COMMONWEALTH of VIRGINIA

DEPARTMENT OF TRANSPORTATION

Stephen C. Brich, P.E.
Commissioner

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December 30, 2024

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Secretary of Transportation
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The Honorable Travis A. Voyles
Secretary of Natural and Historic Resources
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The Honorable L. Louise Lucas
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The Honorable Kelly K. Convirs-Fowler
Vice Chair, Joint Subcommittee on Recurrent Flooding
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P.O. Box 6769
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Secretaries and Members of the Virginia General Assembly:

On behalf of the Virginia Department of Transportation (VDOT), I am submitting this update required by Item 437 (D) of Chapter 2 of the 2024 Special Session I Acts of Assembly (the "Appropriation Act"). In 2019, VDOT's Virginia Transportation Research Council (VTRC) entered into an agreement with the Virginia Institute of Marine Science (VIMS) for a five-year study to develop a strategy for understanding and addressing sea level rise, land subsidence, and recurrent flooding impacts on road infrastructure (the "VIMS Study"). The Appropriation Act directed VDOT, with the assistance of VIMS, to provide an annual update on the status of the "Coastal Virginia Transportation Infrastructure Inundation Study" including: (i) progress on identification of at-risk rural, suburban and urban infrastructure; (ii) planning and options to

mitigate or eliminate the identified risks; and (iii) a report on remaining work and an estimated time frame for completion.

In accordance with the agreement and pursuant to the Appropriation Act, the attached update/report has been developed to summarize the completed VIMS Study and any significant findings for December 2023 – December 2024 ("Study Year Five"). The VIMS Study was completed in September 2024.

Please find attached the final update requested by Chapter 2, Item 437 (D). If you have any questions regarding this update, please do not hesitate to reach out to Mr. Christopher Swanson, Environmental Division Director, by emailing him at chris.swanson@VDOT.Virginia.gov or by calling 804-786-6839.

Sincerely,

Stephen C. Brich

Stephen C. Brich, P.E.
Commissioner of Highways

ANNUAL UPDATE

Coastal Virginia Transportation Infrastructure Inundation Study

December 2023 – December 2024

VDOT
Virginia Department of Transportation

ANNUAL UPDATE
Coastal Virginia Transportation Infrastructure Inundation Study
December 2023 – December 2024
Virginia Department of Transportation

EXECUTIVE SUMMARY

This report has been developed in response to Item 437 (D) of Chapter 2 of the 2024 Special Session I Acts of Assembly (the "Appropriation Act"). The Appropriation Act directed the Virginia Department of Transportation (VDOT or the "Department"), with the assistance of the Virginia Institute for Marine Science (VIMS), to provide an annual update on the status of the "Coastal Virginia Transportation Infrastructure Inundation Study" including: an up-to-date identification of at-risk rural, suburban and urban infrastructure, and planning and options to mitigate or eliminate the identified risks; and a report on what work remains to be completed and estimated time frame for the completion of its work.

In 2019, VDOT's Virginia Transportation Research Council (VTRC) entered into an agreement with VIMS requesting that VIMS conduct a five-year study to develop a strategy for understanding and addressing sea level rise, land subsidence, and recurrent flooding impacts on existing and planned road infrastructure, as well as how that infrastructure will impact natural ecosystems in Virginia's coastal zone as the climate changes (the "VIMS Study"). The Appropriation Act, Chapter 51 of the 2021 Special Session I Acts of the General Assembly, and other related legislation prompted VDOT to evaluate the vulnerability of its current and planned infrastructure with respect to changing environmental conditions and evaluate strategies to enhance its resilience. Thus, alongside the VIMS Study, VDOT has independently developed a statewide *Virginia Department of Transportation's (VDOT) Resilience Plan (Version 1.0, November 2022)* (the "Resilience Plan"). This report summarizes the overall cumulative progress of the VIMS Study, provides an update on significant findings made since the submission of last year's Annual Update in December 2023 ("Study Year Five"), and identifies how data from the VIMS Study is being integrated into VDOT's statewide resilience efforts to manage risks to transportation infrastructure.

In the most recent Study Year Five, which is also the final year of the VIMS Study, VIMS completed the development of a network flooding analysis for Tidewater, Virginia, as defined in Va. Code § 62.1-44.15:68, and the remaining localities of Planning District 8 (collectively, the "Coastal Zone"). The network flooding analysis developed by VIMS measures the inaccessibility of road networks based on flooding intervals of 0.5 feet increments, up to 10 feet of inundation. The analysis classifies the degree of road network accessibility to selected priority destinations ("Source Points") at a minimum flood level of 0.5 feet water depth[1] on the roadway. Primarily comprised of VDOT's maintenance facilities, this final set of Source Points was chosen to determine the accessibility of those locations to surrounding impacted roadways needing repair during flood events at various flood level depths. An additional analysis was done in Study Year Five, to include hospitals and health centers as Source Points around the Coastal Zone.

[1] For the purposes of this report, a road is inaccessible when more than 0.5 feet of flooding covers the centerline of the road. The selection of 0.5 feet as the standard is due to model sensitivity/accuracy and the vertical resolution of the lidar.

VIMS also completed the development of an interactive viewer during Study Year 5, integrating the results from a flood hazard zone assessment, the completed network flooding analyses, and pertinent VDOT infrastructure information. The interactive viewer displays the anticipated duration of flooding across the land surface under different water depths to show which roads are geographically inaccessible from a Source Point to any given end point until the waters recede to less than six inches of water. This data may be used to inform the understanding of the length of travel delay time associated with flooding scenarios. In addition to the impacts of changing weather conditions on existing and planned road infrastructure, VIMS completed their work on examining the impacts of road infrastructure on the natural ecosystems in Virginia's coastal zone. In all, the VIMS Study has delivered the flood hazard zone assessment, network flooding analyses, and infrastructure interactive viewer tool, which are being used to inform and advance the strategies in VDOT's Resilience Plan. The strategies are intended to support the incorporation of resilience in the Department's transportation planning, project development, delivery, operations, maintenance, and asset management efforts. As recommended by VDOT's Resilience Plan, VDOT is developing a further statewide visualization and decision support tool to help identify infrastructure that is at risk to coastal and riverine flooding and landslides. The results of the VIMS Study are being directly incorporated into the methodology for this tool, which is currently in development and expected to be completed and released in mid-2025. The submission of this report concludes the VIMS study and the annual reporting required by legislation.

ANNUAL UPDATE
Coastal Virginia Transportation Infrastructure Inundation Study
December 2023 – September 2024
Virginia Department of
Transportation

INTRODUCTION

This report has been developed in response to Item 437 (D) of Chapter 2 of the 2024 Special Session I Acts of Assembly (the "Appropriation Act"). The Appropriation Act directed the Virginia Department of Transportation (VDOT or the "Department"), with the assistance of the Virginia Institute for Marine Science (VIMS), to provide an annual update on the status of the "Coastal Virginia Transportation Infrastructure Inundation Study" including: an up-to-date identification of at-risk rural, suburban and urban infrastructure, and planning and options to mitigate or eliminate the identified risks; and a report on what work remains to be completed and estimated time frame for the completion of its work.[2]

In 2019, VDOT's Virginia Transportation Research Council (VTRC) entered into an agreement with VIMS requesting that VIMS conduct a five-year study to develop a strategy for understanding and addressing sea level rise, land subsidence, and recurrent flooding impacts on existing and planned road infrastructure, as well as how that infrastructure will impact natural ecosystems in Virginia's coastal zone as the climate changes (the "VIMS Study"). This report summarizes the overall cumulative progress of the VIMS Study, provides an update on significant findings made since the submission of last year's annual update in December 2023 ("Study Year Five"), and identifies how data from the VIMS Study is being incorporated into VDOT's statewide resilience planning efforts to manage identified risks to transportation infrastructure.

I. Identification of At-Risk Rural, Suburban and Urban Infrastructure

A primary component of the VIMS Study is the ultimate development of a tool to identify management strategies for road segments subject to current and future flooding by tidal waters through 2080 in the coastal area, which includes the localities in Tidewater, Virginia, and the remaining localities of Planning District 8 (collectively, the "Coastal Zone"). In the Chesapeake Bay Preservation Act, V "Tidewater Virginia" includes 46 localities: the counties of Accomack, Arlington, Caroline, Charles City, Chesterfield, Essex, Fairfax, Gloucester, Hanover, Henrico, Isle of Wight, James City, King and Queen, King George, King William, Lancaster, Mathews, Middlesex, New Kent, Northampton, Northumberland, Prince George, Prince William, Richmond, Spotsylvania, Stafford, Surry, Westmoreland, and York, and the cities of Alexandria, Chesapeake, Colonial Heights, Fairfax, Falls Church, Fredericksburg, Hampton, Hopewell, Newport News, Norfolk, Petersburg, Poquoson, Portsmouth, Richmond, Suffolk, Virginia Beach, and Williamsburg (Va. Code § 62.1-44.15:68).

[2] More detailed information will be available in the *Virginia Transportation Planning for Sea Level Rise Final Report 2024* prepared by VIMS' Center for Coastal Resources Management for VTRC.

In December 2020 – December 2021 ("Study Year Two"), the geographic scope of the VIMS Study expanded to include the remaining localities of Virginia Planning District 8—Loudoun County and the Cities of Manassas and Manassas Park.[3] The scope of infrastructure evaluated by the VIMS Study in the Coastal Zone has been inclusive of identifying all public at-risk transportation infrastructure, whether occurring in a rural, suburban, or urban area.

The Appropriation Act and other related legislation prompted VDOT to evaluate the vulnerability of its current and planned infrastructure with respect to changing environmental conditions and evaluate strategies to enhance its resilience. Thus, alongside the VIMS Study, VDOT has independently developed a statewide *Virginia Department of Transportation's (VDOT) Resilience Plan (Version 1.0, November 2022)* ("Resilience Plan"), which serves as a roadmap to incorporate a framework of resilience principles in the Department's transportation planning, project development, delivery, operations, maintenance, and asset management efforts. One of the primary objectives of the Resilience Plan, which originated from and is informed by the VIMS Study, is the identification of at-risk infrastructure through the evaluation of vulnerability across current and planned transportation infrastructure. The methodology employed by the Resilience Plan evaluates vulnerability as the degree of risk to which infrastructure is susceptible to various hazards such as flooding. Vulnerability is subjective to the type of infrastructure being assessed and may be evaluated as a function of the asset characteristics including exposure and sensitivity to hazards, criticality, and/or adaptive capacity. Through the Resilience Plan, and with input from the VIMS Study, VDOT is further developing this methodology to evaluate and inventory the vulnerability of transportation assets, which will provide the basis for a systematic, documented approach for the application of resilience strategies to the assets.

VIMS had previously completed an assessment to identify public roads throughout the Coastal Zone that are located within flood hazard zones designated by the Federal Emergency Management Agency (FEMA) during Study Year Two. The flood hazard zones designated by FEMA quantify the risk that a location will be flooded over a given year. For example, the most commonly known 100-year and 500-year flood plains represent flood hazard zones experiencing an annual risk of flooding at greater than or equal to a 1% annual chance and 0.2% annual chance, respectively. The analysis from the flood hazard zone assessment provides valuable information for identification of at-risk transportation infrastructure in the Coastal Zone and helps to further classify road segments and identification of possible management strategies alongside the applicable flooding risk. A summary of the coastal road miles within the various FEMA flood hazard zones is shown below in Table 1. The summary of total road miles within FEMA flood hazard zones by locality is in Appendix A, Table a. The Department is currently evaluating the methodology of the flood hazard zone assessment for the feasibility of extending the model to all Commonwealth localities. This will allow for the continued identification of at-risk infrastructure statewide as well as inform the current and future planning of flood-resistant development and infrastructure.

[3] The geographical expansion of the study was prompted by Chapter 978 of the 2020 Acts of Assembly (HB 1217) which directed VDOT, in collaboration with the Commonwealth Center for Recurrent Flooding Resiliency, to identify public transportation infrastructure under the jurisdiction of VDOT in Planning District 8 at risk of deterioration due to recurrent flooding and to (i) identify the issues related to recurrent flooding and the scope of such issues and (ii) make policy and budget recommendations to alleviate such issues. *See https://rga.lis.virginia.gov/Published/2022/RD125/PDF*

Table 1. Summary of total road miles within FEMA Flood Hazard Zones by locality category.

		Total Road Length *(miles)*	**1% Annual Chance Flood Hazard (all A and V zones)** *(miles)*	**0.2% Annual Chance Flood Hazard** *(miles)*	**Area of Minimal Flood Hazard** *(miles)*
Summary	All Coastal Roads	62,312	3,083	1,498	57,730
	Urban Roads	17,359	1,229	854	15,277
	Suburban Roads	22,590	595	235	21,761
	Rural Roads	22,363	1,259	409	20,692

Study Efforts in Year Five

In the most recent Study Year Five, VIMS completed the development of a network flooding analysis in the Coastal Zone that provides a snapshot of the inaccessibility of road networks during flood events based on flooding intervals of 0.5 feet increments, up to 10 feet of inundation. The analysis classifies the degree of road network accessibility to selected priority destinations ("Source Points") at a minimum flood level of 0.5 feet water depth on the roadway. In its initial phase, VIMS conducted the network flooding analysis for approximately 11,000 miles of roadway in the south Hampton Roads region, with 19 VDOT facilities selected as Source Points. Work continued, with the entire Coastal Zone area being completed by early 2024. A total of 70 Source Points comprised the final set, including the original 19 and an additional 51 VDOT source points for the Eastern Shore (5), Southside (19), Peninsula (8), Middle Peninsula (8), Northern Neck (6), and Northern Virginia (24). Primarily comprised of VDOT's maintenance facilities, this final set of Source Points was chosen to determine the accessibility of those locations to surrounding impacted roadways needing repair during flood events at various flood level depths. An additional analysis was done in Study Year Five, to use hospitals and health centers as Source Points throughout the Coastal Zone. VIMS also developed a layer that shows the anticipated duration of flooding across the land surface under different water levels to show which roads are geographically inaccessible from a VDOT facility to any given end point until the waters recede to less than six inches of water. This information will help inform the understanding of the length of travel delay time associated with flooding. Although the snapshot measure of accessibility provided from VIMS' coastal network flooding analysis differs in purpose from the forward-looking statewide vulnerability tool developed by VDOT, the resulting collaboration improves the identification of, and response to, flooding risk.

As part of the VIMS Study, VIMS was tasked to develop an infrastructure interactive viewer to display asset information on selected road segments and serve as part of a planning portal for VDOT. In Study Year Five, VIMS completed the viewer (Figure 1) with feedback from VDOT and integrated results from the flood hazard zone assessment and the currently completed network flooding analyses with pertinent VDOT infrastructure information. The viewer is a nimble visualization tool displaying asset information by road segment, including road category, pavement type, road ownership (e.g., city highway agency), pavement condition assessment,

annual average daily traffic, future projects from the Six-Year Improvement Program (SYIP), and potential use as an evacuation route. It can summarize information in an interactive dashboard and print reports. Users can also add their own data into the viewer to include in planning considerations.

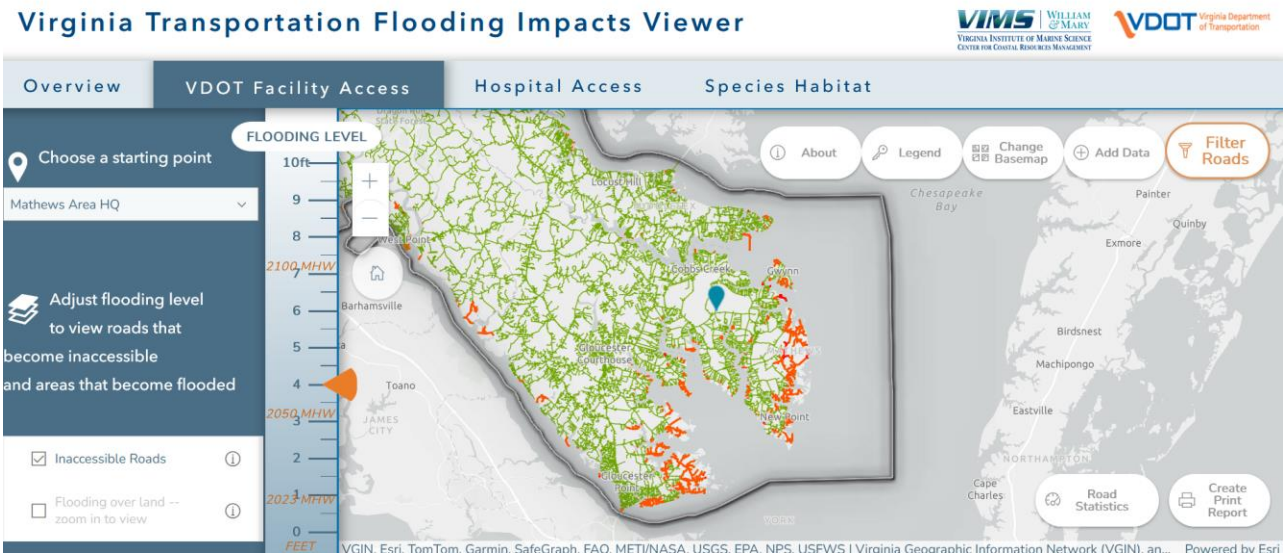


Figure 1. Infrastructure Interactive Viewer showing the roads that are inaccessible from VDOT's Mathews Area Headquarters at 4 feet of flooding. A total of 163 miles of roadway within the southside region will be inaccessible from the office under these flood conditions. Accessible at Virginia Transportation Flooding Impacts Viewer (vims.edu)

A summary of the scope of road vulnerability derived from the VIMS Study is provided below in Table 2 to highlight the overall impacts to roads due to flooding in each region and showcase the capabilities of the Virginia Transportation Flooding Impacts Viewer ("Viewer"); however, a road network analysis is most usable and interpretable in the geospatial format that the Viewer provides. A summary of the inaccessible and accessible roads affecting access to hospitals and health centers at different flooding levels is included in Appendix A, Table b.

