	265	419	571	748	1,587
Boom Swamp	38.191544, -77.102860	2.78	242	385	525	690	1,469
Boom Swamp	38.200281, -77.111591	1.68	177	284	390	515	1,114
Boom Swamp	38.200933, -77.113005	1.35	154	248	342	452	985
Bristol Mine Run	38.172070, -77.063996	0.99	127	205	285	378	831
Dirt Bridge Run	38.317159, -77.257421	3.08	259	410	559	733	1,556
Dirt Bridge Run	38.307290, -77.246474	1.11	137	220	305	404	886
Dirt Bridge Run	38.306206, -77.245581	0.86	116	188	262	348	769
Dogue Run	38.237446, -77.222630	4.60	332	523	709	925	1,939
Dogue Run	38.237005, -77.214563	4.06	308	485	659	861	1,812
Dogue Run	38.241321, -77.196759	2.29	280	447	609	732	1,340
Dogue Run	38.238273, -77.187647	1.94	280	447	609	732	1,340
Dogue Run	38.246369, -77.175861	1.41	280	447	609	732	1,340
Dogue Run	38.251454, -77.175690	0.93	205	329	451	541	1,002
Gingoteague Creek	38.169788, -77.158239	12.85	633	978	1,305	1,685	3,421
Gingoteague Creek	38.173265, -77.153406	11.63	594	920	1,230	1,589	3,236
Gingoteague Creek	38.186791, -77.150156	9.38	519	807	1,082	1,402	2,874
Gingoteague Creek	38.191408, -77.147823	8.84	501	779	1,045	1,354	2,782
Gingoteague Creek	38.193760, -77.148858	8.39	485	755	1,014	1,314	2,704
Gingoteague Creek	38.196889, -77.153780	3.20	265	419	571	749	1,588

Table 9: Summary of Discharges – continued

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)				
			10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Gingoteague Creek	38.219676, -77.144360	1.14	234	377	516	619	1,139
Jetts Creek	38.168368, -77.110562	8.71	496	772	1,036	1,343	2,760
Jetts Creek	38.170834, -77.109990	6.57	416	650	876	1,139	2,362
Jetts Creek	38.177715, -77.099458	4.62	333	524	710	927	1,944
Jetts Creek	38.190861, -77.103162	3.75	293	462	628	822	1,734
Jetts Creek	38.168451, -77.110672	1.16	141	227	314	416	909
Jetts Creek	38.191546, -77.102753	0.97	126	203	282	375	824
Keys Run	38.237615, -77.222635	3.20	536	837	1,127	1,366	2,457
Keys Run	38.260430, -77.207540	1.72	369	575	775	943	1,726
Keys Run	38.265454, -77.210593	1.01	228	364	496	598	1,104
Kings Mill Creek	38.213609, -77.062271	3.41	276	436	594	778	1,646
Kings Mill Creek	38.215217, -77.071979	2.48	226	359	491	645	1,379
Kings Mill Creek	38.216957, -77.074175	1.66	175	281	386	510	1,104
Lambs Creek	38.252235, -77.259814	5.18	358	563	761	992	2,072
Lambs Creek	38.260022, -77.260056	1.72	180	287	395	522	1,128
Lambs Creek	38.272000, -77.266981	1.17	141	228	315	417	913
Mason Mill Pond	38.288501, -77.150898	3.01	485	764	1,033	1,247	2,230
Mason Mill Pond	38.279187, -77.150730	1.16	141	227	313	415	909
Mattox Creek	38.204325, -77.055569	9.00	506	787	1,056	1,369	2,810
Mattox Creek	38.205125, -77.058275	8.19	477	743	999	1,296	2,668
Mattox Creek	38.208176, -77.058146	7.96	469	731	982	1,274	2,626
Mattox Creek	38.213694, -77.062274	4.29	318	501	680	888	1,866
Mattox Creek	38.217983, -77.064005	3.86	298	470	639	836	1,762
Mattox Creek	38.224838, -77.064306	3.06	257	408	556	729	1,548
Mattox Creek	38.232103, -77.070203	2.50	227	361	494	649	1,386
Mattox Creek	38.236701, -77.073662	1.90	191	305	419	552	1,190
Mattox Creek	38.238114, -77.079931	1.15	140	225	311	412	902

Table 9: Summary of Discharges – continued

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)				
			10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Millbank Creek	38.193443, -77.202510	4.33	320	504	684	893	1,875
Millbank Creek	38.203120, -77.210423	3.54	283	446	607	795	1,680
Millbank Creek	38.211107, -77.213563	3.21	265	420	572	750	1,590
Millbank Creek	38.213592, -77.212028	2.42	222	353	484	636	1,360
Muddy Creek	38.260796, -77.341504	6.20	840	1,302	1,744	2,115	3,708
Muddy Creek	38.287101, -77.339018	2.16	384	608	825	994	1,798
Muddy Creek	38.287618, -77.338604	1.23	254	406	554	666	1,223
Passapatanzy Creek	38.325858, -77.284893	5.18	358	562	761	991	2,071
Passapatanzy Creek	38.322843, -77.287486	4.94	348	546	740	965	2,019
Passapatanzy Creek	38.320966, -77.288180	2.70	238	378	516	678	1,445
Passapatanzy Creek	38.319176, -77.288768	2.33	217	346	473	623	1,333
Passapatanzy Creek	38.312492, -77.292751	1.54	168	269	370	489	1,061
Passapatanzy Creek	38.309517, -77.293302	1.25	147	237	328	434	947
Pepper Mill Creek	38.321532, -77.108977	12.14	610	944	1,262	1,629	3,314
Pepper Mill Creek	38.322328, -77.116526	11.69	596	923	1,234	1,594	3,247
Pepper Mill Creek	38.325977, -77.134803	10.56	559	868	1,162	1,502	3,069
Pepper Mill Creek	38.319873, -77.149030	9.53	525	815	1,093	1,415	2,900
Pepper Mill Creek	38.315353, -77.155346	8.58	491	765	1,027	1,331	2,737
Pepper Mill Creek	38.316899, -77.163348	7.09	436	681	917	1,191	2,464
Pepper Mill Creek	38.316801, -77.173235	6.38	408	639	861	1,120	2,325
Pepper Mill Creek	38.309538, -77.190325	4.52	432	683	926	1,116	2,005
Pepper Mill Creek	38.306352, -77.202160	2.98	432	683	926	1,116	2,005
Pepper Mill Creek	38.293286, -77.207891	1.04	257	403	546	663	1,222
Pine Hill Creek	38.266058, -77.070737	7.40	957	1,478	1,976	2,398	4,179
Pine Hill Creek	38.259335, -77.086874	6.49	877	1,357	1,816	2,204	3,869
Pine Hill Creek	38.251586, -77.103408	5.09	744	1,154	1,546	1,877	3,327
Pine Hill Creek	38.250507, -77.106922	4.66	705	1,094	1,466	1,781	3,172

Table 9: Summary of Discharges – continued

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)				
			10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Pine Hill Creek	38.249512, -77.115163	3.64	594	925	1,242	1,508	2,707
Pine Hill Creek	38.248078, -77.119525	3.30	564	877	1,178	1,432	2,582
Pine Hill Creek	38.247486, -77.124126	2.98	530	823	1,106	1,345	2,434
Pine Hill Creek	38.251526, -77.134877	1.87	367	577	781	945	1,723
Pine Hill Creek	38.249332, -77.139109	1.60	340	533	721	875	1,602
Pine Hill Creek	38.248444, -77.141339	1.24	289	453	614	746	1,370
Pine Hill Creek	38.251694, -77.134990	0.79	235	363	491	601	1,106
Popcastle Creek	38.260026, -77.259841	3.23	267	422	575	754	1,598
Poplar Neck Creek	38.279749, -77.110453	1.71	263	422	576	692	1,268
Poplar Neck Creek	38.273656, -77.110169	1.33	263	422	576	692	1,268
Rappahannock River	38.169619, -77.158234	1,848.65	53,732	72,327	88,411	105,842	173,751
Rappahannock River	38.200237, -77.228475	1,783.89	53,732	72,327	88,411	105,842	173,751
Rappahannock River	38.193050, -77.236734	1,783.15	53,732	72,327	88,411	105,842	173,751
Rappahannock River	38.250480, -77.258578	1,734.27	53,732	72,327	88,411	105,842	173,751
Rappahannock River	38.237133, -77.278676	1,732.21	53,732	72,327	88,411	105,842	173,751
Rappahannock River	38.242233, -77.299455	1,721.28	53,732	72,327	88,411	105,842	173,751
Rappahannock River	38.238667, -77.304175	1,720.72	53,732	72,327	88,411	105,842	173,751
Rosier Creek	38.257139, -77.038365	1.84	188	300	412	543	1,171
Tributary No.1 to Birchwood Run	38.259647, -77.275083	2.28	214	341	467	614	1,316
Tributary No.1 to Birchwood Run	38.265732, -77.280107	1.55	168	270	372	491	1,064
Tributary No.1 to Dirt Bridge Run	38.311035, -77.254329	0.96	125	201	279	371	817
Tributary No.1 to Dogue Run	38.241319, -77.196867	1.22	145	233	323	427	933
Tributary No.1 to Dogue Run	38.243109, -77.196276	0.82	113	183	254	338	747
Tributary No.1 to Gingoteague Creek	38.186789, -77.150263	1.57	170	272	375	495	1,073
Tributary No.1 to Gingoteague Creek	38.188986, -77.159772	0.99	127	205	284	377	829

