Evaluating the impact of flooding on road network access in coastal Virginia

Final report (Year 2 of 2)

Submitted to the Virginia Coastal Zone Management Program,
Department of Environmental Quality

Submitted October, 2021

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This project, Task #92.01 was funded by the Virginia Coastal Zone Management Program at the Department of Environmental Quality through Grant FY2020 # NA20NOS4190207 of the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, under the Coastal Zone Management Act of 1972, as amended.

Introduction

The impacts of recurrent flooding on roadways present challenging social and economic considerations for all coastal jurisdictions. Maintenance, public and private accessibility, evacuation routes, emergency services are just a few of the common themes local governments are beginning to address for low-lying roadways currently known to flood. Continuation of these services allows a community to thrive, to maintain or increase its tax base, and to insure the safety and well-being of its citizenry.

In a 2013 report to the Virginia General Assembly, the Center for Coastal Resources Management (CCRM) highlighted the current flood frequency on state-maintained roadways using data only from the Virginia Department of Transportation (Mitchell et al 2013). Between August of 2008 and May of 2012 extreme weather events have resulted in road closures in every coastal locality in Virginia at least once. In some localities, single events have resulted in multiple road closures across the jurisdictions, and some localities have experienced this level of impact as many as 9 different times over this 4-year data collection period. Available data on current flood frequency of roads in coastal Virginia has limited value in a region where sea level rise predictions estimate water levels to be 1.5 feet (0.5m) higher by 2050 than today (Boon et al., 2017). In the low-lying coastal plain this means that roadways that do not currently flood today may flood by the year 2050, or sooner. To prioritize the task of making transportation networks more resilient it is critical to understand, not only which areas will flood, but which additional areas will be inaccessible during the time of the flooding because some portion of their road network is underwater.

A geospatial analysis, delivered through an easy access web portal and detailed road flooding summaries can bring communities new and critical data for planning, zoning, and protection consideration that will have great value of many years.

Approach

A traditional projection analysis would focus only on impacts within the actual zone of inundation. The protocol developed for use in this analysis also considers impacted inhabitants that may not be within the inundation zone but will lose their transportation corridor into or out of their downstream dwelling/service areas and other areas that may be impacted. This project implements a protocol developed by CCRM to analyze the service area(s) impacted by road flooding at periodic intervals through the year 2100 in coastal Virginia. A network analysis of roadways and the average annual duration in hours/year of flooding can be assessed using GIS, water level data, road centerline data and topographic lidar. Land use data at a variety of scales can be used to assess the pressure felt by development not only within but also “downstream” of roadway flooding.

There were two main parts to the analysis, 1) mapping current and future flood duration extents, and 2) determining road inaccessibility under different levels of flooding.

Localities included in the Year 2 analysis are: Norfolk, Portsmouth, Virginia Beach, Chesapeake, Suffolk, Isle of Wight, Smithfield, Surry, Northumberland, Westmoreland, Richmond, Lancaster, King & Queen and King William. This region incorporates the coastal localities of the Southside, Northern Neck and Middle Peninsula regions.

Flood duration:

The purpose of this analysis was to map projected flooding duration extents based on a flood frequency analysis of current observed water levels and those combined with the NOAA intermediate sea level rise projections (NOAA 2017) for 2050 and 2100.

Table 1. Tide gauge stations used for each locality analysis for year 2

Tide Gauge	Regional	Localities
Lewisetta	Northern Neck	Westmoreland
	Northern Neck	Northumberland
Windmill Pt	Northern Neck	Lancaster
	Northern Neck	Richmond
Gloucester/Yorktown	Middle Peninsula	King and Queen
	Middle Peninsula	King William
Sewell's Pt	Southside	Norfolk
	Southside	Portsmouth
	Southside	Virginia Beach
	Southside	Chesapeake
	Southside	Suffolk
	Southside	Isle of Wight
	Southside	Surry

A 19-year record of hourly tide gauge records was downloaded from NOAA Tides & Currents. Tidal records from a 19-year period roughly represent tidal variability associated with one tidal epoch. Tide gauge stations were chosen for proximity to the locality, as shown in Table 1. Data were extracted and analyzed for the frequency of water levels at topographic elevation increments of one foot (NAVD88). Based on NOAA's intermediate sea level rise curve, an approximate 2050 mean sea level of +1.5 ft and an approximate 2100 mean sea level of +4.2 ft 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 water level frequencies were used to delineate flooding zones from a lidar-derived elevation surface. Results were synthesized in a layer depicting four categories of flood durations: 1) 0-5 hours per year, 2) 5 -100 hours per year, 3) 100 - 200 hours per year, and 4) more than 200 hours per year.

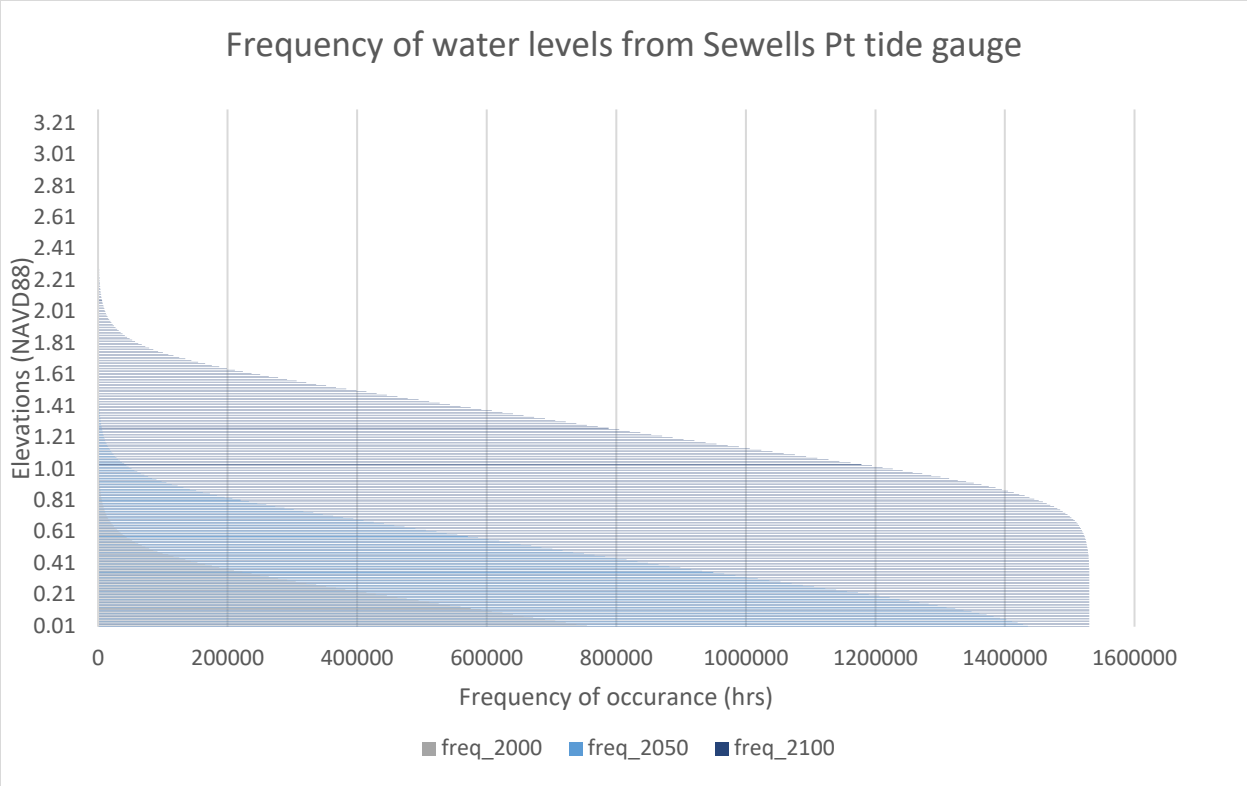

Figure 1. Water level frequency analysis for Sewell's Point tide gauge, assuming sea levels in 2050 and 2100 consistent with the NOAA intermediate scenario (NOAA 2017).