Table 2. Inaccessible/accessible roads by region at current (2023) Mean High Water (MHW) (approximately 1ft of water).

		ROADS AT 2023 MHW (1 FT FLOODING)			
		ACCESSIBLE		INACCESSIBLE	
REGION	CATEGORY	*% OF TOTAL*	*MILES*	*% OF TOTAL*	*MILES*
Southern Hampton Roads	Urban	99.997%	11,273.8	0.003%	0.3
Eastern Shore	Rural	99.950%	2,357	0.050%	1.1
Peninsula	Suburban	100.000%	4,790.1	0.000%	0
Northern Neck	Rural	99.965%	3,123.1	0.035%	1.1
Middle Peninsula	Rural	99.996%	4,865	0.004%	0.2
Northern Virginia	Urban	100.000%	15,023.2	0.000%	0
	Total Urban	99.999%	26,297	0.001%	0.3
	Total Suburban	100.000%	4,790.1	0.000%	0

	ROADS AT 2023 MHW (1 FT FLOODING)			
	ACCESSIBLE		INACCESSIBLE	
Total Rural	99.977%	10,345	0.023%	2.4

The summary shown below in Figure 2 depicts the inaccessible roads by region for various levels of Mean High Water (MHW). Years indicate the approximate time at which sea level will cause these water levels to be exceeded. Within each region, the highest percentage and longest distance of inaccessible roads is shown for each level of MHW. Eastern Shore and Chincoteague Bridge Station are separated in Figure 2 because the combined results are likely to be read as if the entire Eastern Shore is inaccessible by 7 feet of flooding, when that is only true from the station on the other side of the Chincoteague causeway. A summary table of inaccessible/accessible roads by region (except for Northern Virginia because it has 0% or 0 miles of inaccessible roads) for the three ranges of flooding levels is included in Appendix A, Table c, and this data is split by functional class in Appendix A, Table d.

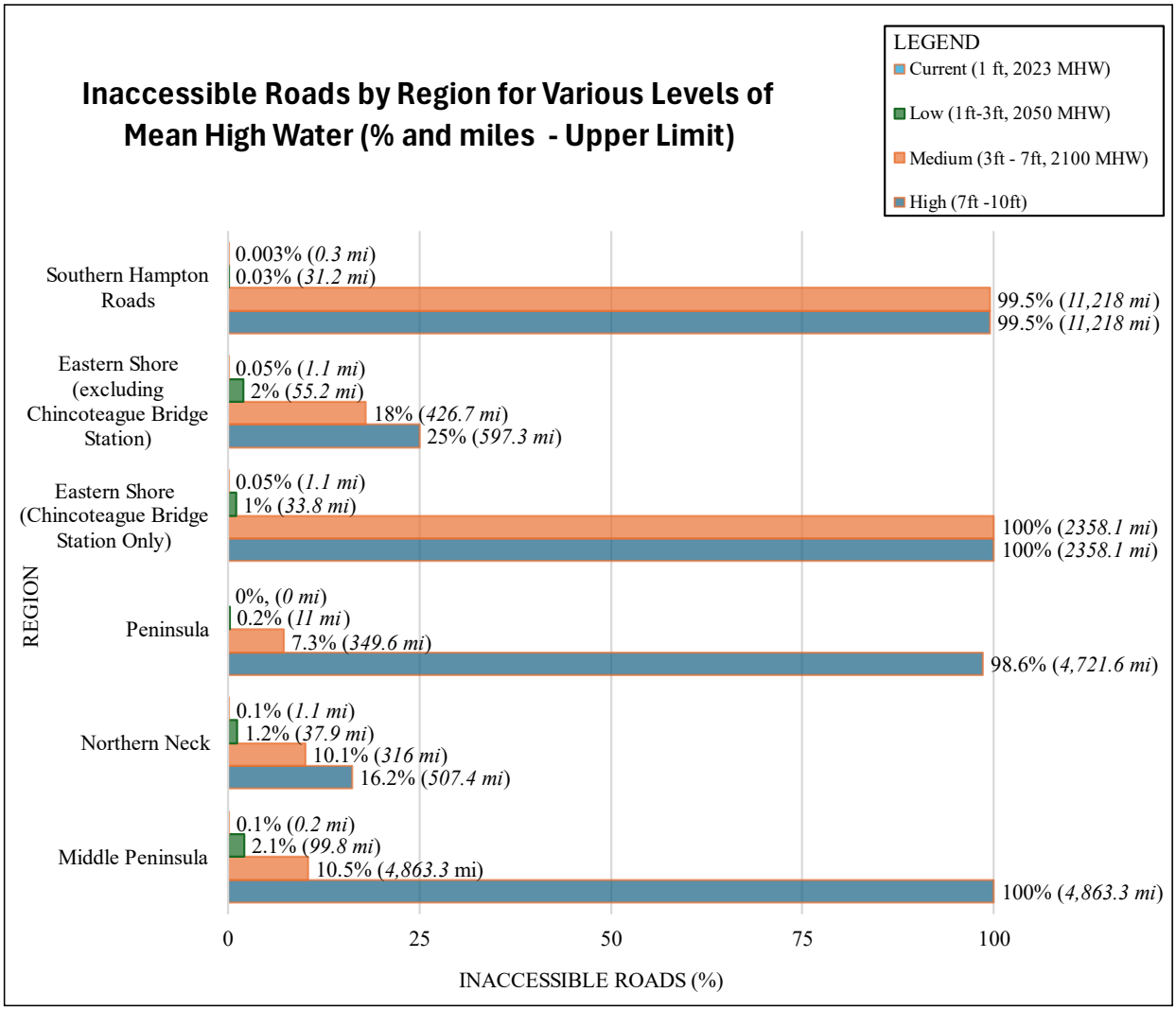
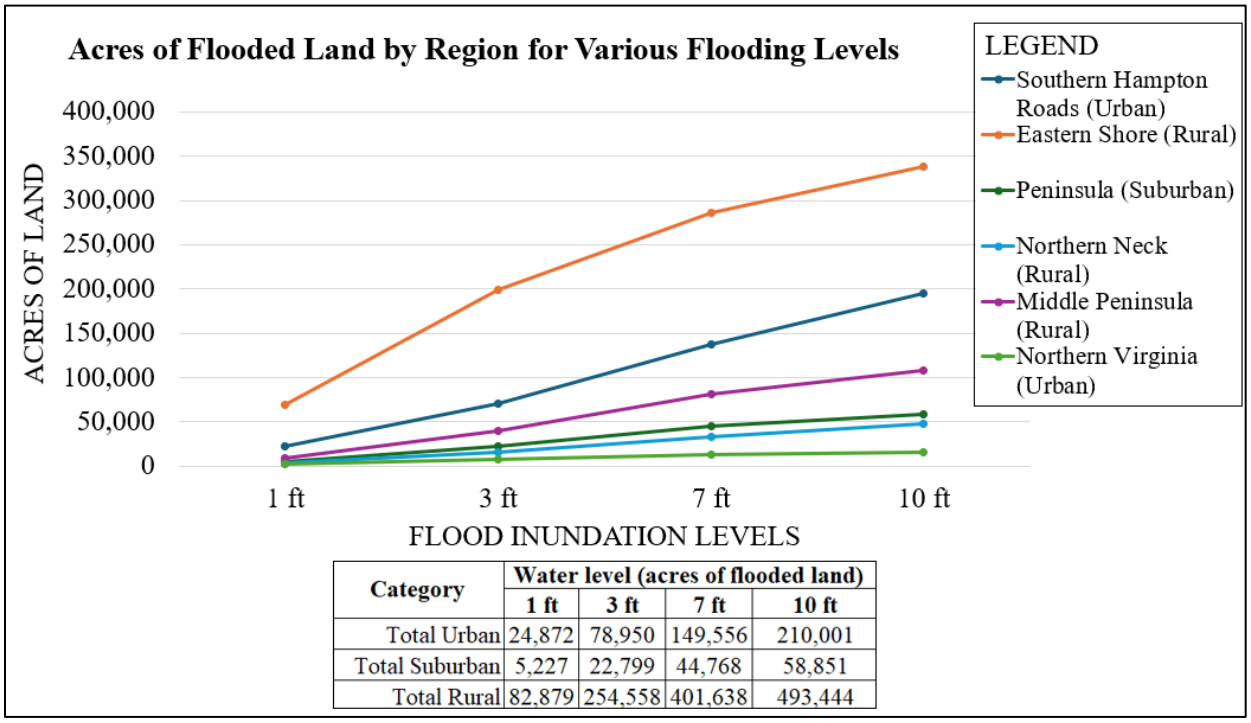


Figure 2. Summary of inaccessible/accessible roads by region for various levels of Mean High Water (MHW).

The acres of flooded land (inundation based on land elevations) by region for four different flooding levels is shown in Figure 3. A summary table of the acres of flooded land by region for the four different flooding levels is included in Appendix A, Table e.



Category	Water level (acres of flooded land)			
	1 ft	3 ft	7 ft	10 ft
Total Urban	24,872	78,950	149,556	210,001
Total Suburban	5,227	22,799	44,768	58,851
Total Rural	82,879	254,558	401,638	493,444

Figure 3. Acres of flooded land (inundation based on land elevations) by region for 4 different flooding levels.

The flooding frequencies for roads in each region is summarized in Figures 4-9. These frequencies were derived from the VIMS Study and highlight the overall impacts to roads due to flooding at different elevations; however, current and future flooding on roads is best viewed geospatially in the Viewer. For the flood frequency analysis, data from NOAA's tide gauges was used to calculate the frequency at which tidal flooding will occur at different elevations. Tide gauge data was taken from the closest gauge to a locality, so some regions are split into multiple sections, all using the same tide gauge. Tidal records from a 19-year period (roughly one tidal epoch) were extracted and the data were analyzed for the frequency of water levels at topographic elevation increments of one foot (NAVD88). Based on the 2017 Intermediate-High numbers with subsidence accounted for elevations of 2.08 feet for 2050 and 6.06 feet for 2100 were added to the tide gauge record to model future flood frequencies. The modeled data was re-analyzed for the frequency of water levels at elevation intervals of one foot (NAVD88). The data can help decision-makers better understand the nature of current flooding and how future flooding trends may affect a specific region or locality over time. A summary table of the mean flooding frequencies for roads in each region is included in Appendix A, Table f.

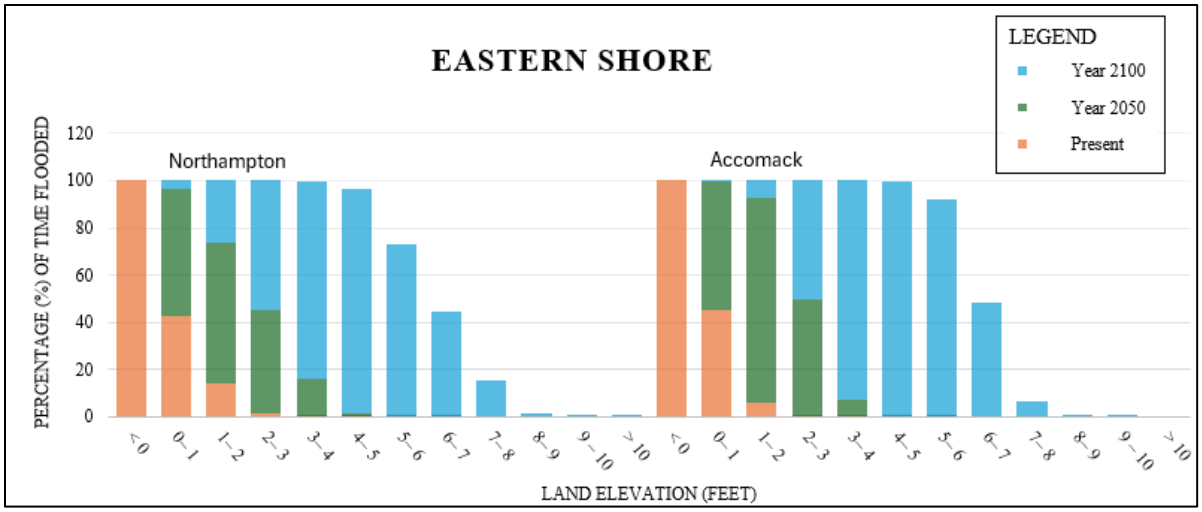


Figure 4. Summary of the mean flooding frequencies for roads in the Eastern Shore region.

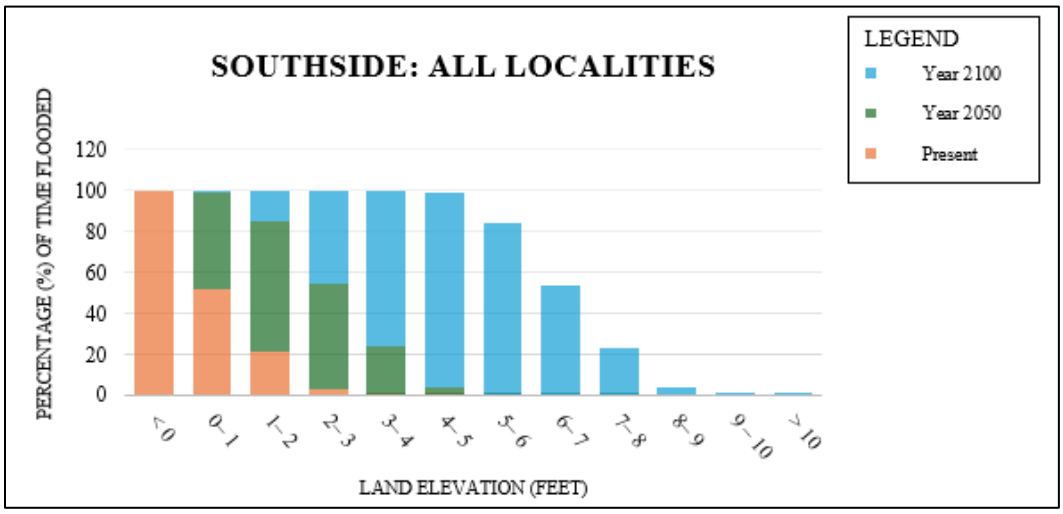


Figure 5. Summary of the mean flooding frequencies for roads in the Southside region.

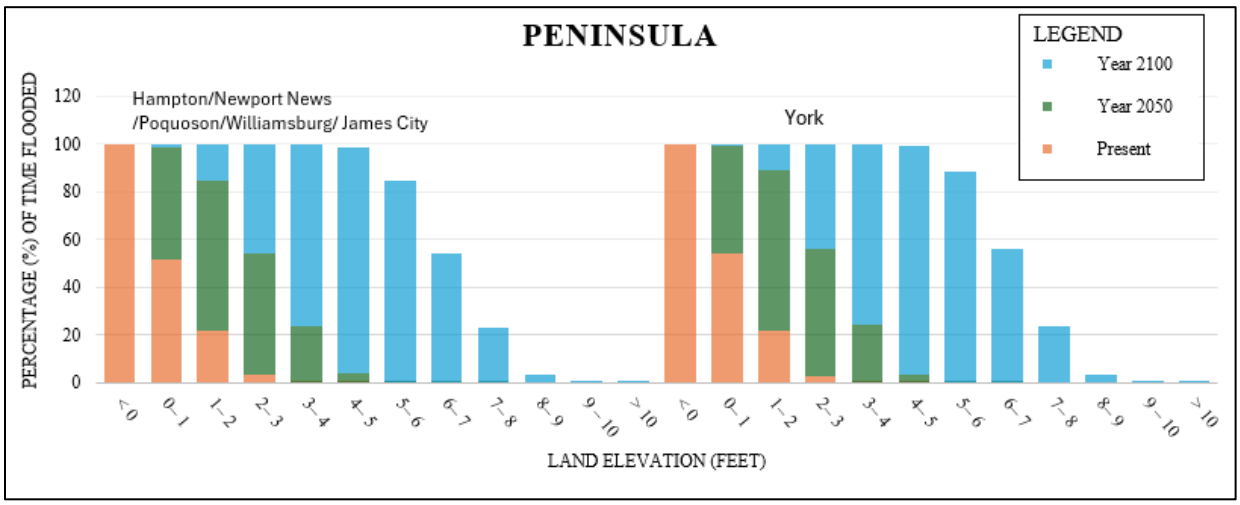


Figure 6. Summary of the mean flooding frequencies for roads in the Peninsula region.