Table 9: Summary of Discharges – continued

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)				
			10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Tributary No.1 to Mason Mill Pond	38.279189, -77.150623	1.59	321	507	688	831	1,518
Tributary No.1 to Mason Mill Pond	38.276504, -77.149254	1.10	236	378	516	620	1,143
Tributary No.1 to Passapatanzy Creek	38.321131, -77.288400	2.21	210	334	458	603	1,293
Tributary No.1 to Passapatanzy Creek	38.321378, -77.297438	1.12	137	221	306	405	888
Tributary No.1 to Pepper Mill Creek	38.316815, -77.163345	1.09	135	218	302	400	878
Tributary No.1 to Pine Hill Creek	38.262133, -77.067618	8.18	1,030	1,588	2,121	2,576	4,474
Tributary No.1 to Tributary No.2 to Birchwood Run	38.257833, -77.311547	1.46	162	261	359	475	1,032
Tributary No.1 to Tributary No.2 to Gingoteague Creek	38.204965, -77.170548	0.88	118	190	265	352	776
Tributary No.1 to Tributary No.2 to Rappahannock River	38.251850, -77.240147	2.08	202	323	443	583	1,252
Tributary No.1 to Tributary No.2 to Rappahannock River	38.254316, -77.235174	1.14	139	224	310	411	900
Tributary No.1 to Upper Machodoc Creek	38.325092, -77.094673	1.06	238	379	517	623	1,149
Tributary No.2 to Birchwood Run	38.260144, -77.288740	3.18	560	868	1,165	1,418	2,565
Tributary No.2 to Birchwood Run	38.257664, -77.311542	0.88	193	312	428	513	951
Tributary No.2 to Gingoteague Creek	38.196887, -77.153887	5.10	355	557	754	983	2,055
Tributary No.2 to Gingoteague Creek	38.202184, -77.165206	4.22	315	496	674	880	1,850
Tributary No.2 to Gingoteague Creek	38.203296, -77.169211	3.50	281	443	603	790	1,670

Table 9: Summary of Discharges – continued

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)				
			10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Tributary No.2 to Gingoteague Creek	38.204967, -77.170441	2.62	234	372	508	667	1,423
Tributary No.2 to Gingoteague Creek	38.218646, -77.168164	1.27	148	238	330	436	952
Tributary No.2 to Jetts Creek	38.170832, -77.110097	2.10	203	324	445	586	1,258
Tributary No.2 to Jetts Creek	38.186043, -77.121482	1.16	141	227	313	415	909
Tributary No.2 to Mattox Creek	38.209192, -77.043575	2.26	213	339	465	611	1,311
Tributary No.2 to Muddy Creek	38.287535, -77.338494	0.93	201	325	446	534	988
Tributary No.2 to Pepper Mill Creek	38.306437, -77.202162	1.08	134	217	300	398	873
Tributary No.2 to Rappahannock River	38.251848, -77.240254	0.96	211	339	464	557	1,030
Tributary No.2 to Tributary No.2 to Gingoteague Creek	38.218563, -77.168054	0.99	229	364	496	599	1,105
Tributary No.3 to Gingoteague Creek	38.219591, -77.144358	1.15	140	225	312	413	904
Tributary No.3 to Jetts Creek	38.177634, -77.099241	1.54	167	268	370	488	1,059
Tributary No.3 to Jetts Creek	38.176514, -77.095561	1.21	144	232	321	425	929
Upper Machodoc Creek	38.311181, -77.086317	26.08	1,307	2,001	2,662	3,240	5,576
Upper Machodoc Creek	38.316726, -77.088841	25.51	1,307	2,001	2,662	3,240	5,576
Upper Machodoc Creek	38.320830, -77.091432	25.12	1,307	2,001	2,662	3,240	5,576
Upper Machodoc Creek	38.325007, -77.094670	23.86	1,307	2,001	2,662	3,240	5,576
Upper Machodoc Creek	38.321365, -77.108864	11.20	1,307	2,001	2,662	3,240	5,576
Upper Machodoc Creek	38.319564, -77.110102	10.87	1,276	1,954	2,601	3,165	5,450
Upper Machodoc Creek	38.312773, -77.120333	9.91	1,190	1,827	2,434	2,959	5,110
Upper Machodoc Creek	38.310152, -77.120041	9.66	1,167	1,793	2,389	2,905	5,021
Upper Machodoc Creek	38.293804, -77.124832	8.47	1,058	1,630	2,176	2,644	4,588
Upper Machodoc Creek	38.294055, -77.129675	8.10	1,026	1,581	2,111	2,565	4,462

Table 9: Summary of Discharges – continued

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)				
			10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Upper Machodoc Creek	38.293669, -77.132243	7.74	997	1,537	2,053	2,494	4,350
Upper Machodoc Creek	38.290150, -77.139448	7.00	929	1,435	1,918	2,330	4,081
Upper Machodoc Creek	38.290355, -77.142140	6.36	865	1,338	1,790	2,173	3,817
Upper Machodoc Creek	38.288499, -77.151005	3.06	510	799	1,077	1,304	2,342
Upper Machodoc Creek	38.286159, -77.163079	2.05	388	611	826	1,000	1,816

Figure 7: Frequency Discharge-Drainage Area Curves

[Not Applicable to this Flood Risk Project]

Table 10: Summary of Non-Coastal Stillwater Elevations

[Not Applicable to this Flood Risk Project]

Table 11: Stream Gage Information used to Determine Discharges

[Not Applicable to this Flood Risk Project]

5.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals. Base flood elevations on the FIRM represent the elevations shown on the Flood Profiles and in the Floodway Data tables in the FIS Report. Rounded whole-foot elevations may be shown on the FIRM in coastal areas, areas of ponding, and other areas with static base flood elevations. These whole-foot elevations may not exactly reflect the elevations derived from the hydraulic analyses. Flood elevations shown on the FIRM are primarily intended for flood insurance rating purposes. For construction and/or floodplain management purposes, users are cautioned to use the flood elevation data presented in this FIS Report in conjunction with the data shown on the FIRM. The hydraulic analyses for this FIS were based on unobstructed flow.

A summary of the methods used in hydraulic analyses performed for this project is provided in Table 12. Roughness coefficients are provided in Table 13. Roughness coefficients are values representing the frictional resistance water experiences when passing overland or through a channel. They are used in the calculations to determine water surface elevations. Greater detail (including assumptions, analysis, and results) is available in the archived project documentation.

Table 12: Summary of Hydrologic and Hydraulic Analyses

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Birchwood Run	At Confluence with Rappahannock River	1 square mile drainage area	Regression Equations	HEC-RAS 5.0.3	11/30/2017	A	Effect of hydraulic structures were not considered in the model
Black Swamp Branch	At Zone Break to Coastal AE	1 square mile drainage area	Regression Equations	HEC-RAS 5.0.3	11/30/2017	A	Effect of hydraulic structures were not considered in the model
Boom Swamp	At Confluence with Jetts Creek	1 square mile drainage area	Regression Equations	HEC-RAS 5.0.3	11/30/2017	A	Effect of hydraulic structures were not considered in the model
Bristol Mine Run	At Confluence with Rappahannock River	1 square mile drainage area	Regression Equations	HEC-RAS 5.0.3	11/30/2017	A	Effect of hydraulic structures were not considered in the model
Dirt Bridge Run	At Confluence with Passapatanzy Creek	1 square mile drainage area	Regression Equations	HEC-RAS 5.0.3	11/30/2017	A	Effect of hydraulic structures were not considered in the model
Dogue Run	At Confluence with Keys Run	1 square mile drainage area	Regression Equations	HEC-RAS 5.0.3	11/30/2017	A	Effect of hydraulic structures were not considered in the model
Gingoteague Creek	At Confluence with Rappahannock River	1 square mile drainage area	Regression Equations	HEC-RAS 5.0.3	11/30/2017	A	Effect of hydraulic structures were not considered in the model
Jetts Creek	At Confluence with Rappahannock River	1 square mile drainage area	Regression Equations	HEC-RAS 5.0.3	11/30/2017	A	Effect of hydraulic structures were not considered in the model
Keys Run	At Confluence with Rappahannock River	1 square mile drainage area	Regression Equations	HEC-RAS 5.0.3	11/30/2017	A	Effect of hydraulic structures were not considered in the model
Kings Mill Creek	At Confluence with Mattox Creek	1 square mile drainage area	Regression Equations	HEC-RAS 5.0.3	11/30/2017	A	Effect of hydraulic structures were not considered in the model

Table 12: Summary of Hydrologic and Hydraulic Analyses – continued

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Lambs Creek	At Confluence with Birchwood Run	1 square mile drainage area	Regression Equations	HEC-RAS 5.0.3	11/30/2017	A	Effect of hydraulic structures were not considered in the model
Mason Mill Pond	At Confluence with Upper Machodoc Creek	1 square mile drainage area	Regression Equations	HEC-RAS 5.0.3	11/30/2017	A	Effect of hydraulic structures were not considered in the model
Mattox Creek	At Zone Break to Coastal AE	1 square mile drainage area	Regression Equations	HEC-RAS 5.0.3	11/30/2017	A	Effect of hydraulic structures were not considered in the model
Millbank Creek	At Confluence with Rappahannock River	1 square mile drainage area	Regression Equations	HEC-RAS 5.0.3	11/30/2017	A	Effect of hydraulic structures were not considered in the model
Muddy Creek	At Confluence with Rappahannock River	Zone Break to A	PEAKFQ 2.4 (April 1998) and up	HEC-RAS 5.0.3	12/17/2018	AE	Backwater from Rappahannock River flooding in Stafford County
Muddy Creek	At Confluence with Rappahannock River	1 square mile drainage area	Regression Equations	HEC-RAS 5.0.3	11/30/2017	A	Effect of hydraulic structures were not considered in the model
Passapatanzy Creek	At Zone Break to Coastal AE	1 square mile drainage area	Regression Equations	HEC-RAS 5.0.3	11/30/2017	A	Effect of hydraulic structures were not considered in the model
Pepper Mill Creek	At Confluence with Upper Machodoc Creek	1 square mile drainage area	Regression Equations	HEC-RAS 5.0.3	11/30/2017	A	Effect of hydraulic structures were not considered in the model
Pine Hill Creek	At Zone Break to Coastal AE	1 square mile drainage area	Regression Equations	HEC-RAS 5.0.3	11/30/2017	A	Effect of hydraulic structures were not considered in the model
Popcastle Creek	At Confluence with Lambs Creek	1 square mile drainage area	Regression Equations	HEC-RAS 5.0.3	11/30/2017	A	Effect of hydraulic structures were not considered in the model