Inaccessible road analysis:

Inaccessible roads are portions of roads that experience flooding and/or experience disconnection due to flooding (i.e., the road portion itself is not flooded but access to that road section is blocked by flooding on adjacent road segment(s)). This analysis seeks to aid in planning by identifying those inaccessible roads. Since the information is given relative to water elevations, this analysis can aid in both sea level rise and storm surge planning efforts.

Road networks and road center line data were acquired from the Open Street Map database. Roads in Open Street Map have information already formatted in a way that makes network building more efficient. Elevations were mapped to the roads using high resolution land use and light detecting and radar (LiDAR) data available through the Virginia Geographic Information Network (VGIN).

The network analysis is run the using raster processing and network analysis tools in ArcGIS Desktop 8.0. Roadways and transportation pathways assess how traffic can move to and from a node if a barrier (i.e. a flooded road) is encountered. Nodes can represent critical infrastructure in a community such as fire and rescue stations, hospitals, military bases, and entrances to major arteries or evacuation routes. For this analysis, the node (point of origin) was always the locality seat. The network analysis was run regionally, to allow for the possibility that roads may transverse multiple localities and that flooding in one locality could affect access in another locality. Results of the network analysis were then clipped to the locality.

Constructing the road network analysis requires the delineation of a “service area” within which movement through the network can be assessed. The service area for the selected localities were initially constructed from a locality specific point of origin (county seat). Raw lidar elevation point clouds were downloaded for the localities of interest and elevation rasters were created from them. From the elevation rasters, the flooded areas were determined for varying flood levels derived from the tide gauge data. These flooding area polygons were used as polygon barrier inputs in the road network analysis. The use of the raw lidar data point clouds reconciled problems associated with overpasses and bridged yielding incorrect elevation profiles from data generated using bare earth raster data. The road network analysis was completed using road network datasets in the Open Street Map format as the source road data. First, the source point locations (county seats) were imported into the network analysis layer. Then, for each flood level, the flood area polygons were imported as a polygon barrier layer. Finally, the network analysis was solved to determine accessible and inaccessible roads for that flood level.

Roads accessibility was determined for 0.1 meter flood intervals from 0 up to 3.0 meters of flooding. Access is evaluated as the ability to travel from the locality's seat (e.g., the county courthouse) to each road in that locality. In some localities (e.g., Hampton City), roads to/from the county seat itself are flooded at a particular flooding level. In these cases, based on our definition of accessibility, the entire locality becomes inaccessible. For map display purposes and ease of use, inaccessible road segments were classified into 0.5 m elevation groups, according to the flood level the road segment first becomes inaccessible. This and other feedback were suggested by local government planners who reviewed and commented at various stages in the project (James City County).

Web viewer development

The web viewer was developed to present the results of the analysis in the most intuitive way for use in comprehensive planning efforts. To ensure that this goal was met, in year 1 of the project, the web viewer draft was presented to a group of stakeholders (James City County planners). The resulting format was used to deliver both year 1 and year 2 products. Due to Covid-19 restrictions, the draft viewer was introduced to the stakeholders in a virtual meeting and all other discussion was conducted via email. The web viewer was updated following their feedback to include:

- Changes to the way that inaccessible roads were displayed to make the results more immediately interpretable
- Clicking on road segments to generate a table in the viewer with information about road flooding at each meter of flooding recorded
- Additional information was added that can help inform planning (social vulnerability data, infrastructure data including locality seats, building footprints and parcel data)
- A dashboard at the bottom of the map that clearly connects road flood impacts to sea level rise projections
- Additional basemaps were added to increase the amount of available information

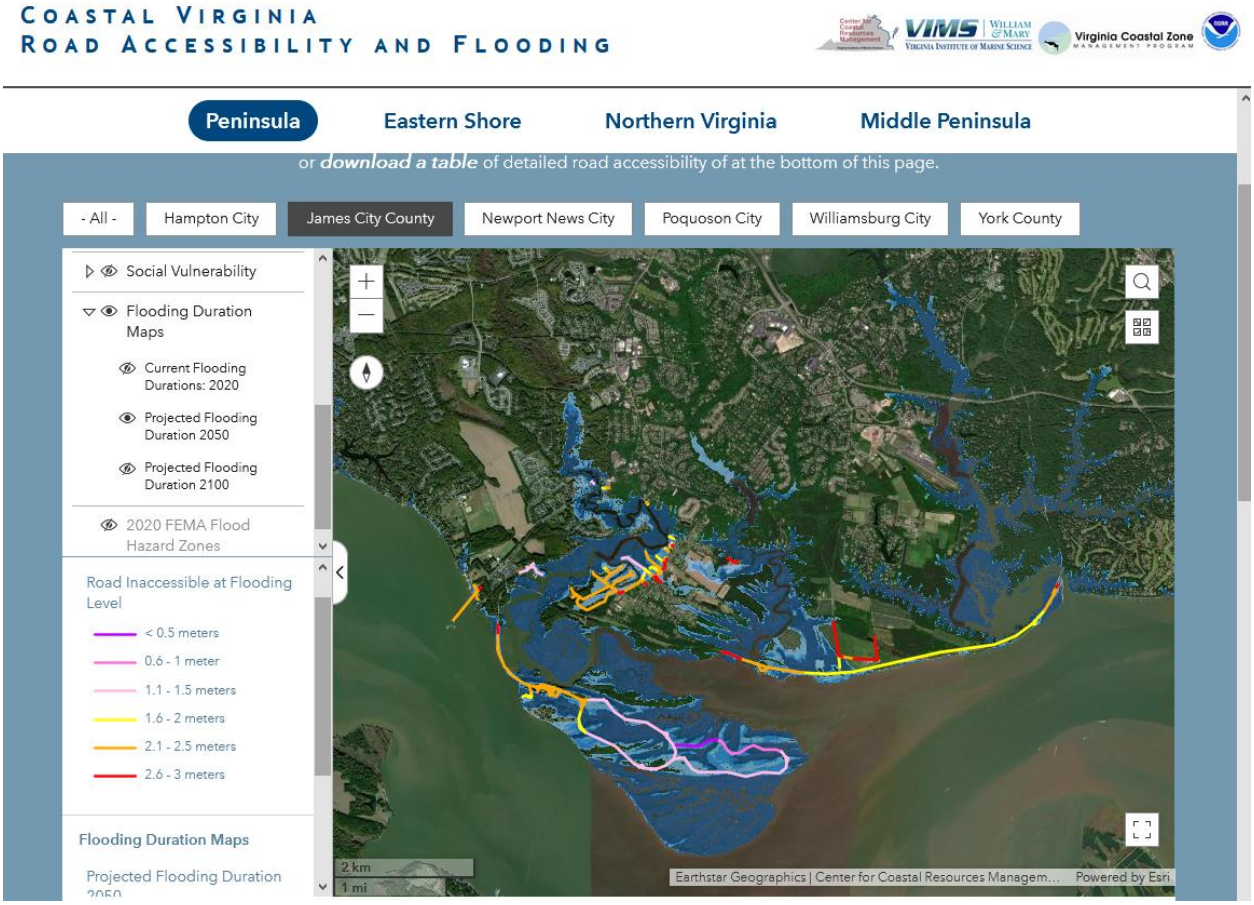

Figure 2. Example of information shown in the web viewer. The example shows inaccessible roads and 2050 flood duration for a section of James City County.

The stakeholders indicated that information from this analysis could inform multiple aspects of locality comprehensive planning, including:

- Land Use Planning (evaluation of land use designation changes and rezoning and SUP requests)
- Public Facilities Planning (consideration of future conditions for the location of public facilities and updates to Hazard Mitigation Plans)
- Transportation Planning (consideration of roadways projected to be impacted and determination of possible future road improvements).