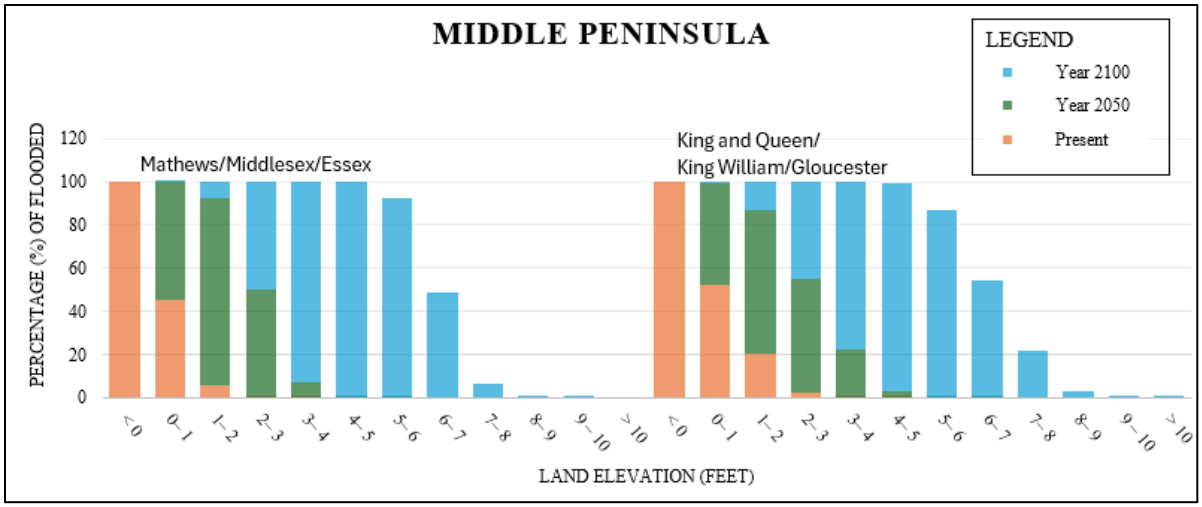


Figure 7. Summary of the mean flooding frequencies for roads in the Middle Peninsula region.

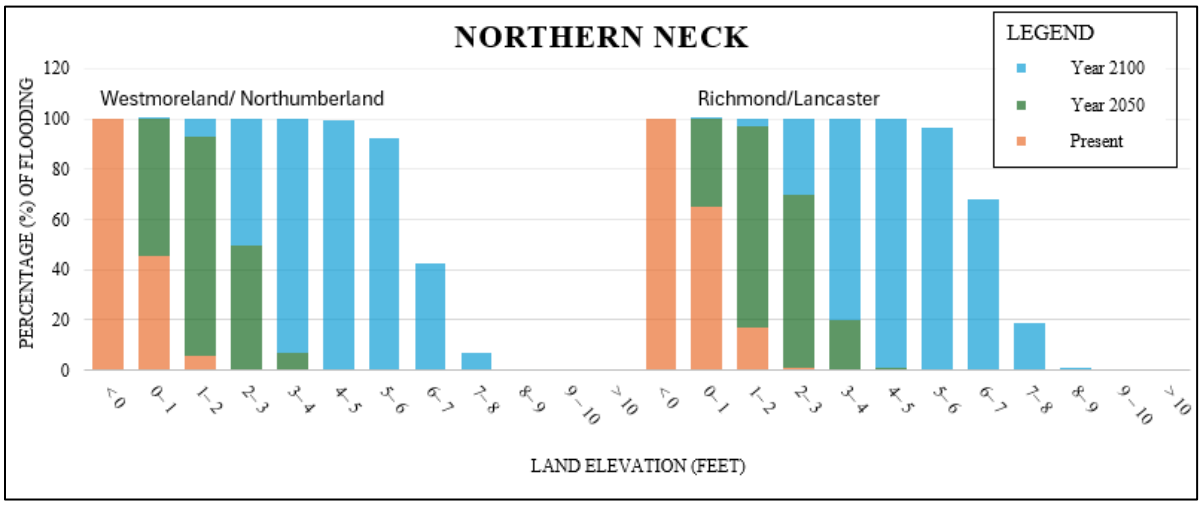


Figure 8. Summary of the mean flooding frequencies for roads in the Northern Neck region.

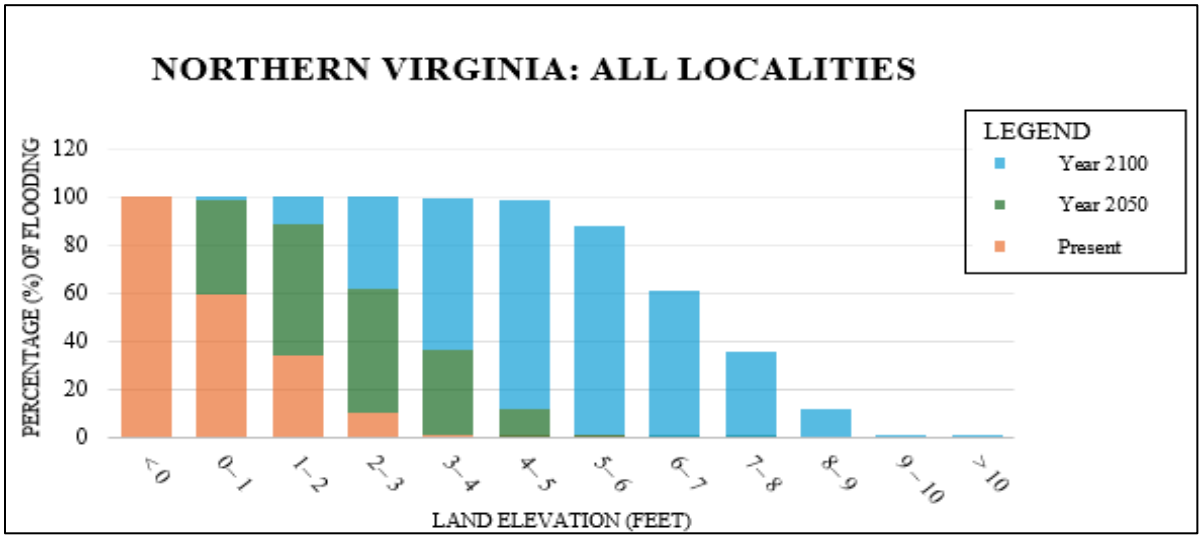


Figure 9. Summary of the mean flooding frequencies for roads in Northern Virginia.

II. Identification of At-Risk Natural Ecosystems

In addition to the impacts of a changing climate on existing and planned road infrastructure, the VIMS Study was tasked with examining the impacts of road infrastructure on the natural ecosystems in Virginia's coastal zone.[4] The goals of the task were to evaluate the extent of the recurrent and future flood impacts on rare, threatened, and endangered (RTE) species and the essential habitats they occupy. VIMS approached this task by undertaking several independent analyses focused on contributing critical data and improving capacity to inform appropriate management strategies that mitigate future land use conflicts.

In Study Year Five, VIMS concluded work on the following: (i) incorporation of species distribution model outputs into an interactive viewer; (ii) development, testing, and launch of a real-time, interactive migratory fish spawning run viewer to allow VDOT employees to understand the potential status of individual anadromous fish species spawning, which may facilitate assessments for time-of-year restrictions (Figure 10); (iii) refinement of future potential marsh habitat in 3-inch intervals up to 4.5 feet of sea level rise; (iv) completion of detailed species information reports for 32 species, including information on life history, demographics, current threats, and the results of previous and ongoing mitigation efforts in Virginia and elsewhere; and (v) the development of an environmental-specific interactive viewer which incorporated all results from this task (Figure 10).

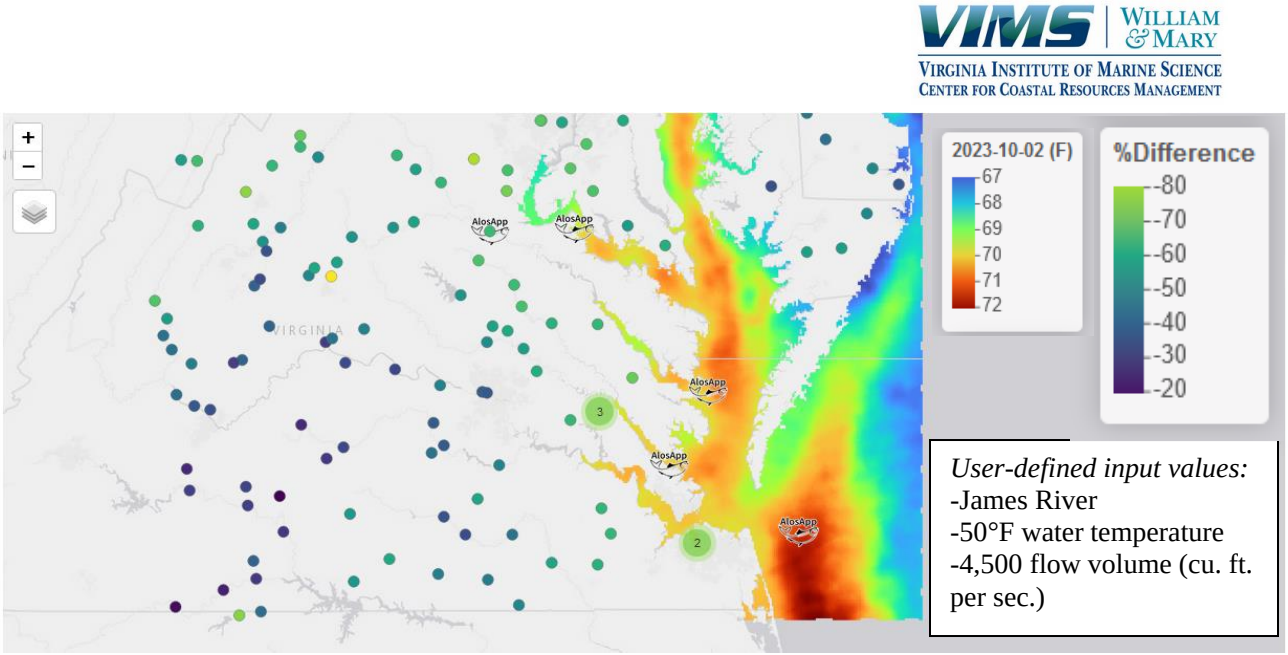


Figure 10. Screenshot of AlosApp, developed as part of this study showing the interactive migratory fish spawning run status prediction tool in support of project planning. Accessible at https://shiny.vims.edu/AlosApp

[4] While this task relates to mitigating risks from transportation infrastructure (rather than risks to transportation infrastructure), it is included here to provide insight on the VIMS Study and the Department's broader resilience planning efforts.

Derived from the VIMS Study, a summary of the number and area of habitats for RTE (rare, threatened, and endangered) and migratory bird species at present and under future conditions in VDOT districts is provided below in Table 3. The number and area of habitats for RTE species, anadromous fish species, and Atlantic sturgeon by watershed (Hydrologic Unit Code (HUC) 12 scale) is included in Appendix A, Table g. While these summaries convey the scope of RTE and migratory bird species habitat throughout Virginia, the species data is more usable and interpretable in the Viewer's geospatial format.

Table 3. Number of coastal RTE (rare, threatened, and endangered) and migratory bird species at present and under future conditions for each VDOT district. % Area is the percentage of the district area that contains some amount of predicted species habitat.

	Present			2050		
District Name	**Species**	**Acres**	**% Area**	**Species**	**Acres**	**% Area**
Bristol	0	0.0	0.0	0	0.0	0.0
Culpepper	0	0.0	0.0	0	0.0	0.0
Fredericksburg	18	972,684.5	37.4	12	1,046,181.1	40.2
Hampton Roads	25	1,648,814.6	42.3	15	1,814,110.3	46.6
Lynchburg	0	0.0	0.0	0	0.0	0.0
Northern Virginia	8	495,152.2	57.8	6	382,470.4	44.7
Richmond	13	616,824.1	17.9	13	783,206.6	22.7
Salem	0	0.0	0.0	0	0.0	0.0
Staunton	2	2.6	0.0	0	0.0	0.0

For each locality in Virginia, the summary in Table 4 highlights the species number and area of habitats for RTE and migratory bird species at present and under future conditions. This data was derived from the VIMS Study, though the Viewer more easily allows a user to explore the area of predicted species habitat.

III. Planning and Options to Mitigate or Eliminate the Identified Risks

One of the main objectives included in VDOT's Resilience Plan is the identification of available resilience practices to mitigate and/or eliminate identified risks to transportation infrastructure throughout planning, design, operations, and maintenance programs. The work from the VIMS Study will contribute to this objective and will be used to inform the development of the required planning and options to address identified at-risk transportation infrastructure throughout the Commonwealth. Further, as discussed above, the results of the VIMS Study are being incorporated into a broader visualization and decision support tool to help identify VDOT's infrastructure at risk from coastal and riverine flooding and landslides in conjunction with VDOT's Resilience Plan. For example, the VIMS Study's flooding frequency dataset (Appendix A, Table f) is being used in the methodology for calculating VDOT's asset vulnerability for coastal flooding hazards, representing 40% of the sensitivity indicator used to estimate the extent to which an asset is affected by a hazard in VDOT's at-risk visualization and decision support tool. Similarly, the VIMS Study's coastal network inundation and connectivity analysis dataset is being used to calculate the vulnerability score for coastal flooding hazard and represents 30% of the adaptive capacity indicator used to estimate the ability of an asset to respond to a hazard in VDOT's at-risk visualization and decision support tool. The flood hazard zone assessment, network flooding analyses, and

infrastructure interactive viewer tool completed by the VIMS Study may be used to help VDOT understand the accessibility of roads from the different VDOT facilities for various flooding depths and in the future to help decision-makers evaluate mitigation options in conjunction with the implementation of the other resilience practices outlined in VDOT's Resilience Plan.

IV. Remaining Work and Estimated Time Frame for Completion

The VIMS Study was completed in September 2024 and the interactive viewer provided by VIMS is complete and operational. The results of the VIMS study are being incorporated in VDOT's statewide, forward-looking at-risk visualization and decision support tool that is currently being developed as part of the implementation of VDOT's Resilience Plan. The results of the VIMS Study may also be used to help VDOT understand the accessibility of roads from the different VDOT facilities for various flooding depths and in the future help inform the appropriate options to mitigate or eliminate identified risks. VDOT's at-risk visualization and decision support tool is anticipated to be completed and released in mid-2025. The submission of this report concludes the VIMS study and the annual reporting required by legislation.

Appendix A: COASTAL VIRGINIA TRANSPORTATION INFRASTRUCTURE INUNDATION STUDY, Summary tables from VDOT viewer

SUMMARIZED ASSESSMENT OF VDOT AND LOCAL ROADS WITHIN FEMA FLOOD HAZARD ZONES

Table a. Summary of total road miles within FEMA flood hazard zones split by locality. All road lengths are rounded to the nearest integer. Blank cells indicate no road segments in that category.

		Total Road Length	**1% Annual Chance Flood Hazard (all A and V zones)**	**0.2% Annual Chance Flood Hazard**	**Area of Minimal Flood Hazard**
		(miles)	*(miles)*	*(miles)*	*(miles)*
Summary	All Coastal Roads	62,309	3,084	1,498	57,728

		Total Road Length	**1% Annual Chance Flood Hazard (all A and V zones)**	**0.2% Annual Chance Flood Hazard**	**Area of Minimal Flood Hazard**
		(miles)	*(miles)*	*(miles)*	*(miles)*
Summary	All Coastal Roads	62,309	3,084	1,498	57,728

		Total Road Length	**1% Annual Chance Flood Hazard (all A and V zones)**	**0.2% Annual Chance Flood Hazard**	**Area of Minimal Flood Hazard**
		(miles)	*(miles)*	*(miles)*	*(miles)*
	Road Type				
Accomack County	Local Main Arteries	152	21	14	117
	Local Secondaries	1,268	350	96	823
	Ramp	0	<1		<1
	US and VA Primary Highways	92	5	0	87
		1,512	**375**	**109**	**1,027**

		Total Road Length	1% Annual Chance Flood Hazard (all A and V zones)	0.2% Annual Chance Flood Hazard	Area of Minimal Flood Hazard
	Road Type	*(miles)*	*(miles)*	*(miles)*	*(miles)*
Alexandria City	Alleys	2	<1	<1	2
	HOV Lanes	1			1
	Limited Access Highway	17	3	1	12
	Local Main Arteries	52	3	3	45
	Local Secondaries	384	13	18	353
	Other	2	<1	<1	2
	Parking Lot Roads	28	1	1	26
	Ramp	20	4	3	13
	US and VA Primary Highways	42	2	1	39
		547	**27**	**27**	**493**

		Total Road Length	1% Annual Chance Flood Hazard (all A and V zones)	0.2% Annual Chance Flood Hazard	Area of Minimal Flood Hazard
	Road Type	*(miles)*	*(miles)*	*(miles)*	*(miles)*
Arlington County	HOV Lanes	5	<1	<1	5
	Limited Access Highway	50	4	5	41
	Local Main Arteries	84	1	2	81
	Local Secondaries	555	8	18	529
	Other	13	1	2	9
	Parking Lot Roads	<1			<1
	Ramp	31	1	1	29
	US and VA Primary Highways	72	1	3	68
		811	**16**	**32**	**763**

		Total Road Length	1% Annual Chance Flood Hazard (all A and V zones)	0.2% Annual Chance Flood Hazard	Area of Minimal Flood Hazard
	Road Type	*(miles)*	*(miles)*	*(miles)*	*(miles)*
Caroline County	Limited Access Highway	32	1		31
	Local Main Arteries	166	8		158
	Local Secondaries	1,544	59		1,484
	Ramp	2			2
	US and VA Primary Highways	135	8		128
		1,879	**76**	**<1**	**1,803**

		Total Road Length	1% Annual Chance Flood Hazard (all A and V zones)	0.2% Annual Chance Flood Hazard	Area of Minimal Flood Hazard
	Road Type	*(miles)*	*(miles)*	*(miles)*	*(miles)*
Charles City County	Local Main Arteries	81	<1		81
	Local Secondaries	397	14	3	380
	Ramp	<1			<1
	US and VA Primary Highways	46	1	<1	45
		524	**16**	**3**	**506**