Table 12: Summary of Hydrologic and Hydraulic Analyses – continued

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Poplar Neck Creek	At Zone Break to Coastal AE	1 square mile drainage area	Regression Equations	HEC-RAS 5.0.3	11/30/2017	A	Effect of hydraulic structures were not considered in the model
Rappahannock River	At Zone Break to Coastal AE	Zone Break to AE	Regression Equations	HEC-RAS 5.0.3	11/30/2017	A	Effect of hydraulic structures were not considered in the model
Rosier Creek	At Zone Break to Coastal AE	1 square mile drainage area	Regression Equations	HEC-RAS 5.0.3	11/30/2017	A	Effect of hydraulic structures were not considered in the model
Tributary No.1 to Birchwood Run	At Confluence with Birchwood Run	1 square mile drainage area	Regression Equations	HEC-RAS 5.0.3	11/30/2017	A	Effect of hydraulic structures were not considered in the model
Tributary No.1 to Dirt Bridge Run	At Confluence with Dirt Bridge Run	1 square mile drainage area	Regression Equations	HEC-RAS 5.0.3	11/30/2017	A	Effect of hydraulic structures were not considered in the model
Tributary No.1 to Dogue Run	At Confluence with Dogue Run	1 square mile drainage area	Regression Equations	HEC-RAS 5.0.3	11/30/2017	A	Effect of hydraulic structures were not considered in the model
Tributary No.1 to Gingoteague Creek	At Confluence with Gingoteague Creek	1 square mile drainage area	Regression Equations	HEC-RAS 5.0.3	11/30/2017	A	Effect of hydraulic structures were not considered in the model
Tributary No.1 to Mason Mill Pond	At Confluence with Mason Mill Pond	1 square mile drainage area	Regression Equations	HEC-RAS 5.0.3	11/30/2017	A	Effect of hydraulic structures were not considered in the model
Tributary No.1 to Passapatanzy Creek	At Confluence with Passapatanzy Creek	1 square mile drainage area	Regression Equations	HEC-RAS 5.0.3	11/30/2017	A	Effect of hydraulic structures were not considered in the model
Tributary No.1 to Pepper Mill Creek	At Confluence with Pepper Mill Creek	1 square mile drainage area	Regression Equations	HEC-RAS 5.0.3	11/30/2017	A	Effect of hydraulic structures were not considered in the model

Table 12: Summary of Hydrologic and Hydraulic Analyses – continued

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Tributary No.1 to Pine Hill Creek	At Confluence with Pine Hill Creek	1 square mile drainage area	Regression Equations	HEC-RAS 5.0.3	11/30/2017	A	Effect of hydraulic structures were not considered in the model
Tributary No.1 to Tributary No.2 to Birchwood Run	At Confluence with Tributary No.2 to Birchwood Run	1 square mile drainage area	Regression Equations	HEC-RAS 5.0.3	11/30/2017	A	Effect of hydraulic structures were not considered in the model
Tributary No.1 to Tributary No.2 to Gingoteague Creek	At Confluence with Gingoteague Creek Tributary 2	1 square mile drainage area	Regression Equations	HEC-RAS 5.0.3	11/30/2017	A	Effect of hydraulic structures were not considered in the model
Tributary No.1 to Tributary No.2 to Rappahannock River	At Confluence with Rappahannock River	1 square mile drainage area	Regression Equations	HEC-RAS 5.0.3	11/30/2017	A	Effect of hydraulic structures were not considered in the model
Tributary No.1 to Upper Machodoc Creek	At Confluence with Upper Machodoc Creek	1 square mile drainage area	Regression Equations	HEC-RAS 5.0.3	11/30/2017	A	Effect of hydraulic structures were not considered in the model
Tributary No.2 to Birchwood Run	At Confluence with Birchwood Run	1 square mile drainage area	Regression Equations	HEC-RAS 5.0.3	11/30/2017	A	Effect of hydraulic structures were not considered in the model
Tributary No.2 to Gingoteague Creek	At Confluence with Gingoteague Creek	1 square mile drainage area	Regression Equations	HEC-RAS 5.0.3	11/30/2017	A	Effect of hydraulic structures were not considered in the model
Tributary No.2 to Jetts Creek	At Confluence with Jetts Creek	1 square mile drainage area	Regression Equations	HEC-RAS 5.0.3	11/30/2017	A	Effect of hydraulic structures were not considered in the model
Tributary No.2 to Mattox Creek	At Confluence with Mattox Creek	1 square mile drainage area	Regression Equations	HEC-RAS 5.0.3	11/30/2017	A	Effect of hydraulic structures were not considered in the model
Tributary No.2 to Muddy Creek	At Confluence with Muddy Creek	1 square mile drainage area	Regression Equations	HEC-RAS 5.0.3	11/30/2017	A	Effect of hydraulic structures were not considered in the model
Tributary No.2 to Pepper Mill Creek	At Confluence with Pepper Mill Creek	1 square mile drainage area	Regression Equations	HEC-RAS 5.0.3	11/30/2017	A	Effect of hydraulic structures were not considered in the model

Table 12: Summary of Hydrologic and Hydraulic Analyses – continued

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Tributary No.2 to Rappahannock River	At Confluence with Rappahannock River	1 square mile drainage area	Regression Equations	HEC-RAS 5.0.3	11/30/2017	A	Effect of hydraulic structures were not considered in the model
Tributary No.2 to Tributary No.2 to Gingoteague Creek	At Confluence with Gingoteague Creek Tributary 2	1 square mile drainage area	Regression Equations	HEC-RAS 5.0.3	11/30/2017	A	Effect of hydraulic structures were not considered in the model
Tributary No.3 to Gingoteague Creek	At Confluence with Gingoteague Creek	1 square mile drainage area	Regression Equations	HEC-RAS 5.0.3	11/30/2017	A	Effect of hydraulic structures were not considered in the model
Tributary No.3 to Jetts Creek	At Confluence with Jetts Creek	1 square mile drainage area	Regression Equations	HEC-RAS 5.0.3	11/30/2017	A	Effect of hydraulic structures were not considered in the model
Upper Machodoc Creek	At Zone Break to Coastal AE	1 square mile drainage area	Regression Equations	HEC-RAS 5.0.3	11/30/2017	A	Effect of hydraulic structures were not considered in the model

Table 13: Roughness Coefficients

Flooding Source	Channel "n"	Overbank "n"
Birchwood Run	0.045-0.055	0.045-0.120
Black Swamp Branch	0.045-0.055	0.045-0.120
Boom Swamp	0.045-0.055	0.045-0.120
Bristol Mine Run	0.045-0.055	0.045-0.120
Dirt Bridge Run	0.045-0.055	0.045-0.120
Dogue Run	0.045-0.055	0.045-0.120
Gingoteague Creek	0.045-0.055	0.045-0.120
Jetts Creek	0.045-0.055	0.045-0.120
Keys Run	0.045-0.055	0.045-0.120
Kings Mill Creek	0.045-0.055	0.045-0.120
Lambs Creek	0.045-0.055	0.045-0.120
Mason Mill Pond	0.045-0.055	0.045-0.120
Mattox Creek	0.045-0.055	0.045-0.120
Millbank Creek	0.045-0.055	0.045-0.120
Muddy Creek	0.045-0.055	0.045-0.120
Passapatanzy Creek	0.045-0.055	0.045-0.120
Pepper Mill Creek	0.045-0.055	0.045-0.120
Pine Hill Creek	0.045-0.055	0.045-0.120
Popcastle Creek	0.045-0.055	0.045-0.120
Poplar Neck Creek	0.045-0.055	0.045-0.120
Rappahannock River	0.045-0.055	0.045-0.120
Rosier Creek	0.045-0.055	0.045-0.120
Tributary No.1 to Birchwood Run	0.045-0.055	0.045-0.120
Tributary No.1 to Dirt Bridge Run	0.045-0.055	0.045-0.120
Tributary No.1 to Dogue Run	0.045-0.055	0.045-0.120
Tributary No.1 to Gingoteague Creek	0.045-0.055	0.045-0.120
Tributary No.1 to Mason Mill Pond	0.045-0.055	0.045-0.120
Tributary No.1 to Passapatanzy Creek	0.045-0.055	0.045-0.120
Tributary No.1 to Pepper Mill Creek	0.045-0.055	0.045-0.120
Tributary No.1 to Pine Hill Creek	0.045-0.055	0.045-0.120
Tributary No.1 to Tributary No.2 to Birchwood Run	0.045-0.055	0.045-0.120
Tributary No.1 to Tributary No.2 to Gingoteague Creek	0.045-0.055	0.045-0.120
Tributary No.1 to Tributary No.2 to Rappahannock River	0.045-0.055	0.045-0.120
Tributary No.1 to Upper Machodoc Creek	0.045-0.055	0.045-0.120
Tributary No.2 to Birchwood Run	0.045-0.055	0.045-0.120
Tributary No.2 to Gingoteague Creek	0.045-0.055	0.045-0.120
Tributary No.2 to Jetts Creek	0.045-0.055	0.045-0.120
Tributary No.2 to Mattox Creek	0.045-0.055	0.045-0.120
Tributary No.2 to Muddy Creek	0.045-0.055	0.045-0.120
Tributary No.2 to Pepper Mill Creek	0.045-0.055	0.045-0.120
Tributary No.2 to Rappahannock River	0.045-0.055	0.045-0.120