In addition to the data in the map and dashboard, detailed summary tables of the miles of flooding for each locality can be accessed through links below the map.

Detailed Road Summary				
	When water rises this much:		*This length of road becomes inaccessible:*	
Road Name	Flooding Level (in meters)	Flooding Level (in feet)	Inaccessible (miles)	Inaccessible (feet)
Lake Powell Road	0.3	1.0	0	9
Lake Powell Road	0.4	1.3	0	13
	0.5	1.6	0	614
Island Drive	0.5	1.6	0	2,179
Lake Powell Road	0.5	1.6	0	13
South Riverside Drive	0.5	1.6	0	3
	0.6	2.0	0	682

Figure 3. Example of Downloadable Detailed Summary. Example is for a few roads in James City County.

Results

Final products include:

1. The following layers for each locality, grouped by region:

   - Tidal flood duration time in hours, raster layers for 2020, 2050, 2100 (provided to CZM in the zipped folder "Final_FloodDuration_rasters_Year 2")
     - These layers were developed using tide gauge data. Water level durations for the past 19-years were determined for the 2020 layers. The projected water level durations for the 2050 and 2100 layers were calculated by adjusting the 19-year record from the tide gauge using the NOAA intermediate projection for Sewell's Pt, Norfolk, VA. These water level durations were mapped onto a 1-m horizontal resolution digital elevation model.
   - Road inaccessibility classified by 0.1m increments (provided to CZM in the zipped folder "Road Accessibility Layers_Year 2")
     - A shapefile layer with inaccessible roads used for the web viewer
     - An excel spreadsheet with inaccessible roads used for Detailed Road Flooding Summaries analyses available for download on the web viewer
     - This layer was developed using a road network analysis. Road networks were based on Open Street Map road centerline data and road elevations were extracted from a 1-m horizontal resolution digital elevation model. For each locality, the point of origin was the locality seat. Flood impacts were mapped from 0-3m of flooding at 0.1m increments to create possible service areas for each flood level. The road network analysis was run for each service area and results were compiled into a single file that codes road segments by the water elevation at which they become inaccessible from the county seat due to flooding.

2. Web viewer available at http://cmap2.vims.edu/VAroads/ with layers developed in this analysis (Inaccessible roads, Flooding duration maps), additional information layers (Infrastructure, Accessible

roads, Social Vulnerability, and 2020 FEMA flood hazard zones), dashboard of road impacts, and downloadable Detailed Road Flooding Summaries

- Each region is grouped on to a page and the locality information can be displayed individually or information for the entire region can be displayed, except in the Northern Virginia Region where both Fairfax and Alexandria are always displayed together
- The Detailed Road Flooding Summaries include the length of each road flooded at 0.1m increments.

The final map viewer is accessible on the AdaptVA.org tool tab and on the locality-specific Comprehensive Coastal Resource Management Portals (CCRMPs, https://www.vims.edu/ccrm/ccrmp/index.php).

Summary

The analysis conducted in this project shows that the current impact of flooding on road accessibility varies by locality; however, many localities are likely to see a significant increase in flood impact with sea level rise (Table 2).

*Table 2. Miles of road way inaccessible at each flood level. *Projected 2100 flood level.*

Region	0.5m flood	1.0 m flood	1.5m flood	2m flood*	2.5m flood	3m flood
Peninsula	0.6 miles	43 miles	149 miles	1,230 miles	1,360 miles	1,411 miles
Middle Peninsula	11 miles	175 miles	389 miles	481 miles	610 miles	826 miles
Northern Virginia	<1 mile	<1 mile	2 miles	10 miles	23 miles	39 miles
Eastern Shore	8 miles	106 miles	228 miles	336 miles	440 miles	519 miles
Northern Neck	13 miles	181 miles	261 miles	325 miles	435 miles	550 miles
Southside	21 miles	114 miles	251 miles	1,390 miles	2,007 miles	5,493 miles

The transportation network analysis of flood frequency over time will be delivered to stakeholders through the ADAPTVA Portal (http://cmap2.vims.edu/AdaptVA/adaptVA_viewer.html) and the locality-specific CCRMP to aid with Comprehensive planning efforts. These two locations were chosen to make the product visible both to end users interested in general planning and in climate change planning. Additional information has been added to the web viewer to help end users visually interpret and combine data output with other data resources to bolster their decision-making capacity. For example, the map contains information on social vulnerability. Therefore, if a community is particularly concerned with maintenance of public roadways to underserved neighborhoods, the new data delivered under this project could be viewed in conjunction with the present social vulnerability data to provide answers.

References

Boon, J. D., Mitchell, M., Loftis, J. D., & Malmquist, D. M. (2018) Anthropocene Sea Level Change: A History of Recent Trends Observed in the U.S. East, Gulf, and West Coast Regions. Special Report in Applied Marine Science and Ocean Engineering (SRAMSOE) No. 467. Virginia Institute of Marine Science, College of William and Mary. https://doi.org/10.21220/V5T17T

Mitchell, M., C. Hershner, J. Herman, D. Schatt, E. Eggington and S. Stiles. 2013. Recurrent flooding study for Tidewater Virginia. Virginia senate document no. 3. Richmond, Virginia. Report. http://ccrm.vims.edu/recurrent_flooding/recurrent_flooding_study_web.pdf.

NOAA. Sweet, W.W.V., Kopp, R., Weaver, C.P., Obeysekera, J.T.B., Horton, R.M., Thieler, E.R. and Zervas, C.E., 2017. Global and regional sea level rise scenarios for the United States. NOAA Technical Report

Appendix 1. Metadata

Middle Peninsula Inaccessible Roads - New Localities Only, Grouped into 0.5 meter Flooding Levels

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Roads accessibility was determined for flooding intervals of 0.1 meters of flooding, up to 3.0 meters of flooding. Access is evaluated as the ability to travel from the locality's seat (e.g., the county courthouse) to each road in that locality. In some localities (e.g., Hampton City), roads to/from the county seat itself are flooded at a particular flooding level. In these cases, based on our definition of accessibility, the entire locality becomes inaccessible. Inaccessible road segments were classified and coded into 0.5 meter elevation groups, according to what flooding level that road segment first becomes inaccessible. This differs from the Easter Shore Inaccessible Roads layer because overlaps were removed. This layer is

used primarily for web display. This project, Task #92.01 was funded in part by the Virginia Coastal Zone Management Program at the Department of Environmental Quality through Grant FY2019 #NA19NOS4190163 of the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, under the Coastal Zone Management Act of 1972, as amended. The views expressed herein are those of the authors and do not necessarily reflect the views of the U.S. Department of Commerce, NOAA, or any of its subagencies.

/Purpose:/

Inaccessible roads are portions of roads that experience flooding and/or experience disconnection due to flooding (i.e., the road portion itself is not flooded but access to that road section is blocked by flooding on adjacent road segment(s)). This analysis seeks to aid in planning by identifying those inaccessible roads.

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Middle Peninsula Inaccessible Roads - New Localities, Year 2

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Administration, under the Coastal Zone Management Act of 1972, as amended. The views expressed herein are those of the authors and do not necessarily reflect the views of the U.S. Department of Commerce, NOAA, or any of its subagencies.

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/Attribute_Definition_Source:/ Esri

/Attribute_Domain_Values:/

/Unrepresentable_Domain:/

Sequential unique whole numbers that are

automatically generated.

/Attribute:/

/Attribute_Label:/ Shape

/Attribute_Definition:/ Feature geometry.

/Attribute_Definition_Source:/ Esri

/Attribute_Domain_Values:/

/Unrepresentable_Domain:/ Coordinates defining the features.

/Attribute:/

/Attribute_Label:/ Network

/Attribute_Definition:/

Indicates that these road segments are inaccessible at

flooding level indicated.