		Total Road Length	1% Annual Chance Flood Hazard (all A and V zones)	0.2% Annual Chance Flood Hazard	Area of Minimal Flood Hazard
	Road Type	*(miles)*	*(miles)*	*(miles)*	*(miles)*
Chesapeake City	Limited Access Highway	93	9	3	81
	Local Main Arteries	113	6	3	104
	Local Secondaries	1,811	152	93	1,566
	Ramp	47	3	1	43
	US and VA Primary Highways	159	7	7	145
		2,223	**176**	**107**	**1,940**

		Total Road Length	1% Annual Chance Flood Hazard (all A and V zones)	0.2% Annual Chance Flood Hazard	Area of Minimal Flood Hazard
	Road Type	*(miles)*	*(miles)*	*(miles)*	*(miles)*
Chesterfield County	Limited Access Highway	123	6	2	115
	Local Main Arteries	351	10	1	341
	Local Secondaries	2,973	38	8	2,926
	Ramp	62	4	1	56
	US and VA Primary Highways	166	7	<1	159
		3,674	**64**	**13**	**3,597**

		Total Road Length	1% Annual Chance Flood Hazard (all A and V zones)	0.2% Annual Chance Flood Hazard	Area of Minimal Flood Hazard
	Road Type	*(miles)*	*(miles)*	*(miles)*	*(miles)*
Colonial Heights City	Limited Access Highway	7	<1	<1	7
	Local Main Arteries	5	<1	<1	5
	Local Secondaries	112	3	2	106
	Ramp	3	<1		3
	US and VA Primary Highways	8	1	<1	7
		135	**5**	**3**	**128**

		Total Road Length	1% Annual Chance Flood Hazard (all A and V zones)	0.2% Annual Chance Flood Hazard	Area of Minimal Flood Hazard
	Road Type	*(miles)*	*(miles)*	*(miles)*	*(miles)*
Essex County	Local Main Arteries	44	<1		44
	Local Secondaries	866	25	8	832
	Ramp	0			0
	US and VA Primary Highways	90	3		86
		1,000	**28**	**8**	**963**

		Total Road Length	1% Annual Chance Flood Hazard (all A and V zones)	0.2% Annual Chance Flood Hazard	Area of Minimal Flood Hazard
	Road Type	*(miles)*	*(miles)*	*(miles)*	*(miles)*
Fairfax City	Local Main Arteries	6	<1	<1	5
	Local Secondaries	140	4	1	135
	Other	<1			<1
	Parking Lot Roads	<1			<1
	Ramp	<1	<1		<1
	US and VA Primary Highways	23	2	<1	21
		164	**7**	**2**	**156**

		Total Road Length	1% Annual Chance Flood Hazard (all A and V zones)	0.2% Annual Chance Flood Hazard	Area of Minimal Flood Hazard
	Road Type	*(miles)*	*(miles)*	*(miles)*	*(miles)*
Fairfax County	Alleys	<1	<1		<1
	HOV Lanes	30	1		28
	Limited Access Highway	241	7	<1	233
	Local Main Arteries	666	22	1	644
	Local Secondaries	5,042	63	4	4,975
	Other	156	8	<1	148
	Parking Lot Roads	78	2	<1	75
	Ramp	153	7	<1	146
	US and VA Primary Highways	328	14	<1	314
		6,694	**124**	**5**	**6,564**

		Total Road Length	1% Annual Chance Flood Hazard (all A and V zones)	0.2% Annual Chance Flood Hazard	Area of Minimal Flood Hazard
	Road Type	*(miles)*	*(miles)*	*(miles)*	*(miles)*
Falls Church City	US and VA Primary Highways				<1
	Local Secondaries				<1

		Total Road Length	1% Annual Chance Flood Hazard (all A and V zones)	0.2% Annual Chance Flood Hazard	Area of Minimal Flood Hazard
	Road Type	*(miles)*	*(miles)*	*(miles)*	*(miles)*
Fauquier County	Local Main Arteries				<1
	Local Secondaries				<1

		Total Road Length	1% Annual Chance Flood Hazard (all A and V zones)	0.2% Annual Chance Flood Hazard	Area of Minimal Flood Hazard
	Road Type	*(miles)*	*(miles)*	*(miles)*	*(miles)*
Fredericksburg City	Limited Access Highway	7	<1		7
	Local Main Arteries	12	1	1	9
	Local Secondaries	179	4	12	163
	Ramp	5	<1	<1	5
	US and VA Primary Highways	24	2	4	19
		227	**7**	**17**	**202**

		Total Road Length	1% Annual Chance Flood Hazard (all A and V zones)	0.2% Annual Chance Flood Hazard	Area of Minimal Flood Hazard
	Road Type	*(miles)*	*(miles)*	*(miles)*	*(miles)*
Gloucester County	Local Main Arteries	27	<1	<1	27
	Local Secondaries	992	137	76	779
	Other	45	3	1	41
	Ramp	<1			<1
	US and VA Primary Highways	94	3	1	91
		1,159	**144**	**78**	**938**

		Total Road Length	1% Annual Chance Flood Hazard (all A and V zones)	0.2% Annual Chance Flood Hazard	Area of Minimal Flood Hazard
	Road Type	*(miles)*	*(miles)*	*(miles)*	*(miles)*
Hampton City	Limited Access Highway	30	4	3	22
	Local Main Arteries	77	13	9	55
	Local Secondaries	862	271	117	474
	Ramp	19	2	1	16
	US and VA Primary Highways	97	13	11	73
		,1084	**303**	**142**	**640**

		Total Road Length	1% Annual Chance Flood Hazard (all A and V zones)	0.2% Annual Chance Flood Hazard	Area of Minimal Flood Hazard
	Road Type	*(miles)*	*(miles)*	*(miles)*	*(miles)*
Hanover County	Limited Access Highway	55	4	1	50
	Local Main Arteries	184	6	<1	178
	Local Secondaries	2,282	41	3	2,239
	Ramp	19	1	<1	18
	US and VA Primary Highways	120	4	1	116
		,2661	**55**	**5**	**2,601**

		Total Road Length	1% Annual Chance Flood Hazard (all A and V zones)	0.2% Annual Chance Flood Hazard	Area of Minimal Flood Hazard
	Road Type	*(miles)*	*(miles)*	*(miles)*	*(miles)*
Henrico County	Limited Access Highway	132	5	1	126
	Local Main Arteries	272	7	1	264
	Local Secondaries	2,135	27	12	2,095
	Ramp	66	1	<1	65
	US and VA Primary Highways	159	6	2	151
		2,763	**46**	**16**	**2,701**

		Total Road Length	1% Annual Chance Flood Hazard (all A and V zones)	0.2% Annual Chance Flood Hazard	Area of Minimal Flood Hazard
	Road Type	*(miles)*	*(miles)*	*(miles)*	*(miles)*
Hopewell City	Limited Access Highway	3	<1		3
	Local Main Arteries	12	<1	<1	12
	Local Secondaries	170	2	1	167
	Ramp	2	<1		1
	US and VA Primary Highways	16	<1	<1	16
		204	**3**	**1**	**200**

		Total Road Length	1% Annual Chance Flood Hazard (all A and V zones)	0.2% Annual Chance Flood Hazard	Area of Minimal Flood Hazard
	Road Type	*(miles)*	*(miles)*	*(miles)*	*(miles)*
Isle of Wight County	Local Main Arteries	172	6	<1	166
	Local Secondaries	910	25	16	869
	Ramp	0			<1
	US and VA Primary Highways	100	9	1	90
		1,182	**40**	**17**	**1,125**

		Total Road Length	1% Annual Chance Flood Hazard (all A and V zones)	0.2% Annual Chance Flood Hazard	Area of Minimal Flood Hazard
	Road Type	*(miles)*	*(miles)*	*(miles)*	*(miles)*
James City County	Limited Access Highway	37	<1	<1	36
	Local Main Arteries	63	1	<1	62
	Local Secondaries	842	18	6	818
	Ramp	11	<1	<1	10
	US and VA Primary Highways	86	2	1	83
		1,038	**22**	**8**	**1,009**

		Total Road Length	1% Annual Chance Flood Hazard (all A and V zones)	0.2% Annual Chance Flood Hazard	Area of Minimal Flood Hazard
	Road Type	*(miles)*	*(miles)*	*(miles)*	*(miles)*
King and Queen County	Local Main Arteries	72	1		71
	Local Secondaries	634	18	12	604
	Other	1			1
	Ramp	<1			
	US and VA Primary Highways	68	1	<1	66
		775	**21**	**12**	**742**

		Total Road Length	1% Annual Chance Flood Hazard (all A and V zones)	0.2% Annual Chance Flood Hazard	Area of Minimal Flood Hazard
	Road Type	*(miles)*	*(miles)*	*(miles)*	*(miles)*
King George County	Local Main Arteries	27	<1		27
	Local Secondaries	529	5	<1	524
	Ramp	<1			<1
	US and VA Primary Highways	102	1	<1	101
		658	**5**	**0**	**652**

		Total Road Length	1% Annual Chance Flood Hazard (all A and V zones)	0.2% Annual Chance Flood Hazard	Area of Minimal Flood Hazard
	Road Type	*(miles)*	*(miles)*	*(miles)*	*(miles)*
King William County	Local Main Arteries	54	1	<1	52
	Local Secondaries	746	17	13	716
	Ramp	<1			<1
	US and VA Primary Highways	58	1	1	55
		857	**20**	**14**	**824**

		Total Road Length	1% Annual Chance Flood Hazard (all A and V zones)	0.2% Annual Chance Flood Hazard	Area of Minimal Flood Hazard
	Road Type	*(miles)*	*(miles)*	*(miles)*	*(miles)*
Lancaster County	Local Main Arteries	18	4	<1	14
	Local Secondaries	611	36	14	561
	Ramp	<1			
	US and VA Primary Highways	65	2		63
		695	**42**	**14**	**638**

	Road Type	Total Road Length	1% Annual Chance Flood Hazard (all A and V zones)	0.2% Annual Chance Flood Hazard	Area of Minimal Flood Hazard
		(miles)		*(miles)*	*(miles)*
			(miles)		
Loudon County	Limited Access Highway	68	3	<1	65
	Local Main Arteries	313	11	3	299
	Local Secondaries	3,218	53	8	3,157
	Other	147	2	1	144
	Parking Lot Roads	<1			
	Ramp	53	2	<1	51
	US and VA Primary Highways	129	4	<1	125
		3,929	**75**	**13**	**3,841**

		Total Road Length	1% Annual Chance Flood Hazard (all A and V zones)	0.2% Annual Chance Flood Hazard	Area of Minimal Flood Hazard
	Road Type	*(miles)*	*(miles)*	*(miles)*	*(miles)*
Manassas City	Alleys	<1			<1
	Local Main Arteries	33	1	<1	32
	Local Secondaries	212	3	2	208
	Other	2			2
	Ramp	2	<1	<1	2
	US and VA Primary Highways	17	<1	1	15
		266	**4**	**3**	**259**

		Total Road Length	1% Annual Chance Flood Hazard (all A and V zones)	0.2% Annual Chance Flood Hazard	Area of Minimal Flood Hazard
	Road Type	*(miles)*	*(miles)*	*(miles)*	*(miles)*
Manassas Park City	Local Main Arteries	3	<1		3
	Local Secondaries	50	1	<1	49
	Other	<1			<1
	Parking Lot Roads	<1			<1
	Ramp	<1			<1
	US and VA Primary Highways	3	<1	<1	3
		57	**1**	**<1**	**56**

		Total Road Length	1% Annual Chance Flood Hazard (all A and V zones)	0.2% Annual Chance Flood Hazard	Area of Minimal Flood Hazard
	Road Type	*(miles)*	*(miles)*	*(miles)*	*(miles)*
Mathews County	Local Main Arteries	20	4	2	13
	Local Secondaries	441	146	61	234
	US and VA Primary Highways	36	3	2	30
		497	**153**	**66**	**278**

		Total Road Length	1% Annual Chance Flood Hazard (all A and V zones)	0.2% Annual Chance Flood Hazard	Area of Minimal Flood Hazard
	Road Type	*(miles)*	*(miles)*	*(miles)*	*(miles)*
Middlesex County	Local Main Arteries	20	1		19
	Local Secondaries	541	13	5	523
	Other	<1	<1		
	US and VA Primary Highways	70	1	1	68
		630	**15**	**6**	**609**

		Total Road Length	1% Annual Chance Flood Hazard (all A and V zones)	0.2% Annual Chance Flood Hazard	Area of Minimal Flood Hazard
	Road Type	*(miles)*	*(miles)*	*(miles)*	*(miles)*
New Kent County	Limited Access Highway	42	<1		41
	Local Main Arteries	65	1	<1	64
	Local Secondaries	544	9	6	529
	Ramp	7	<1		7
	US and VA Primary Highways	93	2	1	90
		749	**12**	**7**	**730**

		Total Road Length	1% Annual Chance Flood Hazard (all A and V zones)	0.2% Annual Chance Flood Hazard	Area of Minimal Flood Hazard
	Road Type	*(miles)*	*(miles)*	*(miles)*	*(miles)*
Newport News City	Limited Access Highway	38	5	0	32
	Local Main Arteries	34	2	1	32
	Local Secondaries	1,149	46	21	1,082
	Ramp	23	<1	<1	22
	US and VA Primary Highways	121	7	1	113
		1,365	**60**	**23**	**1,282**

		Total Road Length	1% Annual Chance Flood Hazard (all A and V zones)	0.2% Annual Chance Flood Hazard	Area of Minimal Flood Hazard
	Road Type	*(miles)*	*(miles)*	*(miles)*	*(miles)*
Norfolk City	Limited Access Highway	68	10	1	56
	Local Main Arteries	44	9	9	27
	Local Secondaries	1,230	213	256	761
	Ramp	33	3	1	28
	US and VA Primary Highways	166	28	24	114
		1,541	**264**	**291**	**986**

		Total Road Length	1% Annual Chance Flood Hazard (all A and V zones)	0.2% Annual Chance Flood Hazard	Area of Minimal Flood Hazard
	Road Type	*(miles)*	*(miles)*	*(miles)*	*(miles)*
Northampton County	Limited Access Highway	1	1		
	Local Main Arteries	80	<1	<1	79
	Local Secondaries	636	36	16	583
	Ramp	<1			<1
	US and VA Primary Highways	93	17	1	76
		810	**54**	**17**	**738**

		Total Road Length	1% Annual Chance Flood Hazard (all A and V zones)	0.2% Annual Chance Flood Hazard	Area of Minimal Flood Hazard
	Road Type	*(miles)*	*(miles)*	*(miles)*	*(miles)*
Northumberland County	Local Main Arteries	23	0		23
	Local Secondaries	965	27	6	933
	US and VA Primary Highways	53	1		53
		1,042	**27**	**6**	**1,009**

		Total Road Length	1% Annual Chance Flood Hazard (all A and V zones)	0.2% Annual Chance Flood Hazard	Area of Minimal Flood Hazard
	Road Type	*(miles)*	*(miles)*	*(miles)*	*(miles)*
Petersburg City	Limited Access Highway	23	1	<1	22
	Local Main Arteries	29	2	<1	27
	Local Secondaries	236	8	2	226
	Ramp	12	<1	<1	11
	US and VA Primary Highways	33	2	1	30
		333	**14**	**4**	**315**

		Total Road Length	1% Annual Chance Flood Hazard (all A and V zones)	0.2% Annual Chance Flood Hazard	Area of Minimal Flood Hazard
	Road Type	*(miles)*	*(miles)*	*(miles)*	*(miles)*
Poquoson City	Local Main Arteries	3	3	1	
	Local Secondaries	75	56	17	2
	US and VA Primary Highways	8	6	2	<1
		87	**64**	**20**	**2**

		Total Road Length	1% Annual Chance Flood Hazard (all A and V zones)	0.2% Annual Chance Flood Hazard	Area of Minimal Flood Hazard
	Road Type	*(miles)*	*(miles)*	*(miles)*	*(miles)*
Portsmouth City	Limited Access Highway	33	5	2	27
	Local Main Arteries	30	5	4	21
	Local Secondaries	619	143	117	360
	Ramp	18	1	1	16
	US and VA Primary Highways	51	11	8	32
		752	**165**	**131**	**456**

		Total Road Length	1% Annual Chance Flood Hazard (all A and V zones)	0.2% Annual Chance Flood Hazard	Area of Minimal Flood Hazard
	Road Type	*(miles)*	*(miles)*	*(miles)*	*(miles)*
Prince George County	Limited Access Highway	59	3	<1	55
	Local Main Arteries	102	2.786437186	<1	102
	Local Secondaries	838	12	2	823
	Ramp	12	<1	<1	12
	US and VA Primary Highways	88	5	<1	83
		1,098	**20**	**3**	**1,075**

		Total Road Length	1% Annual Chance Flood Hazard (all A and V zones)	0.2% Annual Chance Flood Hazard	Area of Minimal Flood Hazard
	Road Type	*(miles)*	*(miles)*	*(miles)*	*(miles)*
Prince William County	Alleys	10	<1		10
	Limited Access Highway	70	2	<1	67
	Local Main Arteries	239	8	1	230
	Local Secondaries	2,884	40	12	2,832
	Other	27	1	<1	26
	Parking Lot Roads	1	<1	<1	1
	Ramp	39	1	<1	38
	US and VA Primary Highways	183	6	1	176
		3,452	**57**	**15**	**3,379**