Table 13: Roughness Coefficients – continued

Flooding Source	Channel "n"	Overbank "n"
Tributary No.2 to Tributary No.2 to Gingoteague Creek	0.045-0.055	0.045-0.120
Tributary No.3 to Gingoteague Creek	0.045-0.055	0.045-0.120
Tributary No.3 to Jetts Creek	0.045-0.055	0.045-0.120
Upper Machodoc Creek	0.045-0.055	0.045-0.120

5.3 Coastal Analyses

For the areas of King George County that are impacted by coastal flooding processes, coastal flood hazard analyses were performed to provide estimates of coastal BFEs. Coastal BFEs reflect the increase in water levels during a flood event due to extreme tides and storm surge as well as overland wave effects.

The following subsections provide summaries of how each coastal process was considered for this FIS Report. Greater detail (including assumptions, analysis, and results) is available in the archived project documentation. Table 14 summarizes the methods and/or models used for the coastal analyses. Refer to Section 2.5.1 for descriptions of the terms used in this section.

Table 14: Summary of Coastal Analyses

Flooding Source	Study Limits From	Study Limits To	Hazard Evaluated	Model or Method Used	Date Analysis was Completed
Potomac River	King George/ Stafford County Boundary	King George/ Westmoreland County Boundary	Comprehensive Coastal	ADCIRC (2003), EST and JPM, WHAFIS 4.0 (2007), RUNUP 2.0	ADCIRC (2003) - 5/13/2011, EST and JPM - 5/1/2010, WHAFIS 4.0 (2007) - 6/5/2013, RUNUP 2.0 - 4/29/2013
Rappahannock Rver	King George/Essex/ Westmoreland County Boundary	Approximately 1,180 feet downstream of confluence with Gingoteague Creek	Comprehensive Coastal	ADCIRC (2003), EST and JPM, WHAFIS 4.0 (2007)	ADCIRC (2003) - 5/13/2011, EST and JPM - 5/1/2010, WHAFIS 4.0 (2007) - 6/5/2013
Upper Machodoc Creek	King George/ Stafford County Boundary	King George/ Stafford County Boundary	Comprehensive Coastal	ADCIRC (2003), EST and JPM, WHAFIS 4.0 (2007), TAW Method	ADCIRC (2003) - 5/13/2011, EST and JPM - 5/1/2010, WHAFIS 4.0 (2007) - 6/5/2013, TAW Method- 4/29/2013

5.3.1 Total Stillwater Elevations

The total stillwater elevations (stillwater including storm surge plus wave setup) for the 1-percent-annual-chance flood were determined for areas subject to coastal flooding. The models and methods that were used to determine storm surge and wave setup are listed in Table 14. The stillwater elevation that was used for each transect in coastal analyses is shown in Table 16, "Coastal Transect Parameters." Figure 8 shows the total stillwater elevations for the 1-percent-annual-chance flood that was determined for this coastal analysis.

Figure 8: 1% Annual Chance Total Stillwater Elevations for Coastal Areas

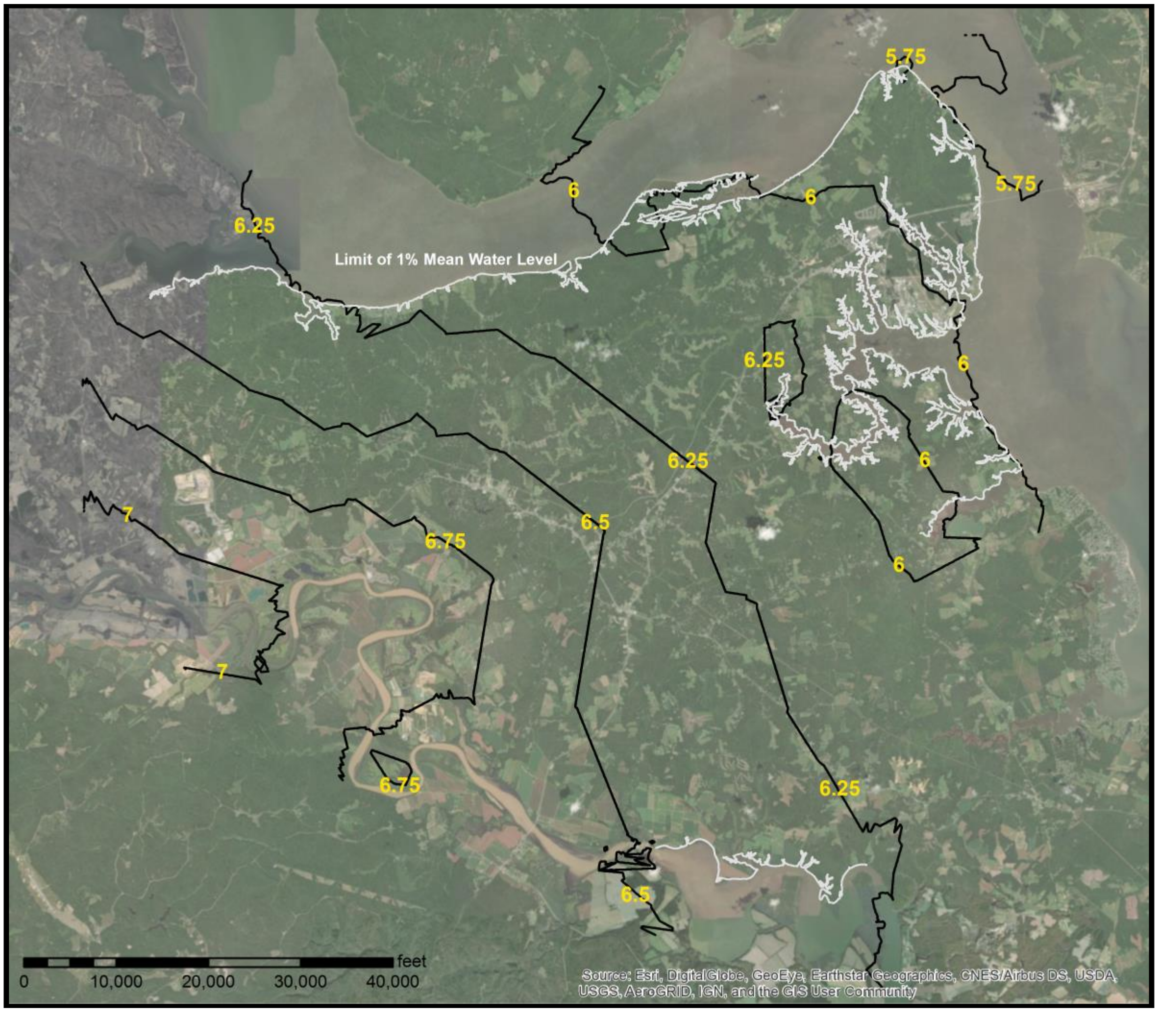


Table 15: Tide Gage Analysis Specifics

[Not Applicable to this Flood Risk Project]

5.3.2 Waves

A coastal wave model was used to calculate the nearshore wave fields required for the addition of wave setup effects. Three nested grids were used to obtain sufficient nearshore resolution to represent the radiation stress gradients required as ADCIRC inputs. Radiation stress fields output from the inner grids are used by ADCIRC to estimate the contribution of breaking waves (wave setup effects) to the total stillwater elevation.

5.3.3 Coastal Erosion

This section is not applicable to this flood risk project.

5.3.4 Wave Hazard Analyses

Overland wave hazards were evaluated to determine the combined effects of ground elevation, vegetation, and physical features on overland wave propagation and wave runup. These analyses were performed at representative transects along all shorelines for which waves were expected to be present during the floods of the selected recurrence intervals. The results of these analyses were used to determine elevations for the 1-percent-annual-chance flood.

Transect locations were chosen with consideration given to the physical land characteristics as well as development type and density so that they would closely represent conditions in their locality. Additional consideration was given to changes in the total stillwater elevation. Transects were spaced close together in areas of complex topography and dense development or where total stillwater elevations varied. In areas having more uniform characteristics, transects were spaced at larger intervals. Transects shown in Figure 9, “Transect Location Map,” are also depicted on the FIRM. Table 16 provides the location, stillwater elevations, and starting wave conditions for each transect evaluated for overland wave hazards. In this table, “starting” indicates the parameter value at the beginning of the transect.

Wave Height Analysis

Wave height analyses were performed to determine wave heights and corresponding wave crest elevations for the areas inundated by coastal flooding and subject to overland wave propagation hazards. Refer to Figure 6 for a schematic of a coastal transect evaluated for overland wave propagation hazards.

Wave heights and wave crest elevations were modeled using the methods and models listed in Table 14, “Summary of Coastal Analyses”.

Wave Runup Analysis

Wave runup analyses were performed to determine the height and extent of runup beyond the limit of stillwater inundation for the 1-percent-annual-chance flood. Wave runup elevations were modeled using the methods and models listed in Table 14.