/Attribute:/

/Attribute_Label:/ level

/Attribute_Definition:/

Field captures the flooding level that the road segment becomes inaccessible at. Level is a text field, and represents flooding levels at 0.1 of the number in the field. For example, 06 means flooding level 0.6 meters.

/Attribute_Definition_Source:/ CCRM

/Attribute:/

/Attribute_Label:/ name

/Attribute:/

/Attribute_Label:/ NAMELSAD

/Attribute_Definition:/ Locality name.

/Attribute_Definition_Source:/ CCRM

/Attribute:/

/Attribute_Label:/ levels_view

/Attribute:/

/Attribute_Label:/ name_Juris

/Attribute:/

/Attribute_Label:/ miles

/Attribute_Definition:/

Length of inaccessible road segment in miles. Calculated

from shape_length. (Shape_length is in meters.)

/Attribute_Definition_Source:/ CCRM

/Attribute:/

/Attribute_Label:/ cat_txt

/Attribute:/

/Attribute_Label:/ Shape_Length

/Attribute_Definition:/ Length of feature in internal units.

/Attribute_Definition_Source:/ Esri

/Attribute_Domain_Values:/

/Unrepresentable_Domain:/ Positive real numbers that are

automatically generated.

/Metadata_Reference_Information:/

/Metadata_Date:/ 20210930

/Metadata_Contact:/

/Contact_Information:/

/Contact_Organization_Primary:/

/Contact_Organization:/

Center for Coastal Resources Management, Virginia

Institute of Marine Science (VIMS)

/Contact_Address:/

/Address_Type:/ unknown

/Address:/ PO Box 1346

/Address:/ 1375 Greate Road

/City:/ Gloucester Point

/State_or_Province:/ Virginia

/Postal_Code:/ 23062

/Country:/ US

/Metadata_Standard_Name:/ FGDC Content Standard for Digital

Geospatial Metadata

/Metadata_Standard_Version:/ FGDC-STD-001-1998

/Metadata_Time_Convention:/ local time

Generated by mp

<http://geology.usgs.gov/tools/metadata/tools/doc/mp.html> version

2.9.12 on Thu Sep 30 10:31:33 2021

Northern Neck Inaccessible Roads, Grouped into 0.5m Flooding Levels

Metadata also available as

Metadata:

/Identification_Information:/

/Citation:/

/Citation_Information:/

/Publication_Date:/ 20201215

/Title:/

Northern Neck Inaccessible Roads, Grouped into 0.5m Flooding Levels

/Geospatial_Data_Presentation_Form:/ vector digital data

/Description:/

/Abstract:/

Roads accessibility was determined for flooding intervals of 0.1 meters of flooding, up to 3.0 meters of flooding. Access is evaluated as the ability to travel from the locality's seat (e.g., the county courthouse) to each road in that locality. In some localities (e.g., Hampton City), roads to/from the county seat itself are flooded at a particular flooding level. In these cases, based on our definition of accessibility, the entire locality becomes inaccessible. Inaccessible road segments were classified and coded into 0.5 meter elevation groups, according to what flooding level that road segment first becomes inaccessible. This differs from the Easter Shore Inaccessible Roads layer because overlaps were removed. This layer is used primarily for web display.This project, Task #92.01 was funded in part by the Virginia Coastal Zone Management Program at the Department of Environmental Quality through Grant FY2019 #NA19NOS4190163 of the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, under the Coastal Zone Management Act of 1972, as amended. The views expressed herein are those of the authors and do not necessarily reflect the views of the U.S. Department of Commerce, NOAA, or any of its subagencies.

/Purpose:/

Inaccessible roads are portions of roads that experience flooding and/or experience disconnection due to flooding (i.e., the road portion itself is not flooded but access to that road section is blocked by flooding on adjacent road segment(s)). This analysis seeks to aid in planning by identifying those inaccessible roads.

/Status:/

/Maintenance_and_Update_Frequency:/ None planned

/Spatial_Domain:/

/Bounding_Coordinates:/

/West_Bounding_Coordinate:/ -77.048014

/East_Bounding_Coordinate:/ -76.233609

/North_Bounding_Coordinate:/ 38.284554

/South_Bounding_Coordinate:/ 37.599641

/Keywords:/

/Theme:/

/Theme_Keyword_Thesaurus:/ None

/Theme_Keyword:/ road inaccessibility, flooding

/Theme:/

/Theme_Keyword_Thesaurus:/ ISO 19115 Topic Categories

/Theme_Keyword:/ transportation

/Place:/

/Place_Keyword_Thesaurus:/ None

/Place_Keyword:/

Lancaster County, Northumberland County, Richmond

County, Westmoreland County

/Access_Constraints:/ None

/Use_Constraints:/ None

/Point_of_Contact:/

/Contact_Information:/

/Contact_Organization_Primary:/

/Contact_Organization:/

Center for Coastal Resources Management, Virginia

Institute of Marine Science (VIMS)

/Contact_Address:/

/Address_Type:/ unknown

/Address:/ PO Box 1346

/Address:/ 1375 Greate Road

/City:/ Gloucester Point

/State_or_Province:/ Virginia

/Postal_Code:/ 23062

/Country:/ US

/Point_of_Contact:/

/Contact_Information:/

/Contact_Organization_Primary:/

/Contact_Organization:/

Center for Coastal Resources Management, Virginia

Institute of Marine Science

/Contact_Person:/ Molly Mitchell

/Contact_Position:/ Research Scientist

/Contact_Address:/

/Address_Type:/ mailing and physical

/Address:/ P.O. Box 1346

/City:/ Gloucester Point

/State_or_Province:/ VA

/Postal_Code:/ 23062

/Country:/ US

/Contact_Voice_Telephone:/ 804-684-7188

/Contact_Electronic_Mail_Address:/ molly@vims.edu

/Data_Set_Credit:/

VIMS Center for Coastal Resources Management (CCRM), OpenStreetMap

/Native_Data_Set_Environment:/ Version 6.2 (Build 9200) ; Esri

ArcGIS 10.6.1.9270

/Data_Quality_Information:/

/Lineage:/

/Source_Information:/

/Type_of_Source_Media:/ None

/Source_Contribution:/ Open Street Map road layers.

/Process_Step:/

/Process_Description:/ Create network dataset.

/Process_Date:/ 20210112

/Process_Step:/

/Process_Description:/ Road network analysis and service areas generation.
/Process_Date:/ 20210512

/Process_Step:/

/Process_Description:/
Inaccessible roads identified and grouped into 0.5 meter intervals corresponding to the flooding level that the road is inaccessible at.
/Process_Date:/ 20210611

/Spatial_Data_Organization_Information:/

/Direct_Spatial_Reference_Method:/ Vector
/Point_and_Vector_Object_Information:/

/SDTS_Terms_Description:/

/SDTS_Point_and_Vector_Object_Type:/ String
/Point_and_Vector_Object_Count:/ 1742

/Spatial_Reference_Information:/

/Horizontal_Coordinate_System_Definition:/

/Planar:/

/Map_Projection:/

/Map_Projection_Name:/ NAD 1983 UTM Zone 18N

/Transverse_Mercator:/

/Scale_Factor_at_Central_Meridian:/ 0.9996

/Longitude_of_Central_Meridian:/ -75.0

/Latitude_of_Projection_Origin:/ 0.0

/False_Easting:/ 500000.0

/False_Northing:/ 0.0

/Planar_Coordinate_Information:/

/Planar_Coordinate_Encoding_Method:/ coordinate pair

/Coordinate_Representation:/

/Abscissa_Resolution:/ 0.00010000000474974514

/Ordinate_Resolution:/ 0.00010000000474974514

/Planar_Distance_Units:/ meter

/Geodetic_Model:/

/Horizontal_Datum_Name:/ D North American 1983

/Ellipsoid_Name:/ GRS 1980

/Semi-major_Axis:/ 6378137.0

/Denominator_of_Flattening_Ratio:/ 298.257222101

/Entity_and_Attribute_Information:/

/Detailed_Description:/

/Entity_Type:/

/Entity_Type_Label:/ NorthernNeck_Inaccessible_GrpLev

/Attribute:/

/Attribute_Label:/ OBJECTID

/Attribute_Definition:/ Internal feature number.