		Total Road Length	1% Annual Chance Flood Hazard (all A and V zones)	0.2% Annual Chance Flood Hazard	Area of Minimal Flood Hazard
	Road Type	*(miles)*	*(miles)*	*(miles)*	*(miles)*
Richmond City	Limited Access Highway	62	5	4	53
	Local Main Arteries	118	2	3	113
	Local Secondaries	1,125	25	13	1,086
	Ramp	27	1	<1	25
	US and VA Primary Highways	131	5	3	123
		1,462	**38**	**23**	**1,401**

		Total Road Length	1% Annual Chance Flood Hazard (all A and V zones)	0.2% Annual Chance Flood Hazard	Area of Minimal Flood Hazard
	Road Type	*(miles)*	*(miles)*	*(miles)*	*(miles)*
Richmond County	Local Main Arteries	30	<1		30
	Local Secondaries	434	8	4	421
	Ramp	<1			<1
	US and VA Primary Highways	53	1	1	52
		517	**10**	**5**	**503**

		Total Road Length	1% Annual Chance Flood Hazard (all A and V zones)	0.2% Annual Chance Flood Hazard	Area of Minimal Flood Hazard
	Road Type	*(miles)*	*(miles)*	*(miles)*	*(miles)*
Spotsylvania County	Limited Access Highway	26	1		26
	Local Main Arteries	217	5		213
	Local Secondaries	1,821	21		1,799
	Ramp	3	<1		3
	US and VA Primary Highways	105	3		102
		2,172	**29**		**2,143**

		Total Road Length	1% Annual Chance Flood Hazard (all A and V zones)	0.2% Annual Chance Flood Hazard	Area of Minimal Flood Hazard
	Road Type	*(miles)*	*(miles)*	*(miles)*	*(miles)*
Stafford County	Limited Access Highway	37	1	<1	36
	Local Main Arteries	162	4	1	158
	Local Secondaries	1,487	23	5	1,459
	Ramp	11	<1	<1	11
	US and VA Primary Highways	72	4	1	67
		1,769	**32**	**6**	**1,731**

		Total Road Length	1% Annual Chance Flood Hazard (all A and V zones)	0.2% Annual Chance Flood Hazard	Area of Minimal Flood Hazard
	Road Type	*(miles)*	*(miles)*	*(miles)*	*(miles)*
Suffolk City	Limited Access Highway	42	5	<1	37
	Local Main Arteries	192	3	<1	189
	Local Secondaries	1,303	35	5	1,262
	Ramp	15		<1	15
	US and VA Primary Highways	145	3	1	142
		1,697	**47**	**6**	**1,645**

		Total Road Length	1% Annual Chance Flood Hazard (all A and V zones)	0.2% Annual Chance Flood Hazard	Area of Minimal Flood Hazard
	Road Type	*(miles)*	*(miles)*	*(miles)*	*(miles)*
Surry County	Local Main Arteries	54	2		52
	Local Secondaries	559	10	<1	548
	US and VA Primary Highways	50	2		48
		663	**14**	**<1**	**649**

		Total Road Length	1% Annual Chance Flood Hazard (all A and V zones)	0.2% Annual Chance Flood Hazard	Area of Minimal Flood Hazard
	Road Type	*(miles)*	*(miles)*	*(miles)*	*(miles)*
Virginia Beach City	Limited Access Highway	30	1	<1	29
	Local Main Arteries	247	17	11	219
	Local Secondaries	2,486	195	155	2,136
	Ramp	18	<1	<1	18
	US and VA Primary Highways	157	13	11	133
		2,939	**225**	**178**	**2,536**

		Total Road Length	1% Annual Chance Flood Hazard (all A and V zones)	0.2% Annual Chance Flood Hazard	Area of Minimal Flood Hazard
	Road Type	*(miles)*	*(miles)*	*(miles)*	*(miles)*
Westmoreland County	Local Main Arteries	32	1	<1	31
	Local Secondaries	776	17	3	757
	Ramp	<1			<1
	US and VA Primary Highways	71	2	<1	70
		880	**19**	**3**	**857**

		Total Road Length	1% Annual Chance Flood Hazard (all A and V zones)	0.2% Annual Chance Flood Hazard	Area of Minimal Flood Hazard
	Road Type	*(miles)*	*(miles)*	*(miles)*	*(miles)*
Williamsburg City	Local Main Arteries	7			7
	Local Secondaries	107	<1	<1	107
	Ramp	1			1
	US and VA Primary Highways	23	<1		23
		138	**1**	**<1**	**137**

		Total Road Length	1% Annual Chance Flood Hazard (all A and V zones)	0.2% Annual Chance Flood Hazard	Area of Minimal Flood Hazard
	Road Type	*(miles)*	*(miles)*	*(miles)*	*(miles)*
York County	Limited Access Highway	31	<1		30
	Local Main Arteries	30	1	1	28
	Local Secondaries	842	57	37	747
	Ramp	14	<1		14
	US and VA Primary Highways	84	2	1	81
		1,001	**61**	**39**	**901**

Table b. Summary of inaccessible/accessible roads affecting Hospital Access for 4 different flooding levels. The analysis was run twice, once for hospitals that could be reached with a 20min drive and once for hospitals that could be reached with a 40min drive. Both analyses ignore the effect of traffic on travel time and therefore could be overestimating accessibility.

	Inaccessible Roads at Flooding Levels								**Accessible**
Hospital	**1ft**		**3ft**		**7ft**		**10ft**		
	miles	*% of total*	*miles*	*% of total*	*miles*	*% of total*	*miles*	*% of total*	*miles*
Eastern Shore									
Riverside Shore Community Hospital, 20 mins	0.0	0%	23.5	2%	177.7	17%	177.7	17%	1,051.7
Riverside Shore Community Hospital, 40mins	46.2	2%	99.0	5%	353.0	17%	353.0	17%	2,034.5
Middle Peninsula									
Riverside Tappahannock Hospital, 20 mins	0.1	0%	3.9	0%	110.6	12%	110.6	12%	894.1
Riverside Tappahannock Hospital, 40mins	0.2	0%	16.0	1%	234.5	9%	234.5	9%	2,727.6
Riverside Walter Reed Hospital, 20 mins	11.8	1%	42.8	3%	182.4	13%	182.4	13%	1,432.1
Riverside Walter Reed Hospital, 40mins	79.9	3%	164.8	6%	679.0	24%	679.0	24%	2,867.8
Northern Neck									
Rappahannock General Hospital, 20 mins	0.1	0%	17.5	3%	77.5	11%	77.5	11%	680.1
Rappahannock General Hospital, 40mins	0.2	0%	32.4	2%	153.5	9%	153.5	9%	1,748.4
Northern Virginia									
Dominion Hospital, 20 mins	0.1	0%	0.1	0%	31.7	0%	31.7	0%	6,539.5
Dominion Hospital, 40mins	0.0	0%	0.2	0%	15.0	0%	15.0	0%	12,623.7
Fort Belvoir Community Hospital, 20 mins	0.0	0%	0.1	0%	13.1	0%	13.1	0%	5,021.0
Fort Belvoir Community Hospital, 40mins	0.0	0%	0.3	0%	7,988.9	61%	7988.9	61%	12,996.7
Inova Alexandria Hospital, 20 mins	0.0	0%	0.1	0%	11.2	0%	11.2	0%	6,085.7
Inova Alexandria Hospital, 40mins	0.0	0%	0.2	0%	980.9	8%	980.9	8%	12,506.7

	Inaccessible Roads at Flooding Levels								Accessible
Hospital	**1ft**		**3ft**		**7ft**		**10ft**		
	miles	*% of total*	*miles*	*% of total*	*miles*	*% of total*	*miles*	*% of total*	*miles*
Inova Fair Oaks Hospital, 20 mins	0.0	0%	0.0	0%	0.1	0%	0.1	0%	6,694.9
Inova Fair Oaks Hospital, 40mins	0.0	0%	0.2	0%	13.4	0%	13.4	0%	12,664.2
Inova Fairfax Hospital, 20 mins	0.0	0%	0.1	0%	16.1	0%	16.1	0%	8,163.5
Inova Fairfax Hospital, 40mins	0.0	0%	0.2	0%	15.4	0%	15.4	0%	13,036.8
Inova Mount Vernon Hospital, 20 mins	0.1	0%	0.4	0%	11.9	0%	11.9	0%	4,106.7
Inova Mount Vernon Hospital, 40mins	0.1	0%	0.3	0%	15.7	0%	15.7	0%	11,883.2
Northern Virginia Mental Health Institute, 20 mins	0.0	0%	0.1	0%	12.8	0%	12.8	0%	7,998.8
Northern Virginia Mental Health Institute, 40mins	0.0	0%	0.2	0%	15.3	0%	15.3	0%	13,005.1
Prince William Medical Center, 20 mins	0.0	0%	4190.2	94%	4190.2	94%	4190.2	94%	4,456.3
Prince William Medical Center, 40mins	0.0	0%	0.1	0%	18.0	0%	18.0	0%	13,106.0
Reston Hospital Center, 20 mins	0.1	0%	0.2	0%	0.2	0%	0.2	0%	4,698.1
Reston Hospital Center, 40mins	0.0	0%	0.1	0%	12.3	0%	12.3	0%	12,205.6
Sentara Northern Virginia Medical Center, 20 mins	0.0	0%	0.1	0%	8.0	0%	8.0	0%	5,329.0
Sentara Northern Virginia Medical Center, 40mins	0.0	0%	0.4	0%	20.1	0%	20.1	0%	14,274.6
Stafford Hospital, 20 mins	0.0	0%	0.3	0%	6.5	0%	6.5	0%	2,177.3
Stafford Hospital, 40mins	0.0	0%	0.5	0%	21.4	0%	21.4	0%	9,812.9
University of Virginia Health Haymarket Medical Center, 20 mins	0.1	0%	0.1	0%	0.1	0%	0.1	0%	3,054.3
University of Virginia Health Haymarket	0.1	0%	0.2	0%	2.0	0%	2.0	0%	11,710.2

	Inaccessible Roads at Flooding Levels								Accessible
Hospital	**1ft**		**3ft**		**7ft**		**10ft**		
	miles	*% of total*	*miles*	*% of total*	*miles*	*% of total*	*miles*	*% of total*	*miles*
Medical Center, 40mins									
Virginia Hospital Center, 20 mins	0.0	0%	0.0	0%	32.0	1%	32.0	1%	5,593.0
Virginia Hospital Center, 40mins	0.1	0%	0.3	0%	14.4	0%	14.4	0%	12,203.4
Peninsula									
Bon Secours Mary Immaculate Hospital, 20 mins	0.0	0%	4.4	0%	310.6	9%	310.6	9%	3,530.8
Bon Secours Mary Immaculate Hospital, 40mins	0.0	0%	11.8	0%	356.7	7%	356.7	7%	4,778.2
Eastern State Hospital, 20 mins	0.0	0%	1.7	0%	16.2	1%	16.2	1%	1,794.2
Eastern State Hospital, 40mins	0.0	0%	6.7	0%	339.0	7%	339.0	7%	4,755.3
Hampton Roads Specialty Hospital, 20 mins	0.0	0%	5.9	0%	442.0	18%	442.0	18%	2,506.2
Hampton Roads Specialty Hospital, 40mins	0.0	0%	9.3	0%	489.0	11%	489.0	11%	4,472.4
Hampton Veterans Affairs Medical Center, 20 mins	0.0	0%	6.0	0%	274.0	11%	274.0	11%	2,520.2
Hampton Veterans Affairs Medical Center, 40mins	0.0	0%	9.3	0%	351.3	8%	351.3	8%	4,483.9
Riverside Behavioral Health Center, 20 mins	0.0	0%	7.7	0%	312.9	10%	312.9	10%	3,022.9
Riverside Behavioral Health Center, 40mins	0.0	0%	9.4	0%	348.2	7%	348.2	7%	4,726.6
Riverside Doctors' Hospital, 20 mins	0.0	0%	0.3	0%	20.2	1%	20.2	1%	2,663.5
Riverside Doctors' Hospital, 40mins	0.0	0%	11.8	0%	356.7	7%	356.7	7%	4,778.2
Riverside Regional Medical Center, 20 mins	0.0	0%	3.1	0%	316.5	10%	316.5	10%	3,234.3
Riverside Regional Medical Center, 40mins	0.0	0%	10.9	0%	354.5	7%	354.5	7%	4,773.4
Riverside Rehabilitation Institute, 20 mins	0.0	0%	5.9	0%	443.5	18%	443.5	18%	2,501.9

	Inaccessible Roads at Flooding Levels								Accessible
Hospital	**1ft**		**3ft**		**7ft**		**10ft**		
	miles	*% of total*	*miles*	*% of total*	*miles*	*% of total*	*miles*	*% of total*	*miles*
Riverside Rehabilitation Institute, 40mins	0.0	0%	9.3	0%	488.7	11%	488.7	11%	4,468.6
Sentara CarePlex Hospital, 20 mins	0.0	0%	7.7	0%	313.1	10%	313.1	10%	3,027.6
Sentara CarePlex Hospital, 40mins	0.1	0%	9.5	0%	348.4	7%	348.4	7%	4,730.4
Sentara Williamsburg Regional Medical Center, 20 mins	0.0	0%	0.6	0%	15.1	1%	15.1	1%	1,770.0
Sentara Williamsburg Regional Medical Center, 40mins	0.0	0%	6.6	0%	337.2	7%	337.2	7%	4,751.0
United States Air Force Hospital Langley, 20 mins	0.0	0%	7.4	0%	2,675.3	100%	2675.3	100%	2,676.7
United States Air Force Hospital Langley, 40mins	0.0	0%	9.3	0%	4,524.5	100%	4524.5	100%	4,525.9
Southern Hampton Roads									
Bon Secours Health Center at Harbour View, 20 mins	0.1	0%	3.1	0%	1,752.2	45%	1752.2	45%	3,877.3
Bon Secours Health Center at Harbour View, 40mins	0.3	0%	7.2	0%	842.8	8%	842.8	8%	10,058.6
Bon Secours Maryview Medical Center, 20 mins	0.3	0%	5.5	0%	2,166.1	34%	2166.1	34%	6,324.0
Bon Secours Maryview Medical Center, 40mins	0.3	0%	31.8	0%	686.5	7%	686.5	7%	10,106.0
Chesapeake Regional Medical Center, 20 mins	0.3	0%	3.7	0%	663.5	11%	663.5	11%	6,034.9
Chesapeake Regional Medical Center, 40mins	0.3	0%	29.9	0%	668.5	7%	668.5	7%	9,466.8
Children's Hospital of the Kings Daughters, 20 mins	0.3	0%	5.7	0%	1,445.0	22%	1445.0	22%	6,604.4
Children's Hospital of the Kings Daughters, 40mins	0.3	0%	34.9	0%	1,546.3	16%	1546.3	16%	9,968.6

	Inaccessible Roads at Flooding Levels								Accessible
Hospital	**1ft**		**3ft**		**7ft**		**10ft**		
	miles	*% of total*	*miles*	*% of total*	*miles*	*% of total*	*miles*	*% of total*	*miles*
Consulate Health Care of Windsor, 20 mins	0.0	0%	0.0	0%	33.7	3%	33.7	3%	1,312.4
Consulate Health Care of Windsor, 40mins	0.3	0%	5.7	0%	1,762.0	23%	1762.0	23%	7,677.6
Lake Taylor Transitional Care Hospital, 20 mins	0.3	0%	4.7	0%	1,354.5	21%	1354.5	21%	6,595.2
Lake Taylor Transitional Care Hospital, 40mins	0.3	0%	37.7	0%	1,272.1	14%	1272.1	14%	9,407.9
Lakeview Medical Center, 20 mins	0.0	0%	0.4	0%	111.1	4%	111.1	4%	2,639.4
Lakeview Medical Center, 40mins	0.3	0%	5.3	0%	946.4	10%	946.4	10%	9,798.4
Naval Medical Center Portsmouth, 20 mins	0.3	0%	6.5	0%	2,777.7	42%	2,777.7	42%	6,576.2
Naval Medical Center Portsmouth, 40mins	0.3	0%	33.3	0%	868.8	9%	868.8	9%	10,013.7
Saint Mary's Home for Disabled Children, 20 mins	0.3	0%	4.3	0%	1,354.3	20%	1,354.3	20%	6,811.5
Saint Mary's Home for Disabled Children, 40mins	0.3	0%	32.8	0%	1,226.5	13%	1,226.5	13%	9,381.1
Sentara Heart Hospital, 20 mins	0.3	0%	5.8	0%	1,473.5	22%	1,473.5	22%	6,628.0
Sentara Heart Hospital, 40mins	0.3	0%	34.6	0%	1,593.5	16%	1,593.5	16%	10,014.4
Sentara Leigh Hospital, 20 mins	0.3	0%	4.3	0%	1,329.0	20%	1,329.0	20%	6,717.7
Sentara Leigh Hospital, 40mins	0.3	0%	34.1	0%	1,223.3	13%	1,223.3	13%	9,340.5
Sentara Norfolk General Hospital, 20 mins	0.3	0%	5.7	0%	1,492.8	23%	1,492.8	23%	6,585.7
Sentara Norfolk General Hospital, 40mins	0.3	0%	34.8	0%	1,547.3	16%	1,547.3	16%	9,948.1
Sentara Obici Hospital, 20 mins	0.0	0%	0.6	0%	186.9	6%	186.9	6%	3,019.9
Sentara Obici Hospital, 40mins	0.3	0%	5.9	0%	881.1	9%	881.1	9%	10,012.4
Sentara Princess Anne Hospital, 20 mins	0.2	0%	18.4	0%	876.0	16%	876.0	16%	5,557.2

	Inaccessible Roads at Flooding Levels								Accessible
Hospital	**1ft**		**3ft**		**7ft**		**10ft**		
	miles	*% of total*	*miles*	*% of total*	*miles*	*% of total*	*miles*	*% of total*	*miles*
Sentara Princess Anne Hospital, 40mins	0.3	0%	29.8	0%	805.5	9%	805.5	9%	8,635.5
Sentara Virginia Beach General Hospital, 20 mins	0.1	0%	3.3	0%	426.6	10%	426.6	10%	4,332.3
Sentara Virginia Beach General Hospital, 40mins	0.3	0%	30.3	0%	1,326.8	16%	1,326.8	16%	8,470.9

The summaries provided below in Table c and Table d depicts the inaccessible/accessible roads by region for 3 ranges of flooding levels, split by functional class in Table d. Years indicate the approximate time at which sea level will cause these water levels to be exceeded. Within each region, there are multiple starting points which may have different accessible and inaccessible roads. Ranges are the minimum distance from any starting point at the minimum flooding level to the longest distance for any starting point at the highest flooding level in the region. Minimum and maximum distances may not be from the same starting point network. In Table d, Unassigned = No VDOT Functional Class (generally local roads included in open street map and not VDOT).