Table 16: Coastal Transect Parameters

Flood Source	Coastal Transect	Starting Wave Conditions for the 1% Annual Chance		Starting Stillwater Elevations (ft NAVD88) Range of Stillwater Elevations (ft NAVD88)				
		Significant Wave Height H_s (ft)	Peak Wave Period T_p (sec)	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Potomac River	1	1.8	3	4.4 4.4-4.4	* *	5.8 5.8-5.8	6.4 6.4-6.4	7.4 7.4-7.6
Potomac River	2	2	3.1	4.4 4.4-4.4	* *	5.8 5.8-5.8	6.3 6.3-6.3	7.3 7.3-7.3
Potomac River	3	2.3	3.7	4.4 4.4-4.4	* *	5.8 5.8-5.8	6.3 6.3-6.3	7.3 7.3-7.4
Potomac River	4	2.7	3.7	4.4 4.4-4.4	* *	5.8 5.8-5.8	6.3 6.3-6.3	7.2 7.2-7.3
Potomac River	5	2.5	3.2	4.4 4.4-4.4	* *	5.7 5.7-5.8	6.3 6.3-6.3	7.4 7.4-7.5
Potomac River	6	2.4	3.3	4.4 4.4-4.4	* *	5.7 5.7-5.7	6.3 6.3-6.3	7.4 7.4-7.4
Potomac River	7	2.4	3.2	4.3 4.3-4.4	* *	5.7 5.7-5.7	6.3 6.3-6.3	7.3 7.3-7.3
Potomac River	8	2.5	3.2	4.3 4.3-4.3	* *	5.7 5.7-5.7	6.2 6.2-6.2	7.1 7.1-7.2
Potomac River	9	2.4	3.4	4.3 4.3-4.3	* *	5.7 5.7-5.7	6.2 6.2-6.2	7.1 7.1-7.1

Table 16: Coastal Transect Parameters – continued

Flood Source	Coastal Transect	Starting Wave Conditions for the 1% Annual Chance		Starting Stillwater Elevations (ft NAVD88) Range of Stillwater Elevations (ft NAVD88)				
		Significant Wave Height H_s (ft)	Peak Wave Period T_p (sec)	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Potomac River	10	2.4	3.4	4.3 4.3-4.3	* *	5.7 5.7-5.7	6.2 6.2-6.2	7.1 7.1-7.1
Potomac River	11	2.3	3.7	4.3 4.3-4.3	* *	5.7 5.7-5.7	6.2 6.2-6.2	7.1 7.1-7.1
Potomac River	12	2.2	3.5	4.3 4.3-4.3	* *	5.6 5.6-5.6	6.1 6.1-6.1	7.1 7.1-7.1
Potomac River	13	2.2	3.7	4.2 4.2-4.3	* *	5.6 5.6-5.6	6.1 6.1-6.1	7.1 7.1-7.1
Potomac River	14	2.2	3.3	4.2 4.2-4.3	* *	5.6 5.6-5.6	6.1 6.1-6.1	7.1 7.1-7.2
Potomac River	15	2.2	3.3	4.2 4.2-4.2	* *	5.5 5.5-5.5	6.0 6.0-6.0	7.1 7.1-7.1
Potomac River	16	2.2	3.7	4.2 4.2-4.2	* *	5.5 5.5-5.5	5.9 5.9-5.9	7.1 7.1-7.1
Potomac River	17	2.5	3.6	4.2 4.2-4.2	* *	5.5 5.5-5.6	6.0 6.0-6.0	7.2 7.2-7.2
Potomac River	18	2.8	3.6	4.2 4.2-4.2	* *	5.5 5.5-5.5	5.9 5.9-5.9	7.2 7.2-7.2
Potomac River	19	2.7	3.5	4.2 4.2-4.2	* *	5.5 5.5-5.6	5.9 5.9-6.0	7.3 7.3-7.3

Table 16: Coastal Transect Parameters – continued

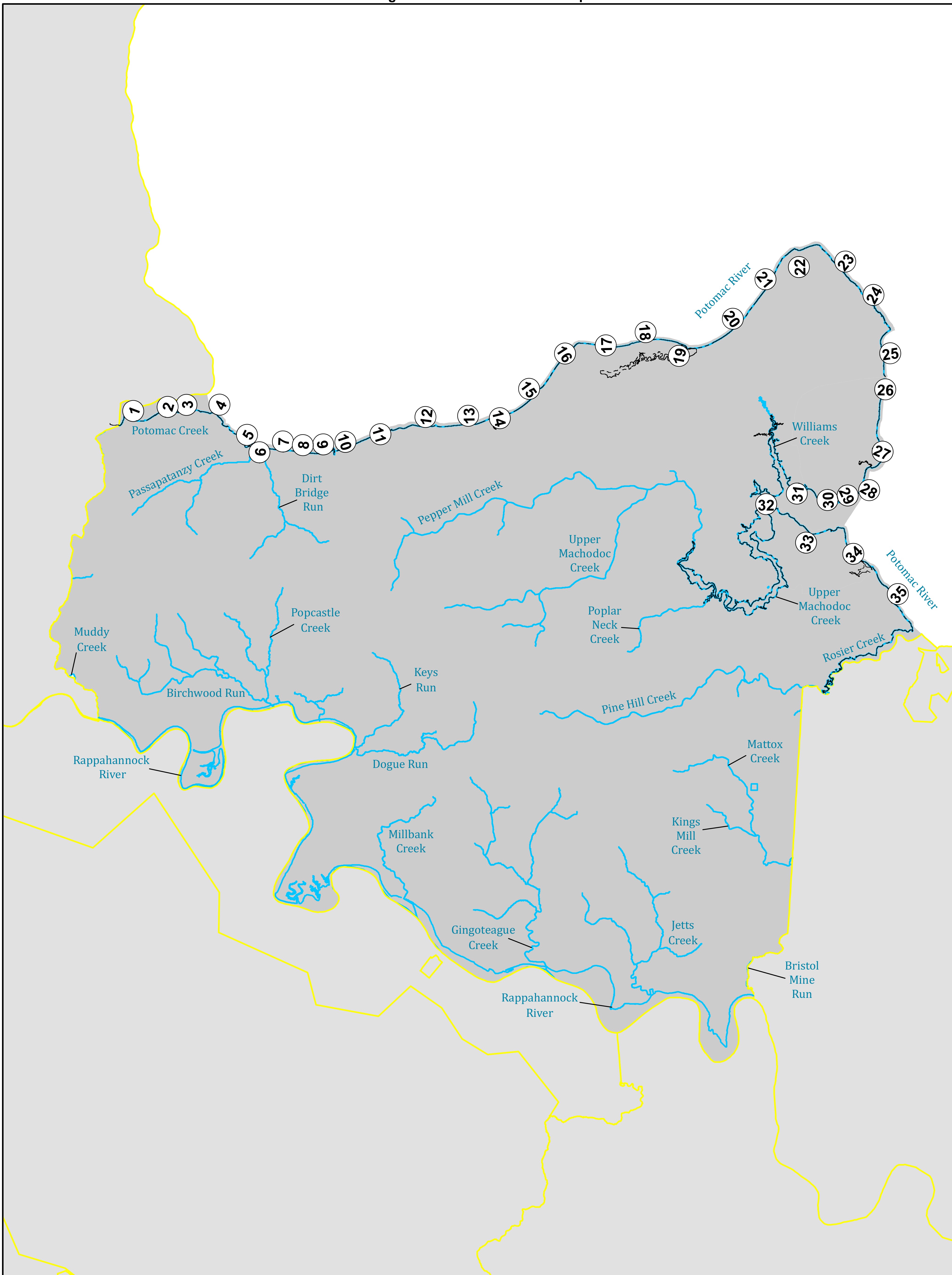
Flood Source	Coastal Transect	Starting Wave Conditions for the 1% Annual Chance		Starting Stillwater Elevations (ft NAVD88) Range of Stillwater Elevations (ft NAVD88)				
		Significant Wave Height H_s (ft)	Peak Wave Period T_p (sec)	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Potomac River	20	2.5	3.6	4.2 4.2-4.2	* *	5.4 5.4-5.5	5.9 5.9-5.9	7.4 7.4-7.4
Potomac River	21	2.2	3.5	4.2 4.2-4.2	* *	5.4 5.4-5.4	5.8 5.8-5.8	7.4 7.4-7.4
Potomac River	22	2.7	3.6	4.2 4.2-4.2	* *	5.4 5.4-5.4	5.8 5.8-5.8	7.5 7.5-7.5
Potomac River	23	3.4	3.6	4.2 4.2-4.2	* *	5.4 5.4-5.4	5.8 5.8-5.8	7.4 7.4-7.4
Potomac River	24	3.2	3.5	4.1 4.1-4.1	* *	5.4 5.4-5.4	5.8 5.8-5.8	7.4 7.4-7.4
Potomac River	25	3.8	3.6	4.1 4.1-4.2	* *	5.4 5.4-5.4	5.8 5.8-5.8	7.4 7.4-7.4
Potomac River	26	3.9	3.8	4.1 4.1-4.2	* *	5.4 5.4-5.5	5.8 5.8-5.8	7.4 7.4-7.4
Potomac River	27	4.7	4.4	4.1 4.1-4.2	* *	5.5 5.5-5.6	5.9 5.9-6.0	7.4 7.4-7.5
Potomac River	28	5.3	4.7	4.1 4.1-4.2	* *	5.5 5.5-5.5	6.0 6.0-6.0	7.7 7.7-7.8
Potomac River	29	4.7	4.4	4.2 4.2-4.3	* *	5.6 5.6-5.6	6.0 6.0-6.1	7.9 7.9-8.0