/Attribute_Definition_Source:/ Esri

/Attribute_Domain_Values:/

/Unrepresentable_Domain:/

Sequential unique whole numbers that are

automatically generated.

/Attribute:/

/Attribute_Label:/ Shape

/Attribute_Definition:/ Feature geometry.

/Attribute_Definition_Source:/ Esri

/Attribute_Domain_Values:/

/Unrepresentable_Domain:/ Coordinates defining the features.

/Attribute:/

/Attribute_Label:/ name

/Attribute_Definition:/
Street name obtained from combination of Open Street Map
street names and Virginia Geospatial Information Network
(VGIN) names.

/Attribute_Definition_Source:/ CCRM

/Attribute:/

/Attribute_Label:/ NAMELSAD

/Attribute_Definition:/ Locality name.

/Attribute_Definition_Source:/ CCRM

/Attribute:/

/Attribute_Label:/ levels_view

/Attribute:/

/Attribute_Label:/ name_Juris

/Attribute:/

/Attribute_Label:/ cat_txt

/Attribute:/

/Attribute_Label:/ fld_start
/Attribute_Definition:/ Flooding level group(s) that the
road segment is inaccessible.
/Attribute_Definition_Source:/ CCRM

/Attribute:/

/Attribute_Label:/ Shape_Length
/Attribute_Definition:/ Length of feature in internal units.
/Attribute_Definition_Source:/ Esri
/Attribute_Domain_Values:/

/Unrepresentable_Domain:/ Positive real numbers that are
automatically generated.

/Attribute:/

/Attribute_Label:/ miles
/Attribute_Definition:/
Length of inaccessible road segment in miles. Calculated
from shape_length. (Shape_length is in meters.)
/Attribute_Definition_Source:/ CCRM

/Metadata_Reference_Information:/

/Metadata_Date:/ 20210930

/Metadata_Contact:/

/Contact_Information:/

/Contact_Organization_Primary:/

/Contact_Organization:/

Center for Coastal Resources Management, Virginia

Institute of Marine Science (VIMS)

/Contact_Address:/

/Address_Type:/ unknown

/Address:/ PO Box 1346

/Address:/ 1375 Greate Road

/City:/ Gloucester Point

/State_or_Province:/ Virginia

/Postal_Code:/ 23062

/Country:/ US

/Metadata_Standard_Name:/ FGDC Content Standard for Digital

Geospatial Metadata

/Metadata_Standard_Version:/ FGDC-STD-001-1998

/Metadata_Time_Convention:/ local time

Generated by mp

<http://geology.usgs.gov/tools/metadata/tools/doc/mp.html> version

2.9.12 on Thu Sep 30 10:31:36 2021

Northern Neck Inaccessible Roads

Metadata also available as

Metadata:

* Identification_Information <#1>

* Data_Quality_Information <#2>

* Spatial_Data_Organization_Information <#3>

* Spatial_Reference_Information <#4>

* Entity_and_Attribute_Information <#5>

* Metadata_Reference_Information <#6>

/Identification_Information:/

/Citation:/

/Citation_Information:/

/Publication_Date:/ 20201218

/Title:/ Northern Neck Inaccessible Roads

/Geospatial_Data_Presentation_Form:/ vector digital data

/Description:/

/Abstract:/

Roads accessibility was determined for flooding intervals of 0.1 meters of flooding, up to 3.0 meters of flooding. Access is evaluated as the ability to travel from the locality's seat (e.g., the county courthouse) to each road in that locality. In some localities (e.g., Hampton City), roads to/from the county seat itself are flooded at a particular flooding level. In these cases, based on our definition of accessibility, the entire locality becomes inaccessible. Road segments overlap where flooding levels impact portions of the road. This layer is used primarily to generate statistics on the length of road segments that are flooded at different levels. This project, Task #92.01 was funded in part by the Virginia Coastal Zone Management Program at the Department of Environmental Quality through Grant FY2019 #NA19NOS4190163 of the U.S. Department of Commerce, National Oceanic and Atmospheric

Administration, under the Coastal Zone Management Act of 1972, as amended. The views expressed herein are those of the authors and do not necessarily reflect the views of the U.S. Department of Commerce, NOAA, or any of its subagencies.

/Purpose:/

Inaccessible roads are portions of roads that experience flooding and/or experience disconnection due to flooding (i.e., the road portion itself is not flooded but access to that road section is blocked by flooding on adjacent road segment(s)). This analysis seeks to aid in planning by identifying those inaccessible roads.

/Status:/

/Maintenance_and_Update_Frequency:/ None planned

/Spatial_Domain:/

/Bounding_Coordinates:/

/West_Bounding_Coordinate:/ -77.048014

/East_Bounding_Coordinate:/ -76.233609

/North_Bounding_Coordinate:/ 38.284554

/South_Bounding_Coordinate:/ 37.599641

/Keywords:/

/Theme:/

/Theme_Keyword_Thesaurus:/ None

/Theme_Keyword:/ road inaccessibility, flooding

/Theme:/

/Theme_Keyword_Thesaurus:/ ISO 19115 Topic Categories

/Theme_Keyword:/ transportation

/Place:/

/Place_Keyword_Thesaurus:/ None

/Place_Keyword:/

Lancaster County, Northumberland County, Richmond

County, Westmoreland County

/Access_Constraints:/ None

/Use_Constraints:/ None

/Point_of_Contact:/

/Contact_Information:/

/Contact_Organization_Primary:/

/Contact_Organization:/

Center for Coastal Resources Management, Virginia

Institute of Marine Science (VIMS)

/Contact_Address:/

/Address_Type:/ unknown

/Address:/ PO Box 1346

/Address:/ 1375 Greate Road

/City:/ Gloucester Point

/State_or_Province:/ Virginia

/Postal_Code:/ 23062

/Country:/ US

/Point_of_Contact:/

/Contact_Information:/

/Contact_Organization_Primary:/

/Contact_Organization:/

Center for Coastal Resources Management, Virginia

Institute of Marine Science

/Contact_Person:/ Molly Mitchell

/Contact_Position:/ Research Scientist

/Contact_Address:/

/Address_Type:/ mailing and physical

/Address:/ P.O. Box 1346

/City:/ Gloucester Point

/State_or_Province:/ VA

/Postal_Code:/ 23062

/Country:/ US

/Contact_Voice_Telephone:/ 804-684-7188

/Contact_Electronic_Mail_Address:/ molly@vims.edu

/Data_Set_Credit:/

VIMS Center for Coastal Resources Management (CCRM), OpenStreetMap

/Native_Data_Set_Environment:/ Version 6.2 (Build 9200) ; Esri ArcGIS 10.6.1.9270

/Data_Quality_Information:/

/Lineage:/

/Source_Information:/

/Type_of_Source_Media:/ None

/Source_Contribution:/ Open Street Map road shapefile.

/Process_Step:/

/Process_Description:/ Create network dataset.

/Process_Date:/ 20210111

/Process_Step:/

/Process_Description:/ Road network analysis and service areas generation.

/Process_Date:/ 20210324

/Process_Step:/

/Process_Description:/ Inaccessible roads identified and statistics generated.