Table c. Summary of inaccessible/accessible roads by region for 3 ranges of flooding levels.

Roads at Ranges of Flooding Levels				
Region	**Accessible**		**Inaccessible**	
	% of total	***miles***		***% of total***
Southern Hampton Roads				
Low (1-3'), 2050 MHW	99.9 - 100%	11,242.8 – 11,274.1	0.01 - 0.03%	<0.1-31.2
Medium (3-7'), 2100 MHW	0.5 – 99.7%	56.2 – 11,243	0.3 – 99.5%	32.2 – 11,217.9
High (7-10')	0.5 – 94%	56.2 – 10,596.8	6 – 99.5%	677.3 – 11,217.9
Eastern Shore (excluding Chincoteague Bridge Station)				
Low (1-3'), 2050 MHW	98 - 100%	2302.9 - 2358	0 - 2%	0.1 - 55.2
Medium (3-7'), 2100 MHW	82 - 98%	1931.4 - 2302.9	2 - 18%	55.2 - 426.7
High (7-10')	75 - 82%	1760.8 - 1931.4	18 - 25%	426.7 - 597.3
Eastern Shore (Chincoteague Bridge Station Only)				
Low (1-3'), 2050 MHW	99 - 100%	2324.3 - 2357	0 - 1%	1.1 - 33.8
Medium (3-7'), 2100 MHW	0 - 99%	0 - 2324.3	1 - 100%	33.8 - 2358.1
High (7-10')	0%	0	100%	2358.1
Peninsula				
Low (1-3'), 2050 MHW	99.8 – 100%	4,779.1 – 4790.1	0 – 0.2%	0 - 11
Medium (3-7'), 2100 MHW	92.7 – 99.8%	4,440.5 – 4779.3	0.2 – 7.3%	10.8 – 349.6
High (7-10')	1.4 – 92.7%	68.5 – 4440.6	7.3 – 98.6%	349.5 - 4721.6
Northern Neck				
Low (1-3'), 2050 MHW	98.8 – 100%	3,086.3 – 3123.1	0 – 1.2%	0.1 – 37.9

Roads at Ranges of Flooding Levels				
Region	**Accessible**		**Inaccessible**	
	% of total	***miles***		***% of total***
Medium (3-7'), 2100 MHW	89.9 – 98.8%	2,808.3 – 3086.3	1.2 – 10.1%	37.9 – 316
High (7-10')	83.8 – 89.9%	2,616.9 – 2808.3	10.1 – 16.2%	316 – 507.4
Middle Peninsula				
Low (1-3'), 2050 MHW	97.9 – 100%	4,765.4 – 4865.1	0 -2.1%	0.1 – 99.8
Medium (3-7'), 2100 MHW	89.5 – 98%	4,354.7 – 4765.6	2 – 10.5%	99.5 – 510.5
High (7-10')	0 – 89.5%	1.9 – 4355.3	10.5 – 100%	510 – 4863.3
Northern Virginia				
Low (1-3'), 2050 MHW	100%	15,029.8	0%	0
Medium (3-7'), 2100 MHW	100%	15,029.8	0%	0
High (7-10')	100%	15,029.8	0%	0.04

Table d. Summary of the inaccessible/accessible roads by region for 3 ranges of flooding levels split by functional class.

Roads at Ranges of Flooding Levels				
Region	**Accessible**		**Inaccessible**	
	% of total	***miles***	***% of total***	***miles***
Southern Hampton Roads				
Low (1-3'), 2050 MHW				
Major Collector	100%	568.5 – 568.7	0%	0 - 0.2
Minor Arterial	100%	590 – 590.2	0%	0 - 0.2
Minor Arterial Ramp	94.4 – 100%	57.5 – 60.9	0 – 5.6%	0 – 3.4
Unassigned	99.7 – 100%	9,027.1 – 9,054.2	0 – 0.3%	0.3 – 27.4
Medium (3-7'), 2100 MHW				
Interstate	1.9 – 100%	3.1 – 160.7	1.9 – 100%	0 – 157.6
Interstate Ramp	0 – 100%	0 – 101.7	0 – 100%	0 – 101.7
Major Collector	0 – 100%	0 – 595.8	0 - 100%	0.2 – 596.2
Minor Arterial	1.1 – 100%	6.5 – 590.1	0 – 98.8%	0.1 – 583.7
Minor Arterial Ramp	0 – 94.4%	0 – 57.5	5.6 – 100%	3.4 – 60.9
Minor Collector	69.2 – 100%	136.8 – 197.7	0 – 30.8%	0 - 198
Other Freeway or Expressway	0 – 100%	0 - 84	0 – 100%	0 - 84
Other Freeway or Expressway Ramp	0 – 100%	0 – 25.5	0 – 100%	0 – 25.5
Other Principal Arterial	5.2 – 100%	21.7 – 421.4	0 – 94.8%	0 – 399.7
Other Principal Arterial Ramp	3 – 100%	0.3 – 9.4	0 – 97%	0 – 9.1
Unassigned	0.7 – 99.7%	63.5 – 9,027.1	0.2 – 99.3%	27.4 – 8,990.9
High (7-10')				
Interstate	1.9 – 97.6%	3.1 – 156.9	2.4 – 98.1%	3.8 – 157.6
Interstate Ramp	0 – 98.5%	0 – 98.5	3.1 – 100%	3.2 – 101.7
Major Collector	0 – 94%	0 – 560.4	6 – 100%	35.8 – 596.2
Minor Arterial	1.1 – 96.4 %	6.5 – 568.9	3.6 – 98.9%	21.3 – 583.7
Minor Arterial Ramp	0 – 94.4%	0 – 57.5	5.6 – 100%	13.8 – 60.9
Minor Collector	0 – 96.3%	0 – 190.6	3.7 - 100%	7.4 - 198

Roads at Ranges of Flooding Levels				
Region	**Accessible**		**Inaccessible**	
	% of total	***miles***	***% of total***	***miles***
Other Freeway or Expressway	0 – 98.7%	0 – 82.9	1.3 – 100%	1.1 - 84
Other Freeway or Expressway Ramp	0 – 98%	0 - 25	2 – 100%	0.5 – 25.5
Other Principal Arterial	5.2 – 100%	21.7 – 421.2	0 – 94.8%	19.6 – 399.7
Other Principal Arterial Ramp	3 – 97.9%	0.3 – 9.2	2.1 – 97%	0.2 – 9.1
Unassigned	0.7 – 99.7%	63.5 – 9027.1	0.2 – 99.3%	27.4 – 8990.9
Eastern Shore				
Low (1-3'), 2050 MHW				
Minor Collector	86.1 – 87.5%	75.3 – 76.6	12.5 – 13.9%	10.9 – 12.2
Minor Arterial	94.2 – 100%	32.2 – 34.2	0 – 5.8%	0 – 2
Major Collector	96 – 98.1%	138.6 – 141.7	1.9 – 4%	2.7 – 5.8
Local	93.3 – 100%	444.9 – 477.1	0 – 6.7%	0 – 32.2
Unassigned	93 – 100%	1,346.5 – 1,447.2	0 – 7%	0.1 – 100.8
Medium (3-7'), 2100 MHW				
Local	77.2 - 100%	368.4 - 477	0 – 22.8%	0.1 – 108.7
Major Collector	90.2 – 97.9%	130.3 – 141.3	2.1 – 9.8%	3.1 – 14.1
Minor Arterial	86 – 98.2%	29.4 – 33.6	1.8 – 14%	0.6 – 4.8
Minor Collector	75.5 – 99.9%	66.1 – 87.4	0.1 – 24.5%	0.1 – 21.4
Minor Arterial Ramp	91.9 – 100%	10.2 – 11.1	0 – 8.1%	0 – 0.9
Unassigned	80.5 – 97.6%	1,164.8 – 1,412.1	2.4 – 19.5%	35.2 – 282.5
High (7-10')				
Local	69.5 – 96.5%	331.8 – 460.6	3.5 – 30.5%	16.5 – 145.3
Major Collector	84.6 – 98.1%	122.1 – 141.7	1.9 – 15.4%	2.7 – 22.3
Minor Arterial	79.9 – 99.1%	27.3 – 33.9	0.9 – 20.1%	0.3 – 6.9
Minor Arterial Ramp	86.5 – 91.9%	9.6 – 10.2	8.1 – 13.5%	0.9 – 1.5
Minor Collector	70.7 – 88%	61.9 - 77	12 – 29.3%	10.5 – 25.6
Unassigned	72.3 - 95.5	1,045.8 – 1,382.2	4.5 – 27.7%	65.1 – 401.5
Peninsula				
Low (1-3'), 2050 MHW				
Interstate	100%	140.8	0%	<0.01
Local	99.6 – 100%	1,345.5 – 1,350.8	0 – 0.4%	0 – 5. 3
Major Collector	99.9 – 100%	224.2 – 224.4	<0.1%	0.2
Unassigned	99.8 – 100%	2,588.7 – 2,594.1	0 – 0.2%	0 – 5.4
Medium (3-7'), 2100 MHW				
Interstate	97.6 – 100%	137.4 – 140.8	0 – 2.4%	0 – 3.4
Local	86.3 – 99.6%	1,166.2 – 1,345.5	0.4 – 13.7%	5.3 – 136.2
Major Collector	92.6 – 99.9%	207.9 – 224.2	0.1 – 224.2%	0.2 – 16.5
Minor Arterial	97.2 – 100%	161.7 – 166.3	0 – 2.8%	0 – 4.6
Non-Interstate Ramp	63.5 – 100%	0.7 – 1.1	0 – 36.5%	0 – 0.4
Other Principle Arterial	99.4 – 100%	237.3 – 238.7	0 – 0.6%	0 – 1.4
Unassigned	92.9 – 99.8%	2,409.6 – 2,588.8	0.2 – 7.1%	5.3 – 184.6

Roads at Ranges of Flooding Levels				
Region	**Accessible**		**Inaccessible**	
	% of total	***miles***	***% of total***	***miles***
High (7-10')				
Interstate	28.3 – 79.6%	39.8 – 137.4	2.4 – 71.7%	3.4 - 101
Interstate Ramp	0 – 100%	0 – 11.4	0 – 100%	0 – 11.4
Local	1 – 89.9%	13.33 – 1,214.6	10.1 – 99%	136.2 – 1,337.5
Major Collector	1.3 – 92.6%	3 – 207.9	7.4 – 98.7%	16.5 – 221.4
Minor Arterial	2.9 – 97.2%	4.8 – 161.7	2.8 – 97.1%	4.6 – 161.5
Minor Collector	0 – 92.9%	0 – 32.9	7.1 – 100%	2.5 – 35.4
Non-Interstate Ramp	0 – 63.5%	0 – 0.7	36.5 – 100%	0.4 – 1.1
Other Freeways and Expressways	0 – 100%	0 – 35.7	0 – 100%	0 – 35.8
Other Principal Arterial	7.1 – 99.4%	16.8 – 237.3	0.6 – 92.9%	1.4 – 221.9
Unassigned	0 – 92.9%	0 – 2,409.6	7.1 – 100%	184.5 – 2,594.1
Northern Neck				
Low (1-3'), 2050 MHW				
Major Collector	98.9 – 100%	254.8 – 257.7	0 – 1.1%	0 – 2.9
Minor Collector	99.9 – 100%	80.6 – 80.7	0.1%	0 – 0.1
Unassigned	98.7 – 100%	2,577.5 – 2,611.3	0 – 1.3%	1.1 – 34.9
Medium (3-7'), 2100 MHW				
Major Collector	89.4 – 98.8%	230.4 – 254.7	1.2 – 10.6%	3 – 27.3
Minor Collector	95.7 – 99.9%	77.2 – 80.6	0.1 – 4.3%	0.1 – 3.5
Other Principal Arterial	96 – 100%	47.7 – 49.7	0 – 4%	0 – 2
Unassigned	89.6 – 98.7%	2,339.5 – 2,577.5	1.3 – 10.4%	34.9 – 272.9
High (7-10')				
Major Collector	87.2 – 89.4%	224.6 – 230.4	10.6 – 12.8%	27.3 – 33.1
Minor Arterial	91.6%	113	8.5%	10.3 – 10.5
Minor Collector	89.7 – 95.7%	72.4 – 77.2	4.3 – 10.3%	3.5 – 8.3
Other Principal Arterial	95.6 – 96%	47.5 – 47.7	4 – 4.4%	2 - 2.2
Unassigned	82.7 – 89.6%	2,159.2 – 2,339.5	10.4 – 17.3%	272.9 – 453.2
Middle Peninsula				
Low (1-3'), 2050 MHW				
Major Collector	99.2 – 100%	352.1 – 354.9	0 – 0.8%	0 – 2.8
Minor Arterial	99.9 – 100%	157.3 – 157.5	0.1%	0.2
Minor Collector	99.5 – 100%	154. 1 – 154.9	0 – 0.5%	0 – 0.8
Unassigned	97.6 – 100%	3,877.1 – 3972.9	0 – 2.4%	0.1 – 95.9
Medium (3-7'), 2100 MHW				
Major Collector	92.8 – 99.2%	329.5 – 352.1	0.8 – 7.2%	2.8 – 25.4
Minor Arterial	95.2 – 99.8%	149.9 – 157.2	0.2 – 4.8%	0.3 – 7.6
Minor Collector	92.9 – 99.5%	143.9 – 154.1	0.5 – 7.1%	0.8 - 11
Other Principal Arterial				0 – 0.9
Unassigned	88.3 – 97.6%	3,507.4 – 3,877.1	2.4 – 11.7%	95.9 – 465.6
High (7-10')				

Roads at Ranges of Flooding Levels				
Region	**Accessible**		**Inaccessible**	
	% of total	***miles***	***% of total***	***miles***
Unassigned	0 – 88.3%	0.6 – 3,507.4	11.7 – 100%	465.6 – 3,972.4
Major Collector	0 – 92.8%	0.2 – 329.5	7.2 – 100%	25.4 – 354.7
Minor Arterial	0.5 – 95.3%	0.7 – 150.1	4.7 – 99.5%	7.4 – 156.8
Minor Collector	0 – 92.9%	0 – 143.9	7.1 – 100%	11 – 154.9
Other Principal Arterial	0 – 99.8%	0 – 223.9	0.2%	0.5 – 224.4
Northern Virginia				
High (7-10')*	100%			
Unassigned	100%	2,612.4	0%	0.03
**No roads were impacted at lower flooding levels.*				

The acres of flooded land (inundation based on land elevations) by region for 4 different flooding levels is shown in Table e. The percent increase of flooded acres from the previous water level is indicated in parentheses below the acreage for flooding of 3, 7, and 10 feet.

Table e. Acres of flooded land (inundation based on land elevations) by region for 4 different flooding levels.

		Water level (acres of flooded land)			
Region	**Category**	**1 ft**	**3 ft**	**7 ft**	**10 ft**
Southern Hampton Roads	Urban	22,362	71,189 (+218%)	137,026 (+92%)	194,844 (+42%)
Eastern Shore	Rural	69,696	198,505 (+185%)	286,440 (+44%)	338,136 (+18%)
Peninsula	Suburban	5,227	22,799 (+336%)	44,768 (+96%)	58,851 (+31%)
Northern Neck	Rural	4,199	15,896 (+279%)	33,699 (+112%)	47,938 (+42%)
Middle Peninsula	Rural	8,984	40,157 (+347%)	81,499 (+103%)	107,370 (+32%)
Northern Virginia	Urban	2,510	7,761 (+209%)	12,530 (+61%)	15,157 (+21%)
Total Urban		24,872	78,950	149,556	210,001
Total Suburban		5,227	5,227	5,227	5,227
Total Rural		82,879	254,558	401,638	493,444

Table f. Summary of the mean flooding frequencies for roads in each region.