Table 16: Coastal Transect Parameters – continued

Flood Source	Coastal Transect	Starting Wave Conditions for the 1% Annual Chance		Starting Stillwater Elevations (ft NAVD88) Range of Stillwater Elevations (ft NAVD88)				
		Significant Wave Height H_s (ft)	Peak Wave Period T_p (sec)	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Upper Machodoc Creek	30	3.6	4.3	4.2 4.2-4.2	* *	5.6 5.6-5.6	6.1 6.1-6.1	7.9 7.9-7.9
Upper Machodoc Creek	31	2.5	3.5	4.2 4.2-4.2	* *	5.6 5.6-5.6	6.1 6.1-6.1	8.1 8.1-8.1
Upper Machodoc Creek	32	2.1	3.4	4.2 4.2-4.2	* *	5.7 5.7-5.7	6.2 6.2-6.2	8.2 8.2-8.2
Upper Machodoc Creek	33	3.2	4.3	4.2 4.1-4.2	* *	5.6 5.6-5.7	6.1 6.1-6.2	7.8 7.8-7.9
Potomac River	34	4.8	4.4	4.1 4.1-4.2	* *	5.6 5.6-5.6	6.0 6.0-6.1	7.5 7.5-7.5
Potomac River	35	5.3	4.6	4.1 4.1-4.1	* *	5.5 5.5-5.5	6.0 6.0-6.0	7.2 7.2-7.2

*Not calculated for this Flood Risk Project

Figure 9: Transect Location Map



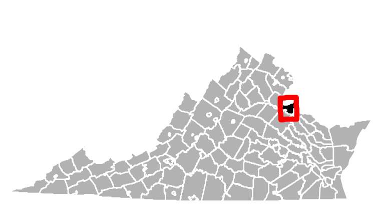
N

1 inch = 2 miles 1:125,000

0 1 2 4 Miles

Map Projection:
Universal Transverse Mercator Zone 18N; North American Datum 1983; Western Hemisphere; Vertical Datum: NAVD 88

COUNTY LOCATOR



NATIONAL FLOOD INSURANCE PROGRAM

Transect Locator Map

PANELS WITH TRANSECTS

0018, 0019, 0029, 0033, 0034, 0053, 0054, 0056, 0057, 0058, 0076, 0077, 0079, 0082, 0083, 0084, 0091, 0092

5.4 Alluvial Fan Analyses

This section is not applicable to this Flood Risk Project.

Table 17: Summary of Alluvial Fan Analyses

[Not Applicable to this Flood Risk Project]

Table 18: Results of Alluvial Fan Analyses

[Not Applicable to this Flood Risk Project]

SECTION 6.0 – MAPPING METHODS

6.1 Vertical and Horizontal Control

All FIS Reports and FIRMs are referenced to a specific vertical datum. The vertical datum provides a starting point against which flood, ground, and structure elevations can be referenced and compared. Until recently, the standard vertical datum used for newly created or revised FIS Reports and FIRMs was the National Geodetic Vertical Datum of 1929 (NGVD29). With the completion of the North American Vertical Datum of 1988 (NAVD88), many FIS Reports and FIRMs are now prepared using NAVD88 as the referenced vertical datum.

Flood elevations shown in this FIS Report and on the FIRMs are referenced to NAVD88. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. For information regarding conversion between NGVD29 and NAVD88 or other datum conversion, visit the National Geodetic Survey website at www.ngs.noaa.gov.

Temporary vertical monuments are often established during the preparation of a flood hazard analysis for the purpose of establishing local vertical control. Although these monuments are not shown on the FIRM, they may be found in the archived project documentation associated with the FIS Report and the FIRMs for this community. Interested individuals may contact FEMA to access these data.

To obtain current elevation, description, and/or location information for benchmarks in the area, please visit the NGS website at www.ngs.noaa.gov.

The datum conversion locations and values that were calculated for King George County are provided in Table 19.

Table 19: Countywide Vertical Datum Conversion

Quadrangle Name	Quadrangle Corner	Latitude	Longitude	Conversion from NGVD29 to NAVD88 (feet)
Average Conversion from NGVD29 to NAVD88 = -0.81 feet				

Table 20: Stream-Based Vertical Datum Conversion

[Not Applicable to this Flood Risk Project]

6.2 Base Map

The FIRMs and FIS Report for this project have been produced in a digital format. The flood hazard information was converted to a Geographic Information System (GIS) format that meets FEMA's FIRM Database specifications and geographic information standards. This information is provided in a digital format so that it can be incorporated into a local GIS and be accessed more easily by the community. The FIRM Database includes most of the tabular information contained in the FIS Report in such a way that the data can be associated with pertinent spatial features. For example, the information contained in the Floodway Data table and Flood Profiles can be linked to the cross sections that are shown on the FIRMs. Additional information about the FIRM Database and its contents can be found in FEMA's *Guidelines and Standards for Flood Risk Analysis and Mapping*, www.fema.gov/flood-maps/guidance-partners/guidelines-standards.

Base map information shown on the FIRM was derived from the sources described in Table 21.

Table 21: Base Map Sources

Data Type	Data Provider	Data Date	Data Scale	Data Description
2017 TIGER/Line Data	U.S. Census Bureau	2017	1:24,000	Spatial and attribute information for transportation
The Watershed Boundary Dataset (WBD)	U.S. Geological Survey	2016	1:12,000	Spatial and attribute information for HUC-8 watershed boundaries
Virginia Administrative Boundaries - Data Standard Schema	Virginia Geographic Information Network	2017	1:6,000	Spatial and attribute information for political boundaries
Virginia Orthophotography	Virginia Geographic Information Network	2017	1:24,000	Orthoimagery, Base Index

6.3 Floodplain and Floodway Delineation

The FIRM shows tints, screens, and symbols to indicate floodplains and floodways as well as the locations of selected cross sections used in the hydraulic analyses and floodway computations.

For riverine flooding sources, the mapped floodplain boundaries shown on the FIRM have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated using the topographic elevation data described in Table 22. For each coastal flooding source studied as part of this FIS Report, the mapped floodplain boundaries on the FIRM have been delineated using the flood and wave elevations determined at each transect; between transects, boundaries were delineated using land use and land cover data, the topographic elevation data described in Table 22, and knowledge of coastal flood processes. In ponding areas, flood elevations were determined at each junction of the model; between junctions, boundaries were interpolated using the topographic elevation data described in Table 22.

In cases where the 1-percent and 0.2-percent-annual-chance floodplain boundaries are close together, only the 1-percent-annual-chance floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

The floodway widths presented in this FIS Report and on the FIRM were computed for certain stream segments on the basis of equal conveyance reduction from each side of the floodplain. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. Table 2 indicates the flooding sources for which floodways have been determined. The results of the floodway computations for those flooding sources have been tabulated for selected cross sections and are shown in Table 23, "Floodway Data."

Certain flooding sources may have been studied that do not have published BFEs on the FIRMs, or for which there is a need to report the 1-percent-annual-chance flood elevations at selected cross sections because a published Flood Profile does not exist in this FIS Report. These streams may have also been studied using methods to determine non-encroachment zones rather than floodways. For these flooding sources, the 1-percent-annual-chance floodplain boundaries have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated using the topographic elevation data described in Table 22.

Table 22: Summary of Topographic Elevation Data used in Mapping

Community	Flooding Source	Source for Topographic Elevation Data			
		Description	Vertical Accuracy	Horizontal Accuracy	Citation
King George County, Unincorporated Areas	All Zone A Flood Zones	Light Detection and Ranging data (LiDAR)	22.3 cm RMSEz	2 feet at 95% confidence level	Virginia Geographic Information Network
King George County, Unincorporated Areas	Muddy Creek	Light Detection and Ranging data (LiDAR)	22.3 cm RMSEz	2 feet at 95% confidence level	Virginia Geographic Information Network
King George County, Unincorporated Areas	Pototmac River, Rappahannock River, Upper Machodoc Creek	Light Detection and Ranging data (LiDAR)	0.49 ft RMSEz	3.28 feet at 95% confidence level	FEMA 2015

BFEs shown at cross sections on the FIRM represent the 1-percent-annual-chance water surface elevations shown on the Flood Profiles and in the Floodway Data tables in the FIS Report. Rounded whole-foot elevations may be shown on the FIRM in coastal areas, areas of ponding, and other areas with static base flood elevations.

Table 23: Floodway Data

[Not Applicable to this Flood Risk Project]

Table 24: Flood Hazard and Non-Encroachment Data for Selected Streams

[Not Applicable to this Flood Risk Project]

6.4 Coastal Flood Hazard Mapping

Flood insurance zones and BFEs including the wave effects were identified on each transect based on the results from the onshore wave hazard analyses. Between transects, elevations were interpolated using topographic maps, land-use and land-cover data, and knowledge of coastal flood processes to determine the aerial extent of flooding. Sources for topographic data are shown in Table 22.

Zone VE is subdivided into elevation zones and BFEs are provided on the FIRM.

The limit of Zone VE shown on the FIRM is defined as the farthest inland extent of any of these criteria (determined for the 1-percent-annual-chance flood condition):

- The *primary frontal dune zone* is defined in 44 CFR Section 59.1 of the NFIP regulations. The primary frontal dune represents a continuous or nearly continuous mound or ridge of sand with relatively steep seaward and landward slopes that occur immediately landward and adjacent to the beach. The primary frontal dune zone is subject to erosion and overtopping from high tides and waves during major coastal storms. The inland limit of the primary frontal dune zone occurs at the point where there is a distinct change from a relatively steep slope to a relatively mild slope.
- The *wave runup zone* occurs where the (eroded) ground profile is 3.0 feet or more below the 2-percent wave runup elevation.
- The *wave overtopping splash zone* is the area landward of the crest of an overtopped barrier, in cases where the potential 2-percent wave runup exceeds the barrier crest elevation by 3.0 feet or more.
- The *breaking wave height zone* occurs where 3-foot or greater wave heights could occur (this is the area where the wave crest profile is 2.1 feet or more above the total stillwater elevation).