/Process_Date:/ 20210715

/Spatial_Data_Organization_Information:/

/Direct_Spatial_Reference_Method:/ Vector

/Point_and_Vector_Object_Information:/

/SDTS_Terms_Description:/

/SDTS_Point_and_Vector_Object_Type:/ String

/Point_and_Vector_Object_Count:/ 52949

/Spatial_Reference_Information:/

/Horizontal_Coordinate_System_Definition:/

/Planar:/

/Map_Projection:/

/Map_Projection_Name:/ NAD 1983 UTM Zone 18N

/Transverse_Mercator:/

/Scale_Factor_at_Central_Meridian:/ 0.9996

/Longitude_of_Central_Meridian:/ -75.0

/Latitude_of_Projection_Origin:/ 0.0

/False_Easting:/ 500000.0

/False_Northing:/ 0.0

/Planar_Coordinate_Information:/

/Planar_Coordinate_Encoding_Method:/ coordinate pair

/Coordinate_Representation:/

/Abscissa_Resolution:/ 0.00010000000474974514

/Ordinate_Resolution:/ 0.00010000000474974514

/Planar_Distance_Units:/ meter

/Geodetic_Model:/

/Horizontal_Datum_Name:/ D North American 1983

/Ellipsoid_Name:/ GRS 1980

/Semi-major_Axis:/ 6378137.0

/Denominator_of_Flattening_Ratio:/ 298.257222101

/Entity_and_Attribute_Information:/

/Detailed_Description:/

/Entity_Type:/

/Entity_Type_Label:/ NorthernNeck_Inaccessible_all

/Attribute:/

/Attribute_Label:/ OBJECTID

/Attribute_Definition:/ Internal feature number.

/Attribute_Definition_Source:/ Esri

/Attribute_Domain_Values:/

/Unrepresentable_Domain:/

Sequential unique whole numbers that are

automatically generated.

/Attribute:/

/Attribute_Label:/ Shape

/Attribute_Definition:/ Feature geometry.

/Attribute_Definition_Source:/ Esri

/Attribute_Domain_Values:/

/Unrepresentable_Domain:/ Coordinates defining the features.

/Attribute:/

/Attribute_Label:/ Network

/Attribute_Definition:/

Indicates that these road segments are inaccessible at

flooding level indicated.

/Attribute:/

/Attribute_Label:/ level

/Attribute_Definition:/

Field captures the flooding level that the road segment becomes inaccessible at. Level is a text field, and represents flooding levels at 0.1 of the number in the field. For example, 06 means flooding level 0.6 meters.

/Attribute_Definition_Source:/ CCRM

/Attribute:/

/Attribute_Label:/ name

/Attribute:/

/Attribute_Label:/ NAMELSAD

/Attribute_Definition:/ Locality name.

/Attribute_Definition_Source:/ CCRM

/Attribute:/

/Attribute_Label:/ levels_view

/Attribute:/

/Attribute_Label:/ name_Juris

/Attribute:/

/Attribute_Label:/ miles

/Attribute_Definition:/

Length of inaccessible road segment in miles. Calculated

from shape_length. (Shape_length is in meters.)

/Attribute_Definition_Source:/ CCRM

/Attribute:/

/Attribute_Label:/ cat_txt

/Attribute:/

/Attribute_Label:/ Shape_Length

/Attribute_Definition:/ Length of feature in internal units.

/Attribute_Definition_Source:/ Esri

/Attribute_Domain_Values:/

/Unrepresentable_Domain:/ Positive real numbers that are

automatically generated.

/Metadata_Reference_Information:/

/Metadata_Date:/ 20210930

/Metadata_Contact:/

/Contact_Information:/

/Contact_Organization_Primary:/

/Contact_Organization:/

Center for Coastal Resources Management, Virginia

Institute of Marine Science (VIMS)

/Contact_Address:/

/Address_Type:/ unknown

/Address:/ PO Box 1346

/Address:/ 1375 Greate Road

/City:/ Gloucester Point

/State_or_Province:/ Virginia

/Postal_Code:/ 23062

/Country:/ US

/Metadata_Standard_Name:/ FGDC Content Standard for Digital

Geospatial Metadata

/Metadata_Standard_Version:/ FGDC-STD-001-1998

/Metadata_Time_Convention:/ local time

Generated by mp

<http://geology.usgs.gov/tools/metadata/tools/doc/mp.html> version

2.9.12 on Thu Sep 30 10:31:35 2021

Northern Virginia Inaccessible Roads, Grouped into 0.5 meter Flooding Levels

Metadata also available as

Metadata:

* Identification_Information <#1>

* Data_Quality_Information <#2>

* Spatial_Data_Organization_Information <#3>

* Spatial_Reference_Information <#4>

* Entity_and_Attribute_Information <#5>

* Metadata_Reference_Information <#6>

/Identification_Information:/

/Citation:/

/Citation_Information:/

/Publication_Date:/ 20201214

/Title:/

Northern Virginia Inaccessible Roads, Grouped into 0.5 meter Flooding Levels
/Geospatial_Data_Presentation_Form:/ vector digital data

/Description:/

/Abstract:/

Roads accessibility was determined for flooding intervals of 0.1 meters of flooding, up to 3.0 meters of flooding. Access is evaluated as the ability to travel from the locality's seat (e.g., the county courthouse) to each road in that locality. In some localities (e.g., Hampton City), roads to/from the county seat itself are flooded at a particular flooding level. In these cases, based on our definition of accessibility, the entire locality becomes inaccessible. Inaccessible road segments were classified and coded into 0.5

meter elevation groups, according to what flooding level that road segment first becomes inaccessible. This differs from the Easter Shore Inaccessible Roads layer because overlaps were removed. This layer is used primarily for web display.This project, Task #92.01 was funded in part by the Virginia Coastal Zone Management Program at the Department of Environmental Quality through Grant FY2019 #NA19NOS4190163 of the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, under the Coastal Zone Management Act of 1972, as amended. The views expressed herein are those of the authors and do not necessarily reflect the views of the U.S. Department of Commerce, NOAA, or any of its subagencies.

/Purpose:/

Inaccessible roads are portions of roads that experience flooding and/or experience disconnection due to flooding (i.e., the road portion itself is not flooded but access to that road section is blocked by flooding on adjacent road segment(s)). This analysis seeks to aid in planning by identifying those inaccessible roads.

/Status:/

/Maintenance_and_Update_Frequency:/ None planned

/Spatial_Domain:/

/Bounding_Coordinates:/

/West_Bounding_Coordinate:/ -77.257832

/East_Bounding_Coordinate:/ -77.033260

/North_Bounding_Coordinate:/ 38.845129

/South_Bounding_Coordinate:/ 38.633459

/Keywords:/

/Theme:/

/Theme_Keyword_Thesaurus:/ None

/Theme_Keyword:/ road inaccessibility, road flooding

/Theme:/

/Theme_Keyword_Thesaurus:/ ISO 19115 Topic Categories

/Theme_Keyword:/ transportation

/Place:/

/Place_Keyword_Thesaurus:/ None

/Place_Keyword:/ Fairfax County, Alexandria City

/Access_Constraints:/ None

/Use_Constraints:/ None

/Point_of_Contact:/

/Contact_Information:/

/Contact_Organization_Primary:/

/Contact_Organization:/

Center for Coastal Resources Management, Virginia

Institute of Marine Science (VIMS)

/Contact_Address:/

/Address_Type:/ unknown

/Address:/ PO Box 1346

/Address:/ 1375 Greate Road

/City:/ Gloucester Point

/State_or_Province:/ Virginia

/Postal_Code:/ 23062

/Country:/ US

/Point_of_Contact:/

/Contact_Information:/

/Contact_Organization_Primary:/

/Contact_Organization:/

Center for Coastal Resources Management, Virginia

Institute of Marine Science

/Contact_Person:/ Molly Mitchell

/Contact_Position:/ Research Scientist

/Contact_Address:/

/Address_Type:/ mailing and physical

/Address:/ P.O. Box 1346

/City:/ Gloucester Point

/State_or_Province:/ VA

/Postal_Code:/ 23062

/Country:/ US

/Contact_Voice_Telephone:/ 804-684-7188

/Contact_Electronic_Mail_Address:/ molly@vims.edu

/Data_Set_Credit:/

VIMS Center for Coastal Resources Management (CCRM), OpenStreetMap

/Native_Data_Set_Environment:/ Version 6.2 (Build 9200) ; Esri

ArcGIS 10.6.1.9270

/Data_Quality_Information:/

/Lineage:/

/Source_Information:/

/Type_of_Source_Media:/ None

/Source_Contribution:/ Open Street Map road layer.