Region/locality	Elevation range	Road miles in that elevation range	% time elevation is flooded		
			Present	2050	2100
Eastern Shore: Northampton	< 0 ft	0	100	100	100
	0– 1 ft	0.04	42.49	96.67	100
	1– 2 ft	0.16	14.09	73.47	100
	2– 3 ft	1.28	1.4	44.84	100
	3– 4 ft	8.91	0.11	15.94	99.93
	4– 5 ft	8.04	0.01	1.71	96.45
	5– 6 ft	12.55	0	0.14	72.88
	6– 7 ft	9.41	0	0.01	44.27
	7– 8 ft	10.29	0	0	15.46
	8– 9 ft	13.52	0	0	1.63
	9 – 10 ft	9.19	0	0	0.12
	> 10 ft	726.37	0	0	0.01
Eastern Shore: Accomack	< 0 ft	0.2	100	100	100
	0– 1 ft	0.9	45.31	99.76	100
	1– 2 ft	5.47	5.72	92.74	100
	2– 3 ft	37.97	0.31	49.85	100
	3– 4 ft	73.1	0.02	7.13	100
	4– 5 ft	62.38	0	0.39	99.75
	5– 6 ft	52.61	0	0.02	92.28
	6– 7 ft	52.23	0	0	48.59
	7– 8 ft	44.36	0	0	6.67
	8– 9 ft	39.38	0	0	0.37
	9 – 10 ft	33.8	0	0	0.02
	> 10 ft	1,123.43	0	0	0
Southside: All localities	< 0 ft	0.05	100	100	100
	0– 1 ft	0.11	51.92	98.76	100
	1– 2 ft	4.99	21.46	84.91	100
	2– 3 ft	23.15	3.04	54.43	100
	3– 4 ft	33.8	0.3	23.8	99.96
	4– 5 ft	73.87	0.06	3.65	98.68
	5– 6 ft	144.18	0.01	0.37	84.39
	6– 7 ft	273.49	0	0.07	53.84
	7– 8 ft	342.87	0	0.01	23.18
	8– 9 ft	381.19	0	0	3.48
	9 – 10 ft	504.12	0	0	0.34
	> 10 ft	7,190.3	0	0	0.07

Region/locality	Elevation range	Road miles in that elevation range	% time elevation is flooded		
			Present	2050	2100
Peninsula: Hampton/Newport News/Poquoson/ Williamsburg/James City	< 0 ft	0	100	100	100
	0– 1 ft	0.03	51.92	98.76	100
	1– 2 ft	0.12	21.46	84.91	100
	2– 3 ft	5.7	3.05	54.43	100
	3– 4 ft	22.31	0.3	23.8	99.96
	4– 5 ft	37.74	0.06	3.65	98.68
	5– 6 ft	68.61	0.01	0.37	84.39
	6– 7 ft	106.17	0	0.07	53.84
	7– 8 ft	101.85	0	0.01	23.18
	8– 9 ft	119.44	0	0	3.48
	9 – 10 ft	113.78	0	0	0.34
	> 10 ft	3,181.72	0	0	0.07
Peninsula: York	< 0 ft	0	100	100	100
	0– 1 ft	0	53.84	99.42	100
	1– 2 ft	4.47	21.63	88.86	100
	2– 3 ft	1.07	2.73	56.24	100
	3– 4 ft	3.62	0.22	24.01	100
	4– 5 ft	9.33	0.03	3.3	99.37
	5– 6 ft	9.89	0	0.27	88.39
	6– 7 ft	9.08	0	0.03	55.89
	7– 8 ft	12.27	0	0	23.36
	8– 9 ft	16.31	0	0	3.15
	9 – 10 ft	26.09	0	0	0.26
	> 10 ft	929.4	0	0	0.03
Middle Peninsula: Mathews/Middlesex/Essex	< 0 ft	0.01	100	100	100
	0– 1 ft	0.08	45.31	99.76	100
	1– 2 ft	4.5	5.72	92.74	100
	2– 3 ft	24.56	0.31	49.85	100
	3– 4 ft	30.51	0.02	7.13	100
	4– 5 ft	36.49	0	0.39	99.75
	5– 6 ft	30.86	0	0.02	92.28
	6– 7 ft	27.16	0	0	48.59
	7– 8 ft	30.09	0	0	6.67
	8– 9 ft	38.37	0	0	0.37
	9 – 10 ft	30.3	0	0	0.02
	> 10 ft	1,881.33	0	0	0

Region/locality	Elevation range	Road miles in that elevation range	% time elevation is flooded		
			Present	2050	2100
Middle Peninsula: King and Queen/King William/Gloucester	< 0 ft	0.01	100	100	100
	0– 1 ft	0.03	52.05	99.18	100
	1– 2 ft	1.05	20.13	87.14	100
	2– 3 ft	17.9	2.46	54.76	100
	3– 4 ft	25.2	0.19	22.43	100
	4– 5 ft	20.41	0.03	2.98	99.11
	5– 6 ft	22.83	0	0.24	86.64
	6– 7 ft	22.18	0	0.03	54.1
	7– 8 ft	24.26	0	0	21.8
	8– 9 ft	27.34	0	0	2.84
	9 – 10 ft	25.38	0	0	0.23
	> 10 ft	2,610.7	0	0	0.03
Northern Neck: Westmoreland/ Northumberland	< 0 ft	0.02	100	100	100
	0– 1 ft	0.19	45.31	99.77	100
	1– 2 ft	0.71	5.71	92.74	100
	2– 3 ft	5.29	0.31	49.85	100
	3– 4 ft	7.76	0.02	7.08	100
	4– 5 ft	7.62	0	0.39	99.75
	5– 6 ft	8.84	0	0.02	92.28
	6– 7 ft	14.06	0	0	42.59
	7– 8 ft	20.98	0	0	6.67
	8– 9 ft	29.68	0	0	0.37
	9 – 10 ft	32.57	0	0	0.02
	> 10 ft	1,801.61	0	0	0
Northern Neck: Richmond/Lancaster	< 0 ft	0	100	100	100
	0– 1 ft	0.15	64.84	99.91	100
	1– 2 ft	1.31	16.84	96.93	100
	2– 3 ft	9.68	1.01	69.94	100
	3– 4 ft	9.44	0.04	19.79	100
	4– 5 ft	8.94	0	1.29	99.9
	5– 6 ft	8.12	0	0.06	96.76
	6– 7 ft	10.67	0	0	67.98
	7– 8 ft	11.14	0	0	19.03
	8– 9 ft	12.64	0	0	1.21
	9 – 10 ft	12	0	0	0.06
	> 10 ft	1,162.62	0	0	0

Region/locality	Elevation range	Road miles in that elevation range	% time elevation is flooded		
			Present	2050	2100
Northern Virginia: All localities	< 0 ft	0	100	100	100
	0– 1 ft	0.01	59.51	98.64	100
	1– 2 ft	0.02	34.06	88.37	100
	2– 3 ft	0.02	10.09	61.75	99.97
	3– 4 ft	0.03	0.92	36.09	99.85
	4– 5 ft	0.08	0.09	11.68	98.57
	5– 6 ft	0.11	0.01	1.13	87.94
	6– 7 ft	0.13	0	0.1	61.21
	7– 8 ft	0.17	0	0.01	35.59
	8– 9 ft	0.09	0	0	11.28
	9 – 10 ft	0.13	0	0	1.08
	> 10 ft	6,897.13	0	0	0.1

Table g. Number of coastal RTE (rare, threatened, and endangered) and migratory bird species at present and under future conditions for each coastal 12-digit Hydrologic Unit Code. % Area is the percentage of the district area that contains some amount of predicted species habitat.

HUC12 Code	Present			2050		
	Species	Acres	% Area	Species	Acres	% Area
20403030501	9	2,595.3	61.1	5	1,957.9	46.1
20403030502	8	5,894.3	20.8	5	5,764.5	20.3
20403030503	12	26,235.3	69.4	5	20,361.1	53.8
20403030504	13	13,695.9	78.0	5	9,666.8	55.0
20403030603	11	3,667.1	15.1	5	972.6	4.0
20403040101	13	10,758.0	83.1	5	10,527.5	81.3
20403040102	13	10,054.4	83.0	5	9,080.6	74.9
20403040103	14	20,304.4	80.3	5	17,923.3	70.9
20403040104	14	24,247.4	63.3	5	20,184.1	52.7
20403040201	12	14,012.9	42.4	5	11,569.1	35.0
20403040202	8	25,060.1	74.8	5	24,081.8	71.9
20403040203	13	11,525.3	28.0	5	9,461.6	23.0
20403040301	8	15,950.0	70.7	5	13,004.3	57.7
20403040302	13	6,934.6	27.9	5	5,985.8	24.1
20403040303	13	10,870.6	53.7	5	9,946.1	49.1
20403040304	15	14,665.6	59.1	5	12,018.9	48.5
20403040401	11	566.3	2.3	4	3.2	0.0
20403040402	10	819.7	3.1	4	208.6	0.8

20403040404	13	2,147.5	3.5	5	929.7	1.5
20403040501	9	5,882.1	40.6	7	4,018.2	27.7
20600010204	5	11.2	0.1	3	7.8	0.0
20700080202	5	7,190.1	30.3	0	0.0	0.0
20700080301	3	15,570.0	43.2	0	0.0	0.0
20700080302	4	9,934.4	43.0	0	0.0	0.0
20700080401	3	2,451.3	34.1	0	0.0	0.0
20700080403	4	8,187.8	21.2	0	0.0	0.0
20700080501	3	2,024.5	10.6	0	0.0	0.0
20700080502	5	14,323.0	36.8	0	0.0	0.0
20700080503	5	6,925.9	37.9	0	0.0	0.0
20700080504	4	4,534.3	37.6	0	0.0	0.0
20700080505	5	5,275.3	27.2	0	0.0	0.0
20700080601	4	11,586.8	33.9	0	0.0	0.0
20700080602	3	11,611.4	40.8	0	0.0	0.0
20700080701	4	10,279.3	29.1	0	0.0	0.0
20700080702	5	5,219.3	31.3	0	0.0	0.0
20700080703	4	4,102.3	37.5	0	0.0	0.0
20700080704	4	8,496.4	62.0	0	0.0	0.0
20700080901	5	8,604.9	50.9	4	4,005.7	23.7
20700080902	5	11,622.4	76.7	4	4,965.9	32.8
20700080903	4	14,438.4	81.0	0	0.0	0.0
20700080904	4	3,752.7	19.6	0	0.0	0.0
20700080905	5	12,126.2	83.6	4	457.7	3.2
20700081004	5	20,667.3	55.4	4	20,108.6	53.9
20700081005	4	8,036.2	21.5	4	2,734.6	7.3
20700100103	5	13,870.7	59.3	4	14,349.5	61.3
20700100301	5	12,512.5	49.7	4	12,612.4	50.1
20700100302	6	27,447.4	93.7	5	29,164.3	99.5
20700100306	7	10,774.8	92.6	5	10,410.6	89.5
20700100307	6	9,356.9	35.3	5	8,524.6	32.1
20700100401	6	20,210.1	85.6	5	22,252.9	94.3
20700100402	7	31,500.5	87.8	5	33,880.8	94.4
20700100501	4	6,331.1	26.2	0	0.0	0.0
20700100502	5	8,617.9	36.6	0	0.0	0.0
20700100503	5	6,043.5	36.3	3	5,934.2	35.7
20700100504	6	16,189.9	66.5	5	18,789.7	77.1
20700100601	5	6,879.7	37.3	0	0.0	0.0
20700100602	5	7,411.0	31.3	0	0.0	0.0
20700100603	5	4,530.6	27.8	0	0.0	0.0
20700100604	4	2,576.0	23.2	3	3,317.1	29.9
20700100605	5	4,040.7	15.8	4	5,028.4	19.6
20700100606	5	8,109.7	26.8	5	15,558.2	51.4
20700100701	5	7,457.7	30.5	3	7,604.9	31.1

20700100702	5	7,921.7	45.2	4	4,594.8	26.2
20700100703	5	8,751.8	49.8	4	13,319.6	75.7
20700100704	5	22,971.4	68.6	4	28,492.4	85.0
20700100705	6	19,374.3	62.6	5	25,292.9	81.7
20700100801	6	12,962.8	70.5	5	15,903.1	86.5
20700100802	6	15,391.3	68.6	5	18,535.1	82.6
20700100803	7	11,443.2	78.5	5	11,433.9	78.5
20700100804	7	13,016.4	91.6	5	13,758.6	96.8
20700100805	7	8,203.7	28.8	5	6,571.6	23.1
20700110103	7	8,082.3	70.0	5	9,321.2	80.7
20700110104	8	16,102.9	64.8	6	15,756.4	63.4
20700110105	8	9,343.7	43.9	6	10,086.5	47.4
20700110106	8	6,141.7	14.2	6	4,862.3	11.2
20700110201	4	3,595.8	30.0	5	6,081.5	50.8
20700110202	5	7,370.4	31.1	6	10,965.9	46.3
20700110203	8	15,527.0	76.5	6	14,542.6	71.6
20700110204	8	5,381.4	37.2	6	7,225.4	49.9
20700110205	4	5,496.7	28.3	4	10,144.0	52.2
20700110206	8	8,578.8	37.8	6	9,691.9	42.7
20700110207	8	4,128.5	16.1	6	4,460.1	17.4
20700110301	7	4,187.9	24.1	5	4,332.1	25.0
20700110305	6	5,790.4	11.1	4	5,975.3	11.5
20700110601	8	10,793.8	36.2	6	11,648.3	39.1
20700110602	8	5,808.4	37.7	6	6,293.0	40.8
20700110603	8	6,533.2	36.2	6	7,555.4	41.9
20700110604	9	11,519.7	44.5	6	11,628.6	44.9
20700110801	7	15,989.0	49.2	5	17,634.7	54.3
20700110802	7	7,405.2	61.5	4	6,081.3	50.5
20700110803	6	18,510.9	13.3	4	16,407.8	11.8
20700110804	8	19,842.6	61.9	6	19,198.3	59.9
20700110805	7	12,822.2	65.4	5	12,270.1	62.6
20700110806	7	16,075.5	56.6	4	14,450.2	50.9
20801010000	6	4,921.2	0.7	5	2.5	0.0
20801020101	7	9,725.4	83.8	4	8,211.1	70.7
20801020102	8	17,303.6	43.1	5	16,313.4	40.6
20801020103	7	5,773.6	72.2	4	3,851.2	48.1
20801020104	9	13,893.7	52.8	5	11,287.4	42.9
20801020105	8	13,996.4	62.2	5	11,510.2	51.2
20801020201	3	4,786.5	16.5	2	10,792.7	37.2
20801020202	3	583.0	3.9	2	2,118.0	14.0
20801020203	3	2,305.5	11.3	3	4,851.1	23.7
20801020204	6	4,769.1	18.8	3	8,360.3	33.0
20801020301	9	18,053.3	51.2	8	17,535.2	49.7
20801020302	9	11,033.3	79.1	6	7,767.0	55.7

20801020303	11	15,450.6	57.8	7	10,851.8	40.6
20801020401	10	11,611.5	57.9	9	13,873.7	69.1
20801020402	9	8,030.1	80.2	7	7,815.8	78.1
20801020403	10	9,767.8	71.9	8	7,739.3	57.0
20801020404	10	18,445.0	69.5	8	14,656.0	55.2
20801020405	8	10,919.5	74.4	7	8,404.3	57.2
20801020406	12	13,235.0	55.3	5	10,593.3	44.2
20801020407	11	16,788.2	62.9	8	13,552.5	50.8
20801030104	4	4,978.9	21.5	0	0.0	0.0
20801030201	3	525.3	5.3	0	0.0	0.0
20801030202	4	6,597.7	18.6	0	0.0	0.0
20801030203	4	8,393.0	21.4	0	0.0	0.0
20801030601	6	9,057.4	30.4	1	0.9	0.0
20801030602	4	4,075.7	16.3	0	0.0	0.0
20801030603	4	1,493.4	5.8	1	137.5	0.5
20801030604	5	4,273.9	17.5	3	4,368.2	17.8
20801031104	3	1,200.7	11.4	1	134.0	1.3
20801031105	4	1,812.9	12.9	2	471.9	3.4
20801040101	5	9,844.8	39.0	3	12,844.5	50.9
20801040102	6	25,551.6	75.3	5	28,362.5	83.6
20801040103	8	12,646.0	51.4	6	16,798.7	68.3
20801040104	7	8,436.4	42.8	6	11,239.5	57.0
20801040201	9	16,828.2	43.7	7	19,345.7	50.3
20801040202	8	11,001.9	49.5	4	10,833.5	48.7
20801040203	9	14,088.2	47.0	6	14,731.4	49.1
20801040301	9	11,765.3	49.3	6	11,193.3	46.9
20801040302	7	4,184.4	32.2	6	5,197.6	40.0
20801040303	8	16,101.7	63.1	6	15,096.1	59.1
20801040304	9	11,325.3	36.0	6	14,607.9	46.4
20801040305	9	16,440.9	59.0	6	14,420.0	51.8
20801040401	4	4,929.7	16.9	3	9,013.8	30.9
20801040402	8	10,354.5	55.8	6	12,064.1	65.0
20801040403	8	4,139.2	24.8	5	6,062.6	36.3
20801040404	9	4,645.3	25.0	6	6,432.6	34.6
20801040405	8	11,342.5	30.9	6	15,850.7	43.1
20801040406	7	14,644.4	61.1	5	11,831.4	49.4
20801040501	7	5,790.7	41.3	6	8,072.0	57.6
20801040502	7	11,173.0	37.7	6	12,734.8	42.9
20801040503	7	4,417.7	39.2	5	5,154.7	45.7
20801040504	8	14,708.7	45.2	6	12,834.0	39.4
20801040601	8	8,164.9	40.8	5	9,328.3	46.6
20801040602	8	18,302.7	45.4	4	14,531.7	36.1
20801040603	8	15,054.5	50.1	5	12,956.1	43.1
20801040701	7	10,462.0	36.7	4	11,059.3	38.8