- The *high-velocity flow zone* is landward of the overtopping splash zone (or area on a sloping beach or other shore type), where the product of depth of flow times the flow velocity squared (hv^2) is greater than or equal to 200 ft^3/sec^2. This zone may only be used on the Pacific Coast.

The SFHA boundary indicates the limit of SFHAs shown on the FIRM as either “V” zones or “A” zones.

Table 25 indicates the coastal analyses used for floodplain mapping and the criteria used to determine the inland limit of the open-coast Zone VE and the SFHA boundary at each transect.

Table 25: Summary of Coastal Transect Mapping Considerations

Coastal Transect	Primary Frontal Dune (PFD) Identified	Wave Runup Analysis Zone Designation and BFE (ft NAVD88)	Wave Height Analysis Zone Designation and BFE (ft NAVD88)	Zone VE Limit	SFHA Boundary
1		N/A	AE 8-6	N/A	SWEL
2		N/A	VE 9-8 AE 8-6	Wave Height	SWEL
3		VE 9	VE 9-8 AE 8-6	Runup	Runup
4		VE 13	VE 9-8 AE 8-6	Runup	Runup
5		N/A	VE 9-8 AE 8-6	Wave Height	SWEL
6		VE 9	VE 9-8 AE 8-6	Runup	Runup
7		VE 15	VE 9-8 AE 8-6	Runup	Runup
8		VE 10	VE 9-8 AE 8-6	Runup	Runup
9		VE 9	VE 9-8 AE 8-6	Runup	Runup
10		VE 9	VE 9-8 AE 8-6	Runup	Runup
11		N/A	VE 9-8 AE 8-6	Wave Height	SWEL

Table 25: Summary of Coastal Transect Mapping Considerations – continued

Coastal Transect	Primary Frontal Dune (PFD) Identified	Wave Runup Analysis Zone Designation and BFE (ft NAVD88)	Wave Height Analysis Zone Designation and BFE (ft NAVD88)	Zone VE Limit	SFHA Boundary
12		VE 13	VE 9-8 AE 8-6	Runup	Runup
13		N/A	VE 9-8 AE 8-6	Wave Height	SWEL
14		N/A	VE 9-8 AE 8-6	Wave Height	SWEL
15		N/A	VE 9-8 AE 8-6	Wave Height	SWEL
16		VE 8	VE 8 AE 8-6	Runup	Runup
17		VE 9	VE 9-8 AE 8-6	Runup	Runup
18		VE 10	VE 9-8 AE 8-6	Runup	Runup
19		N/A	VE 9-8 AE 8-6	Wave Height	SWEL
20		VE 14	VE 9-8 AE 8-6	Runup	Runup
21		N/A	VE 8 AE 8-6	Wave Height	SWEL
22		N/A	VE 9-8 AE 8-6	Wave Height	SWEL
23		VE 9	VE 9-8 AE 8-6	Runup	Runup
24		AE 7	VE 8 AE 8-6	Wave Height	Runup
25		VE 11	VE 9-8 AE 8-6	Runup	Runup
26		AE 7	VE 9-8 AE 8-6	Wave Height	Runup
27		VE 9	VE 9-8 AE 8-6	Runup	Runup

Table 25: Summary of Coastal Transect Mapping Considerations – continued

Coastal Transect	Primary Frontal Dune (PFD) Identified	Wave Runup Analysis Zone Designation and BFE (ft NAVD88)	Wave Height Analysis Zone Designation and BFE (ft NAVD88)	Zone VE Limit	SFHA Boundary
28		VE 14	VE 9-8 AE 8-6	Runup	Runup
29		VE 9	VE 9-8 AE 8-6	Runup	Runup
30		VE 11	VE 9-8 AE 8-6	Runup	Runup
31		VE 13	VE 9-8 AE 8-6	Runup	Runup
32		VE 9	VE 9-8 AE 8-6	Runup	Runup
33		N/A	VE 9-8 AE 8-6	Wave Height	SWEL
34		VE 13	VE 9-8 AE 8-6	Runup	Overtopping
35		AE 7	VE 9-8 AE 8-6	Wave Height	Runup

A LiMWA boundary has also been added in coastal areas subject to wave action for use by local communities in safe rebuilding practices. The LiMWA represents the approximate landward limit of the 1.5-foot breaking wave.

6.5 FIRM Revisions

This FIS Report and the FIRM are based on the most up-to-date information available to FEMA at the time of its publication; however, flood hazard conditions change over time. Communities or private parties may request flood map revisions at any time. Certain types of requests require submission of supporting data. FEMA may also initiate a revision. Revisions may take several forms, including Letters of Map Amendment (LOMAs), Letters of Map Revision Based on Fill (LOMR-Fs), Letters of Map Revision (LOMRs) (referred to collectively as Letters of Map Change (LOMCs)), Physical Map Revisions (PMRs), and FEMA-contracted restudies. These types of revisions are further described below. Some of these types of revisions do not result in the republishing of the FIS Report. To assure that any user is aware of all revisions, it is advisable to contact the community repository of flood-hazard data (shown in Table 30, "Map Repositories").

6.5.1 Letters of Map Amendment

A LOMA is an official revision by letter to an effective NFIP map. A LOMA results from an administrative process that involves the review of scientific or technical data submitted by the owner or lessee of property who believes the property has incorrectly been included in a designated SFHA. A LOMA amends the currently effective FEMA map and establishes that a specific property is not located in a SFHA.

To obtain an application for a LOMA, visit www.fema.gov/flood-maps/change-your-flood-zone and download the form "MT-1 Application Forms and Instructions for Conditional and Final Letters of Map Amendment and Letters of Map Revision Based on Fill". Visit the "Flood Map-Related Fees" section to determine the cost, if any, of applying for a LOMA.

FEMA offers a tutorial on how to apply for a LOMA. The LOMA Tutorial Series can be accessed at www.fema.gov/flood-maps/tutorials.

For more information about how to apply for a LOMA, call the FEMA Mapping and Insurance eXchange; toll free, at 1-877-FEMA MAP (1-877-336-2627).

6.5.2 Letters of Map Revision Based on Fill

A LOMR-F is an official revision by letter to an effective NFIP map. A LOMR-F states FEMA's determination concerning whether a structure or parcel has been elevated on fill above the base flood elevation and is, therefore, excluded from the SFHA.

Information about obtaining an application for a LOMR-F can be obtained in the same manner as that for a LOMA, by visiting www.fema.gov/flood-maps/change-your-flood-zone for the "MT-1 Application Forms and Instructions for Conditional and Final Letters of Map Amendment and Letters of Map Revision Based on Fill" or by calling the FEMA Mapping and Insurance eXchange, toll free, at 1-877-FEMA MAP (1-877-336-2627). Fees for applying for a LOMR-F, if any, are listed in the "Flood Map-Related Fees" section.

A tutorial for LOMR-F is available at www.fema.gov/flood-maps/tutorials.

6.5.3 Letters of Map Revision

A LOMR is an official revision to the currently effective FEMA map. It is used to change flood zones, floodplain and floodway delineations, flood elevations and planimetric features. All requests for LOMRs should be made to FEMA through the chief executive officer of the community, since it is the community that must adopt any changes and revisions to the map. If the request for a LOMR is not submitted through the chief executive officer of the community, evidence must be submitted that the community has been notified of the request.

To obtain an application for a LOMR, visit www.fema.gov/flood-maps/change-your-flood-zone and download the form "MT-2 Application Forms and Instructions for Conditional Letters of Map Revision and Letters of Map Revision". Visit the "Flood Map-Related Fees" section to determine the cost of applying for a LOMR. For more information about how to apply for a LOMR, call the FEMA Mapping and Insurance eXchange; toll free, at 1-877-FEMA MAP (1-877-336-2627) to speak to a Map Specialist.

Previously issued mappable LOMCs (including LOMRs) that have been incorporated into the King George County FIRM are listed in Table 26.

Table 26: Incorporated Letters of Map Change

[Not Applicable to this Flood Risk Project]

6.5.4 Physical Map Revisions

A Physical Map Revisions (PMR) is an official republication of a community's NFIP map to effect changes to base flood elevations, floodplain boundary delineations, regulatory floodways and planimetric features. These changes typically occur as a result of structural works or improvements, annexations resulting in additional flood hazard areas or correction to base flood elevations or SFHAs.

The community's chief executive officer must submit scientific and technical data to FEMA to support the request for a PMR. The data will be analyzed and the map will be revised if warranted. The community is provided with copies of the revised information and is afforded a review period. When the base flood elevations are changed, a 90-day appeal period is provided. A 6-month adoption period for formal approval of the revised map(s) is also provided.

For more information about the PMR process, please visit www.fema.gov and visit the Floods & Maps "Change Your Flood Zone Designation" section.