/Process_Step:/

/Process_Description:/ Create network dataset.

/Process_Date:/ 20200720

/Process_Step:/

/Process_Description:/ Road network analysis and service

areas generation.

/Process_Date:/ 20200914

/Process_Step:/

/Process_Description:/

Inaccessible roads identified and grouped into 0.5 meter intervals corresponding to the flooding level that the road is inaccessible at.
/Process_Date:/ 20201109

/Spatial_Data_Organization_Information:/

/Direct_Spatial_Reference_Method:/ Vector
/Point_and_Vector_Object_Information:/

/SDTS_Terms_Description:/

/SDTS_Point_and_Vector_Object_Type:/ String
/Point_and_Vector_Object_Count:/ 1994

/Spatial_Reference_Information:/

/Horizontal_Coordinate_System_Definition:/

/Planar:/

/Map_Projection:/

/Map_Projection_Name:/ NAD 1983 UTM Zone 18N
/Transverse_Mercator:/

/Scale_Factor_at_Central_Meridian:/ 0.9996

/Longitude_of_Central_Meridian:/ -75.0

/Latitude_of_Projection_Origin:/ 0.0

/False_Easting:/ 500000.0

/False_Northing:/ 0.0

/Planar_Coordinate_Information:/

/Planar_Coordinate_Encoding_Method:/ coordinate pair

/Coordinate_Representation:/

/Abscissa_Resolution:/ 0.0001

/Ordinate_Resolution:/ 0.0001

/Planar_Distance_Units:/ meter

/Geodetic_Model:/

/Horizontal_Datum_Name:/ D North American 1983

/Ellipsoid_Name:/ GRS 1980

/Semi-major_Axis:/ 6378137.0

/Denominator_of_Flattening_Ratio:/ 298.257222101

/Entity_and_Attribute_Information:/

/Detailed_Description:/

/Entity_Type:/

/Entity_Type_Label:/ NoVA_Inaccessible_GrpLev

/Attribute:/

/Attribute_Label:/ OBJECTID

/Attribute_Definition:/ Internal feature number.

/Attribute_Definition_Source:/ Esri

/Attribute_Domain_Values:/

/Unrepresentable_Domain:/
Sequential unique whole numbers that are
automatically generated.

/Attribute:/

/Attribute_Label:/ Shape

/Attribute_Definition:/ Feature geometry.

/Attribute_Definition_Source:/ Esri

/Attribute_Domain_Values:/

/Unrepresentable_Domain:/ Coordinates defining the features.

/Attribute:/

/Attribute_Label:/ name

/Attribute_Definition:/

Street name obtained from combination of Open Street Map street names and Virginia Geospatial Information Network (VGIN) names.
/Attribute_Definition_Source:/ CCRM

/Attribute:/

/Attribute_Label:/ NAMELSAD
/Attribute_Definition:/ Locality name.
/Attribute_Definition_Source:/ CCRM

/Attribute:/

/Attribute_Label:/ miles

/Attribute:/

/Attribute_Label:/ fld_start
/Attribute_Definition:/ Flooding level group(s) that the road segment is inaccessible.
/Attribute_Definition_Source:/ CCRM

/Attribute:/

/Attribute_Label:/ Shape_Length
/Attribute_Definition:/ Length of feature in internal units.
/Attribute_Definition_Source:/ Esri
/Attribute_Domain_Values:/

/Unrepresentable_Domain:/ Positive real numbers that are automatically generated.

/Metadata_Reference_Information:/

/Metadata_Date:/ 20210217

/Metadata_Standard_Name:/ FGDC Content Standard for Digital Geospatial Metadata

/Metadata_Standard_Version:/ FGDC-STD-001-1998

/Metadata_Time_Convention:/ local time

Generated by mp <http://geology.usgs.gov/tools/metadata/tools/doc/mp.html> version 2.9.12 on Thu Sep 30 10:31:39 2021

Northern Virginia Inaccessible Roads

Metadata also available as

Metadata:

* Identification_Information <#1>

* Data_Quality_Information <#2>

* Spatial_Data_Organization_Information <#3>

* Spatial_Reference_Information <#4>

* Entity_and_Attribute_Information <#5>

* Metadata_Reference_Information <#6>

/Identification_Information:/

/Citation:/

/Citation_Information:/

/Publication_Date:/ 20201217

/Title:/ Northern Virginia Inaccessible Roads

/Geospatial_Data_Presentation_Form:/ vector digital data

/Description:/

/Abstract:/

Roads accessibility was determined for flooding intervals of 0.1 meters of flooding, up to 3.0 meters of flooding. Access is evaluated as the ability to travel from the locality's seat (e.g., the county courthouse) to each road in that locality. In some localities (e.g., Hampton City), roads to/from the county seat itself are flooded at a particular flooding level. In these cases, based on our definition of accessibility, the entire locality becomes inaccessible. Road segments overlap where flooding levels impact portions of the road. This layer is used primarily to generate statistics on the length of road segments that are flooded at different levels. This project, Task #92.01 was funded in part by the Virginia Coastal Zone Management Program at the Department of Environmental Quality through Grant FY2019 #NA19NOS4190163 of the U.S. Department of Commerce, National Oceanic and Atmospheric

Administration, under the Coastal Zone Management Act of 1972, as amended. The views expressed herein are those of the authors and do not necessarily reflect the views of the U.S. Department of Commerce, NOAA, or any of its subagencies.

/Purpose:/

Inaccessible roads are portions of roads that experience flooding and/or experience disconnection due to flooding (i.e., the road portion itself is not flooded but access to that road section is blocked by flooding on adjacent road segment(s)). This analysis seeks to aid in planning by identifying those inaccessible roads.

/Status:/

/Maintenance_and_Update_Frequency:/ None planned

/Spatial_Domain:/

/Bounding_Coordinates:/

/West_Bounding_Coordinate:/ -77.257832

/East_Bounding_Coordinate:/ -77.033260

/North_Bounding_Coordinate:/ 38.845129

/South_Bounding_Coordinate:/ 38.633459

/Keywords:/

/Theme:/

/Theme_Keyword_Thesaurus:/ None

/Theme_Keyword:/ road inaccessibility, flooding

/Theme:/

/Theme_Keyword_Thesaurus:/ ISO 19115 Topic Categories

/Theme_Keyword:/ transportation

/Place:/

/Place_Keyword_Thesaurus:/ None

/Place_Keyword:/ Alexandria City, Fairfax County

/Access_Constraints:/ None

/Use_Constraints:/ None

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/Contact_Information:/

/Contact_Organization_Primary:/

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Center for Coastal Resources Management, Virginia

Institute of Marine Science (VIMS)

/Contact_Address:/

/Address_Type:/ unknown

/Address:/ PO Box 1346

/Address:/ 1375 Greate Road

/City:/ Gloucester Point

/State_or_Province:/ Virginia

/Postal_Code:/ 23062

/Country:/ US

/Point_of_Contact:/

/Contact_Information:/

/Contact_Organization_Primary:/

/Contact_Organization:/
Center for Coastal Resources Management, Virginia
Institute of Marine Science
/Contact_Person:/ Molly Mitchell

/Contact_Position:/ Research Scientist
/Contact_Address:/

/Address_Type:/ mailing and physical
/Address:/ P.O. Box 1346
/City:/ Gloucester Point
/State_or_Province:/ VA
/Postal_Code:/ 23062
/Country:/ US

/Contact_Voice_Telephone:/ 804-684-7188
/Contact_Electronic_Mail_Address:/ molly@vims.edu

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VIMS Center for Coastal Resources Management (CCRM), OpenStreetMap
/Native_Data_Set_Environment:/ Version 6.2 (Build 9200) ; Esri
ArcGIS 10.6.1.9270

/Data_Quality_Information:/

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/Process_Date:/ 20200708

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/Process_Description:/ Road network analysis and service areas generation.