20801040702	7	7,367.2	42.7	5	8,055.9	46.7
20801040703	6	7,641.4	73.0	4	5,257.7	50.2
20801040704	7	10,701.0	61.0	5	7,536.1	43.0
20801040705	7	14,007.7	49.1	6	9,226.2	32.4
20801050101	6	4,843.5	14.6	4	8,120.9	24.4
20801050102	4	2,762.8	8.3	3	156.1	0.5
20801050103	2	639.9	5.9	0	0.0	0.0
20801050104	5	2,267.0	14.8	5	5,866.2	38.4
20801050105	6	2,575.0	19.1	4	4,639.0	34.4
20801050201	3	214.8	2.1	3	542.8	5.4
20801050202	4	1,072.0	6.1	2	578.3	3.3
20801050203	6	1,433.6	10.0	4	3,569.2	24.8
20801050204	5	3,752.7	9.3	3	11,555.6	28.8
20801050205	6	8,852.8	27.0	6	15,449.0	47.1
20801050301	5	4,320.8	13.7	5	12,122.5	38.5
20801050302	5	1,964.8	11.3	4	3,826.2	22.1
20801050303	6	4,292.9	16.9	5	10,715.7	42.3
20801050401	5	9,497.2	30.2	4	13,178.9	41.9
20801050402	5	5,685.4	14.5	3	9,214.2	23.5
20801050403	5	3,344.9	19.7	3	3,633.4	21.3
20801050501	5	4,042.2	17.0	3	6,878.5	28.9
20801050502	4	5,628.7	38.6	3	6,171.5	42.3
20801050503	6	3,593.0	11.9	3	7,830.6	25.9
20801050504	8	18,218.7	45.9	6	21,532.7	54.3
20801050601	7	3,316.6	15.2	5	7,171.6	32.9
20801050602	6	6,421.4	34.7	6	6,571.3	35.5
20801050603	7	8,811.2	37.6	6	10,227.9	43.7
20801050604	8	12,033.7	42.4	6	13,239.6	46.6
20801060204	1	95.9	0.4	0	0.0	0.0
20801060301	3	1,235.2	5.2	2	35.4	0.1
20801060302	3	2,861.3	12.6	2	101.2	0.4
20801060303	3	2,758.1	10.5	2	4,880.4	18.5
20801060304	5	5,890.3	15.1	3	16,209.4	41.6
20801060404	2	1,416.2	6.7	0	0.0	0.0
20801060501	2	875.0	2.3	0	0.0	0.0
20801060502	3	1,551.5	5.5	0	0.0	0.0
20801060503	3	1,565.5	12.2	0	0.0	0.0
20801060602	2	1,253.6	9.7	0	0.0	0.0
20801060603	3	1,859.9	6.6	0	0.0	0.0
20801060701	2	290.1	0.8	0	0.0	0.0
20801060702	4	2,711.9	7.2	2	5,428.7	14.4
20801060801	3	1,016.5	3.8	0	0.0	0.0
20801060802	2	798.3	3.0	2	2,085.9	7.9
20801060803	5	4,699.8	14.5	4	11,958.9	36.8

20801060901	6	10,228.5	26.0	5	20,527.6	52.1
20801060902	5	2,906.5	22.5	4	6,160.0	47.6
20801060903	4	8,533.9	49.5	3	9,313.5	54.0
20801060904	6	7,370.0	37.7	5	12,082.2	61.7
20801061001	5	8,951.7	61.2	5	10,208.5	69.8
20801061002	5	3,404.0	20.3	5	6,988.5	41.6
20801061003	7	2,411.0	11.7	4	6,794.5	33.0
20801061004	9	14,349.8	42.8	6	19,510.2	58.2
20801061005	5	2,600.1	14.7	3	5,916.0	33.4
20801061101	8	17,711.3	45.9	6	17,649.1	45.7
20801061102	9	22,194.5	69.0	7	20,451.1	63.6
20801070101	10	9,418.6	65.8	9	10,674.3	74.6
20801070102	10	14,120.7	52.3	9	12,420.8	46.0
20801070103	9	12,008.5	45.6	9	13,461.4	51.1
20801070104	11	16,616.8	64.7	9	14,695.7	57.2
20801070201	10	11,558.0	55.0	9	10,177.3	48.4
20801070202	8	10,904.9	71.6	9	11,965.2	78.6
20801070203	10	23,468.7	70.7	10	19,109.0	57.6
20801070204	12	12,134.2	50.5	10	8,252.3	34.3
20801080101	15	29,139.7	70.7	10	23,146.2	56.2
20801080102	9	14,250.8	96.9	8	13,336.8	90.7
20801080103	8	16,093.1	98.5	7	15,003.8	91.9
20801080104	14	9272.9	68.7	6	6,762.5	50.1
20801080201	11	41,236.6	99.7	8	36,200.1	87.5
20801080202	12	19,533.1	98.3	7	17,394.3	87.5
20801100501	7	27.4	0.1	3	11.3	0.0
20801100502	8	2,503.9	9.4	5	1,410.8	5.3
20801110303	6	147.5	77.1	5	138.6	72.4
20801110401	7	4,154.3	19.1	5	4,353.5	20.0
20801110402	8	10,049.3	49.4	5	10,916.5	53.6
20801110501	9	2,789.2	9.6	5	2,793.1	9.7
20801110502	10	997.0	3.2	5	489.1	1.6
20801110601	11	11,377.9	40.9	5	13,010.0	46.8
20801110602	12	19,397.2	55.9	5	19,349.7	55.8
20801110701	6	44.7	0.2	3	25.6	0.1
20801110702	11	8,875.9	45.5	5	8,272.4	42.4
20801110703	12	14,737.4	63.2	5	11,611.0	49.8
20801110801	10	14,441.2	50.4	5	13,639.4	47.6
20801110802	11	12,541.1	68.4	5	10,289.9	56.1
20801110803	9	16,301.8	70.4	5	13,867.9	59.9
20801110804	7	17,411.5	81.0	5	15,489.4	72.0
20801110901	7	18,319.8	78.4	5	15,303.2	65.5
20801110902	11	25,980.3	82.4	5	20,633.1	65.4
20802050505	1	5.4	0.0	0	0.0	0.0

20802050604	3	2,845.2	18.6	3	34.7	0.2
20802050605	5	13,268.0	33.0	4	14,560.3	36.2
20802050606	5	4,297.2	39.7	4	9,051.4	83.6
20802050607	5	17,759.0	84.0	4	20,733.2	98.1
20802060101	6	28,292.4	90.7	5	29,834.9	95.6
20802060102	6	28,065.3	72.4	4	33,433.5	86.3
20802060103	7	22,034.1	67.0	5	27,393.5	83.2
20802060104	6	3,988.8	31.6	4	6,880.3	54.5
20802060105	9	3,307.2	27.6	7	6,179.0	51.5
20802060106	9	19,717.7	82.2	7	16,924.1	70.5
20802060201	8	22,864.2	70.9	6	19,813.1	61.4
20802060202	8	9,735.7	47.3	6	11,555.8	56.2
20802060203	8	8,859.1	46.1	7	11,167.3	58.1
20802060204	8	11,070.4	63.0	7	13,408.7	76.3
20802060205	8	10,559.7	83.2	6	6,706.0	52.9
20802060301	7	10,418.5	60.8	5	11,366.2	66.3
20802060302	9	16,206.5	82.6	7	12,376.8	63.1
20802060303	9	15,605.9	56.5	7	16,928.2	61.3
20802060304	9	4,400.2	52.6	7	2,913.9	34.8
20802060401	5	8,826.8	48.2	4	13,004.6	71.0
20802060402	6	10,351.2	42.7	5	17,154.3	70.7
20802060403	6	21,740.3	85.3	5	24,504.1	96.1
20802060501	5	15,622.4	52.3	5	22,515.8	75.3
20802060502	5	3,488.3	22.0	4	9,584.9	60.4
20802060503	5	4,664.3	26.8	5	9,047.0	52.0
20802060504	6	2,768.7	16.2	4	7,573.5	44.4
20802060505	8	4,303.2	14.9	8	10,660.5	36.9
20802060506	7	7,349.9	43.0	7	7,835.0	45.9
20802060601	10	7,627.0	70.8	9	7,356.3	68.3
20802060602	5	4,065.4	14.5	6	10,329.1	36.8
20802060603	11	6,012.3	52.5	9	6,959.1	60.8
20802060604	11	13,982.6	76.4	9	14,195.7	77.6
20802060605	10	25,579.0	67.7	9	24,203.1	64.1
20802060701	9	9,505.2	51.2	8	6,037.0	32.5
20802060702	10	12,200.4	86.1	8	12,486.3	88.1
20802060703	8	6,861.3	49.6	6	7,272.8	52.5
20802060704	11	25,274.4	68.2	8	22,219.4	59.9
20802060801	8	8,968.6	98.3	7	8,547.2	93.7
20802060802	12	15,430.4	61.6	10	12,709.0	50.7
20802060803	8	9,557.7	80.6	7	9,556.5	80.6
20802060804	9	8,666.2	32.1	6	5,418.6	20.1
20802060901	11	30,529.6	98.0	9	27,787.8	89.2
20802060902	11	15,108.9	78.0	9	16,294.0	84.2
20802060903	8	10,376.1	78.4	6	10,562.2	79.8

20802060904	11	12,821.0	95.2	8	11,457.5	85.0
20802060905	11	16,486.6	91.5	9	15,628.1	86.7
20802060906	10	19,081.6	44.0	8	14,982.7	34.5
20802070603	3	69.4	0.3	0	0.0	0.0
20802070604	4	211.9	0.6	0	0.0	0.0
20802070801	2	21.1	0.1	0	0.0	0.0
20802070802	3	506.0	3.1	1	7.9	0.0
20802070803	4	213.7	1.8	3	413.0	3.5
20802070804	4	1,304.5	3.2	3	547.8	1.4
20802070805	4	2,907.1	26.1	4	4,446.4	39.9
20802070806	4	4,136.0	29.5	4	9,746.5	69.6
20802070901	5	10,272.7	24.9	3	93.2	0.2
20802070902	5	9,505.9	33.4	4	12,758.9	44.8
20802070903	4	3,316.1	17.2	5	6,491.2	33.7
20802070904	7	14,380.1	52.5	5	18,176.6	66.4
20802071001	7	22,767.8	61.5	5	30,551.9	82.5
20802071002	9	16,999.5	72.7	7	18,713.0	80.1
20802080101	7	8,195.2	53.6	6	11,826.9	77.4
20802080102	6	13,188.2	51.5	7	19,303.5	75.4
20802080103	6	9,644.0	50.7	7	15,223.8	80.0
20802080104	7	10,934.2	48.1	7	18,642.5	82.0
20802080105	9	17,330.7	65.3	7	15,166.5	57.1
20802080106	10	29,349.6	85.0	8	23,735.2	68.7
20802080201	7	16,094.8	95.2	5	15,500.5	91.7
20802080202	9	25,240.2	87.5	7	23,467.0	81.4
20802080203	6	1,652.4	14.6	5	1,359.1	12.0
20802080204	7	25,773.2	99.9	5	24,328.9	94.3
20802080205	10	24,470.4	96.6	7	21,405.6	84.5
20802080206	9	20,253.7	98.5	6	15,576.6	75.8
20802080301	10	7,334.8	81.2	5	5,848.1	64.7
20802080302	9	8,865.4	86.7	5	7,482.7	73.2
20802080303	12	12,781.5	83.8	6	10,433.1	68.4
20802080304	5	3,787.4	23.2	4	31.5	0.2
30102010303	2	24.2	0.1	0	0.0	0.0
30102010401	0	0.0	0.0	1	47.8	0.4
30102010402	3	14.0	0.1	3	229.9	2.0
30102010403	4	3,725.4	10.1	4	10,094.8	27.5
30102010404	5	4,665.9	31.8	5	8,625.1	58.9
30102010501	3	117.4	0.4	0	0.0	0.0
30102010502	3	470.7	2.2	3	29.0	0.1
30102010503	2	2,193.9	17.9	3	1,259.5	10.3
30102010504	4	5,572.9	25.3	3	8,496.1	38.6
30102010601	4	5,566.5	22.7	3	7,103.5	29.0
30102010602	4	10,034.2	50.5	3	13,397.9	67.4

30102010603	4	12,777.4	42.2	3	18,564.8	61.3
30102010701	4	8,844.8	24.0	4	18,511.8	50.2
30102010702	4	4,461.6	41.3	3	5,957.7	55.2
30102010703	4	11,088.0	33.4	4	19,142.2	57.6
30102010801	5	9,972.1	43.9	4	13,506.1	59.5
30102010802	5	13,212.8	48.0	4	18,024.5	65.5
30102010803	5	6,369.3	29.0	6	9,773.7	44.5
30102010901	5	8,803.6	51.0	5	11,795.2	68.3
30102010902	5	12,748.2	52.8	5	14,933.2	61.8
30102010903	6	4,240.7	27.7	4	5,843.5	38.2
30102010904	6	12,577.5	44.7	5	16,333.0	58.1
30102010905	6	6,459.4	49.1	5	9,715.6	73.9
30102011003	5	2,761.3	11.1	4	5,210.8	20.9
30102011004	5	2,007.7	5.2	4	10,085.5	26.3
30102011005	5	2,291.7	17.6	4	7,031.8	54.1
30102011006	6	6,432.8	30.5	5	11,391.7	53.9
30102011101	5	8,676.8	39.1	6	11,428.0	51.4
30102011102	5	5,208.9	44.1	5	5,507.7	46.6
30102011103	6	15,504.2	44.1	5	21,274.7	60.5
30102011201	6	6,200.0	38.7	5	9,942.1	62.1
30102011202	4	2,752.0	17.4	4	9,365.4	59.3
30102011203	6	3,198.8	27.2	6	10,840.8	92.3
30102011204	5	10,132.6	52.4	5	15,372.4	79.5
30102011205	3	3,665.7	15.5	3	13,899.6	58.8
30102011206	5	5,241.8	21.1	4	20,314.5	81.8
30102020101	4	6,630.5	39.6	3	11,492.9	68.7
30102020102	6	15,246.9	42.6	5	23,997.8	67.1
30102020103	4	11,097.8	44.8	4	16,997.9	68.6
30102020201	5	6,400.0	43.6	6	10,281.5	70.0
30102020202	4	7,520.7	48.6	5	9,945.4	64.2
30102020203	6	21,980.3	59.5	6	28,884.4	78.1
30102020204	5	24,910.9	66.2	4	28,763.6	76.5
30102020301	6	12,808.1	50.2	6	20,132.1	79.0
30102020302	6	9,569.2	40.2	5	16,876.4	70.9
30102020303	6	14,076.2	44.3	5	21,332.7	67.1
30102020304	6	22,969.7	58.2	6	31,288.8	79.3
30102020401	6	10,625.3	42.4	5	18,479.1	73.7
30102020402	5	6,817.3	49.3	4	9,604.6	69.4
30102020403	5	15,092.6	55.5	4	21,178.9	77.9
30102020501	5	11,473.8	48.0	5	18,362.5	76.8
30102020502	5	5,417.0	40.3	5	11,008.3	81.9
30102020503	5	11,106.3	57.1	5	17,559.1	90.2
30102020504	5	12,082.8	51.6	5	18,205.6	77.8
30102020505	5	9,115.9	36.7	5	22,419.6	90.2

30102030101	5	6,845.5	27.0	6	17,581.9	69.4
30102030102	5	3,957.3	19.4	5	10,029.3	49.3
30102030103	4	1,399.8	11.1	4	5,719.9	45.4
30102030201	1	34.1	2.9	2	234.5	19.8
30102030501	2	122.2	3.8	2	392.6	12.3
30102040903	5	3,621.8	10.5	4	10,412.5	30.3
30102040904	4	2,772.2	21.3	4	5,444.1	41.8
30102040905	3	974.8	12.7	3	2,979.1	38.7
30102050601	5	1,747.9	14.2	4	1,350.2	11.0
30102050602	6	5,529.5	21.7	5	17,624.9	69.2
30102050603	5	368.9	2.5	4	1,107.8	7.6
30102050604	7	10,794.4	26.8	6	8,556.8	21.3
30102050605	3	1,432.0	18.1	4	2,687.7	34.0
30102050606	4	1,027.9	17.5	3	443.7	7.6
30102051101	6	18,278.5	74.4	5	15,789.0	64.3
30102051102	4	975.6	85.8	3	688.0	60.5
30102051103	6	17,102.4	58.6	5	22,519.9	77.2
30102051104	5	10,174.8	67.8	5	13,194.7	87.9
30102051108	3	288.3	34.6	2	638.4	76.7
30102051201	7	24,453.1	87.6	5	26,151.2	93.6
30102051202	7	12,026.3	86.3	5	12,919.8	92.8
30102051203	7	15,703.5	92.4	5	16,468.7	96.9
30102051204	6	12,332.3	72.6	5	14,872.9	87.6
30102051205	7	11,993.3	66.5	5	15,632.2	86.7
30102051206	6	8,693.3	73.8	5	8,735.9	74.2
30102051301	8	14,121.6	91.1	5	14,321.6	92.4
30102051302	8	6,325.3	60.6	4	5,293.2	50.7
30102051303	10	18,936.8	48.0	4	16,970.4	43.0
30102051701	8	4,405.0	28.3	4	1,317.9	8.5