6.5.5 Contracted Restudies

The NFIP provides for a periodic review and restudy of flood hazards within a given community. FEMA accomplishes this through a national watershed-based mapping needs assessment strategy, known as the Coordinated Needs Management Strategy (CNMS). The CNMS is used by FEMA to assign priorities and allocate funding for new flood hazard analyses used to update the FIS Report and FIRM. The goal of CNMS is to define the validity of the engineering study data within a mapped inventory. The CNMS is used to track the assessment process, document engineering gaps and their resolution, and aid in prioritization for using flood risk as a key factor for areas identified for flood map updates. Visit www.fema.gov to learn more about the CNMS or contact the FEMA Regional Office listed in Section 8 of this FIS Report.

6.5.6 Community Map History

The current FIRM presents flooding information for the entire geographic area of King George County. Previously, separate FIRMs, Flood Hazard Boundary Maps (FHBMs) and/or Flood Boundary and Floodway Maps (FBFMs) may have been prepared for the incorporated communities and the unincorporated areas in the county that had identified SFHAs. Current and historical data relating to the maps prepared for the project area are presented in Table 27, "Community Map History." A description of each of the column headings and the source of the date is also listed below.

- *Community Name* includes communities falling within the geographic area shown on the FIRM, including those that fall on the boundary line, nonparticipating communities, and communities with maps that have been rescinded. Communities with No Special Flood Hazards are indicated by a footnote. If all maps (FHBM, FBFM, and FIRM) were rescinded for a community, it is not listed in this table unless SFHAs have been identified in this community.

- *Initial Identification Date (First NFIP Map Published)* is the date of the first NFIP map that identified flood hazards in the community. If the FHBM has been converted to a FIRM, the initial FHBM date is shown. If the community has never been mapped, the upcoming effective date or "pending" (for Preliminary FIS Reports) is shown. If the community is listed in Table 27 but not identified on the map, the community is treated as if it were unmapped.

- *Initial FHBM Effective Date* is the effective date of the first FHBM. This date may be the same date as the Initial NFIP Map Date.

- *FHBM Revision Date(s)* is the date(s) that the FHBM was revised, if applicable.

- *Initial FIRM Effective Date* is the date of the first effective FIRM for the community.

- *FIRM Revision Date(s)* is the date(s) the FIRM was revised, if applicable. This is the revised date that is shown on the FIRM panel, if applicable. As countywide studies are completed or revised, each community listed should have its FIRM dates updated accordingly to reflect the date of the countywide study. Once the FIRMs exist in countywide format, as PMRs of FIRM panels within the county are completed, the FIRM Revision Dates in the table for each community affected by the PMR are updated with the date of the PMR, even if the PMR did not revise all the panels within that community.

The initial effective date for the King George County FIRMs in countywide format was 03/16/2009.

Table 27: Community Map History

Community Name	Initial Identification Date	Initial FHBM Effective Date	FHBM Revision Date(s)	Initial FIRM Effective Date	FIRM Revision Date(s)
King George County, Unincorporated Areas	02/21/1975	02/21/1975	04/30/1982	12/15/1990	12/02/2021 02/18/2015 03/16/2009

SECTION 7.0 – CONTRACTED STUDIES AND COMMUNITY COORDINATION

7.1 Contracted Studies

Table 28 provides a summary of the contracted studies, by flooding source, that are included in this FIS Report.

Table 28: Summary of Contracted Studies Included in this FIS Report

Flooding Source	FIS Report Dated	Contractor	Number	Work Completed Date	Affected Communities
Coastal Flooding - Potomac River, Rappahannock River, Upper Machodoc Creek	02/18/2015	USACE	HSFEHQ-09-D-0369	05/01/2010 05/13/2011 04/29/2013 06/05/2013	King George County, Unincorporated Areas
Riverine Flooding in King George County (Zone A)	12/02/2021	STARR II	HSFE03-16-J-0205	11/30/2017	King George County, Unincorporated Areas
Muddy Creek (Zone AE)	12/02/2021	USACE - Baltimore District	HSFE60-15-D-0005	12/17/2018	King George County, Unincorporated Areas

7.2 Community Meetings

The dates of the community meetings held for this Flood Risk Project and previous Flood Risk Projects are shown in Table 29. These meetings may have previously been referred to by a variety of names (Community Coordination Officer (CCO), Scoping, Discovery, etc.), but all meetings represent opportunities for FEMA, community officials, study contractors, and other invited guests to discuss the planning for and results of the project.

Table 29: Community Meetings

Community	FIS Report Dated	Date of Meeting	Meeting Type	Attended By
King George County, Unincorporated Areas	02/18/2015	09/19/2013	Final CCO Meeting	FEMA, King George County, Virginia Department of Conservation and Recreation (VADCR), U.S. Army Corps of Engineers (USACE), the study contractor
King George County, Unincorporated Areas	12/02/2021	09/19/2017	Discovery	FEMA, King George County, VADCR, Compass, Resilience Action Partners, USHUD, Northern Neck Planning Commission
		02/25/2019	Flood Risk Review Meeting (FRR)	FEMA, King George County, VADCR, Compass, Resilience Action Partners
		02/18/2020	Final CCO Meeting	FEMA, King George County, VADCR, Compass, Resilience Action Partners

SECTION 8.0 – ADDITIONAL INFORMATION

Information concerning the pertinent data used in the preparation of this FIS Report can be obtained by submitting an order with any required payment to the FEMA Engineering Library. For more information on this process, see www.fema.gov.

Table 30 is a list of the locations where FIRMs for King George County can be viewed. Please note that the maps at these locations are for reference only and are not for distribution. Also, please note that only the maps for the community listed in the table are available at that particular repository. A user may need to visit another repository to view maps from an adjacent community.

Table 30: Map Repositories

Community	Address	City	State	Zip Code
King George County, Unincorporated Areas	King George Community Development Department 10459 Courthouse Drive, Suite 104	King George	Virginia	22485

The National Flood Hazard Layer (NFHL) dataset is a compilation of effective FIRM Databases and LOMCs. Together they create a GIS data layer for a State or Territory. The NFHL is updated as studies become effective and extracts are made available to the public monthly. NFHL data can be viewed or ordered from the website shown in Table 31.

Table 31 contains useful contact information regarding the FIS Report, the FIRM, and other relevant flood hazard and GIS data. In addition, information about the State NFIP Coordinator and GIS Coordinator is shown in this table. At the request of FEMA, each Governor has designated an agency of State or territorial government to coordinate that State's or territory's NFIP activities. These agencies often assist communities in developing and adopting necessary floodplain management measures. State GIS Coordinators are knowledgeable about the availability and location of State and local GIS data in their state.

Table 31: Additional Information

FEMA and the NFIP	
FEMA and FEMA Engineering Library website	www.fema.gov/national-flood-insurance-program-flood-hazard-mapping/engineering-library
NFIP website	www.fema.gov/national-flood-insurance-program
NFHL Dataset	msc.fema.gov
FEMA Region III	Federal Regional Center 615 Chestnut Street One Independence Mall, Sixth Floor Philadelphia, PA 19106-4404 (215) 931-5500

Table 31: Additional Information – continued

Other Federal Agencies	
USGS website	www.usgs.gov
Hydraulic Engineering Center website	www.hec.usace.army.mil
State Agencies and Organizations	
State NFIP Coordinator	Wendy C. Howard Cooper Director, Dam Safety and Floodplain Management State NFIP Coordinator Department of Conservation and Recreation 600 East Main Street, 24th Floor Richmond, Virginia 23219 Office (804) 786-5099
State GIS Coordinator	Stuart Blankenship, Geospatial Projects Mgr. Integrated Services Program VITA, Virginia Geographic Information Network (VGIN) 11751 Meadowville Lane Chester, VA 23836 Phone: (804) 416-6208 stuart.blankenship@vita.virginia.gov

SECTION 9.0 – BIBLIOGRAPHY AND REFERENCES

Table 32 includes sources used in the preparation of and cited in this FIS Report as well as additional studies that have been conducted in the study area.

Table 32: Bibliography and References

Citation in this FIS	Publisher/ Issuer	*Publication Title,* "Article," Volume, Number, etc.	Author/Editor	Place of Publication	Publication Date/ Date of Issuance	Link
COMPASS (2019)	Federal Emergency Management Agency	Revised LiMWA with data from MIP case: 12-03-0387S	Compass	Washington, D.C.	07/08/2019	https://msc.fema.gov
FEMA (2018)	Federal Emergency Management Agency	Updated study for King George County, VA	COMPASS	Washington, D.C.	2018	http://hazards.fema.gov
FEMA (2014)	Federal Emergency Management Agency	NFHL Layers	Federal Emergency Management Agency	Washington, D.C.	02/18/2015	http://hazards.fema.gov
FEMA (2015)	Federal Emergency Management Agency	Flood Insurance Study King George County, Virginia (All Jurisdictions)	Federal Emergency Management Agency	Washington, D.C.	02/18/2015	http://hazards.fema.gov
HUC8 (2016)	U.S. Geological Survey	The Watershed Boundary Dataset (WBD)	U.S. Geological Survey - USGS	Reston,VA	2016	http://www.usgs.gov
USACE (2018)	U.S. Army Corps of Engineers	Stafford County, Virginia Zone AE Reaches	U.S. Army Corps of Engineers	Washington, D.C.	12/17/2018	
USCB (2017)	U.S. Census Bureau	2017 TIGER/Line Data	U.S. Census Bureau	Washington, D.C.	06/01/2017	http://hazards.fema.gov
VGIN (2017_1)	Virginia Geographic Information Network	Virginia Orthophotography	Virginia Geographic Information Network	Richmond, VA	03/23/2017	vgin.maps.arcgis.com
VGIN (2017_2)	Virginia Geographic Information Network	Virginia Administrative Boundaries - Data Standard Schema	Virginia Geographic Information Network	Richmond, VA	08/14/2017	vgin.maps.arcgis.com