/Process_Date:/ 20201006

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/Process_Description:/ Inaccessible roads identified and statistics generated.

/Process_Date:/ 20201117

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/SDTS_Point_and_Vector_Object_Type:/ String

/Point_and_Vector_Object_Count:/ 5605

/Spatial_Reference_Information:/

/Horizontal_Coordinate_System_Definition:/

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/Map_Projection_Name:/ NAD 1983 UTM Zone 18N

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/Scale_Factor_at_Central_Meridian:/ 0.9996

/Longitude_of_Central_Meridian:/ -75.0

/Latitude_of_Projection_Origin:/ 0.0

/False_Easting:/ 500000.0

/False_Northing:/ 0.0

/Planar_Coordinate_Information:/

/Planar_Coordinate_Encoding_Method:/ coordinate pair

/Coordinate_Representation:/

/Abscissa_Resolution:/ 0.0001

/Ordinate_Resolution:/ 0.0001

/Planar_Distance_Units:/ meter

/Geodetic_Model:/

/Horizontal_Datum_Name:/ D North American 1983

/Ellipsoid_Name:/ GRS 1980

/Semi-major_Axis:/ 6378137.0

/Denominator_of_Flattening_Ratio:/ 298.257222101

/Entity_and_Attribute_Information:/

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/Entity_Type_Label:/ NoVA_Inaccessible

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/Attribute_Label:/ OBJECTID

/Attribute_Definition:/ Internal feature number.

/Attribute_Definition_Source:/ Esri

/Attribute_Domain_Values:/

/Unrepresentable_Domain:/
Sequential unique whole numbers that are
automatically generated.

/Attribute:/

/Attribute_Label:/ Shape

/Attribute_Definition:/ Feature geometry.

/Attribute_Definition_Source:/ Esri

/Attribute_Domain_Values:/

/Unrepresentable_Domain:/ Coordinates defining the features.

/Attribute:/

/Attribute_Label:/ level

/Attribute_Definition:/
Field captures the flooding level that the road segment
becomes inaccessible at. Level is a text field, and
represents flooding levels at 0.1 of the number in the
field. For example, 06 means flooding level 0.6 meters.

/Attribute_Definition_Source:/ CCRM

/Attribute:/

/Attribute_Label:/ Network

/Attribute_Definition:/

Indicates that these road segments are inaccessible at

flooding level indicated.

/Attribute_Definition_Source:/ CCRM

/Attribute:/

/Attribute_Label:/ name

/Attribute_Definition:/

Street name obtained from combination of Open Street Map

street names and Virginia Geospatial Information Network

(VGIN) names.

/Attribute_Definition_Source:/ CCRM

/Attribute:/

/Attribute_Label:/ NAMELSAD

/Attribute_Definition:/ Locality name.

/Attribute_Definition_Source:/ CCRM

/Attribute:/

/Attribute_Label:/ miles

/Attribute_Definition:/

Length of inaccessible road segment in miles. Calculated

from shape_length. (Shape_length is in meters.)

/Attribute_Definition_Source:/ CCRM

/Attribute:/

/Attribute_Label:/ Shape_Length

/Attribute_Definition:/ Length of feature in internal units.

/Attribute_Definition_Source:/ Esri

/Attribute_Domain_Values:/

/Unrepresentable_Domain:/ Positive real numbers that are automatically generated.

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Center for Coastal Resources Management, Virginia Institute of Marine Science (VIMS)

/Contact_Address:/

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/City:/ Gloucester Point

/State_or_Province:/ Virginia

/Postal_Code:/ 23062

/Country:/ US

/Metadata_Standard_Name:/ FGDC Content Standard for Digital Geospatial Metadata

/Metadata_Standard_Version:/ FGDC-STD-001-1998

/Metadata_Time_Convention:/ local time

Generated by mp <http://geology.usgs.gov/tools/metadata/tools/doc/mp.html> version 2.9.12 on Thu Sep 30 10:31:38 2021

Southside Inaccessible Roads, Grouped into 0.5 meter Flooding Levels

Metadata also available as

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* Identification_Information <#1>

* Data_Quality_Information <#2>

* Spatial_Data_Organization_Information <#3>

* Spatial_Reference_Information <#4>

* Entity_and_Attribute_Information <#5>

* Metadata_Reference_Information <#6>

/Identification_Information:/

/Citation:/

/Citation_Information:/

/Publication_Date:/ 20201215

/Title:/

Southside Inaccessible Roads, Grouped into 0.5 meter

Flooding Levels

/Geospatial_Data_Presentation_Form:/ vector digital data

/Description:/

/Abstract:/

Roads accessibility was determined for flooding intervals of 0.1 meters of flooding, up to 3.0 meters of flooding. Access is evaluated as the ability to travel from the locality's seat (e.g., the county courthouse) to each road in that locality. In some localities (e.g., Hampton City), roads to/from the county seat itself are flooded at a particular flooding level. In these cases, based on our definition of accessibility, the entire locality becomes inaccessible. Inaccessible road segments were classified and coded into 0.5 meter elevation groups, according to what flooding level that road segment first becomes inaccessible.

This differs from the Easter Shore Inaccessible Roads layer because overlaps were removed. This layer is used primarily for web display. This project, Task #92.01 was funded in part by the Virginia Coastal Zone Management Program at the Department of Environmental Quality through Grant FY2019 #NA19NOS4190163 of the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, under the Coastal Zone Management Act of 1972, as amended. The views expressed herein are those of the authors and do not necessarily reflect the views of the U.S. Department of Commerce, NOAA, or any of its subagencies.

/Purpose:/

Inaccessible roads are portions of roads that experience flooding and/or experience disconnection due to flooding (i.e., the road portion itself is not flooded but access to that road section is blocked by flooding on adjacent road segment(s)). This analysis seeks to aid in planning by identifying those inaccessible roads.

/Status:/

/Maintenance_and_Update_Frequency:/ None planned

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/East_Bounding_Coordinate:/ -75.908749

/North_Bounding_Coordinate:/ 37.251562

/South_Bounding_Coordinate:/ 36.537417

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/Theme_Keyword:/ road inaccessibility, flooding

/Theme:/

/Theme_Keyword_Thesaurus:/ ISO 19115 Topic Categories

/Theme_Keyword:/ transportation

/Place:/

/Place_Keyword_Thesaurus:/ None

/Place_Keyword:/

City of Chesapeake, Isle of Wight County, City of

Norfolk, City of Portsmouth, Suffolk County, Surry

County, City of Virginia Beach

/Access_Constraints:/ None

/Use_Constraints:/ None

/Point_of_Contact:/

/Contact_Information:/

/Contact_Organization_Primary:/

/Contact_Organization:/

Center for Coastal Resources Management, Virginia

Institute of Marine Science (VIMS)

/Contact_Address:/

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/Address:/ PO Box 1346

/Address:/ 1375 Greate Road

/City:/ Gloucester Point

/State_or_Province:/ Virginia

/Postal_Code:/ 23062

/Country:/ US

/Point_of_Contact:/

/Contact_Information:/

/Contact_Organization_Primary:/

/Contact_Organization:/

Center for Coastal Resources Management, Virginia

Institute of Marine Science

/Contact_Person:/ Molly Mitchell

/Contact_Position:/ Research Scientist

/Contact_Address:/

/Address_Type:/ mailing and physical

/Address:/ P.O. Box 1346

/City:/ Gloucester Point

/State_or_Province:/ VA

/Postal_Code:/ 23062

/Country:/ US

/Contact_Voice_Telephone:/ 804-684-7188

/Contact_Electronic_Mail_Address:/ molly@vims.edu

/Data_Set_Credit:/

VIMS Center for Coastal Resources Management (CCRM), OpenStreetMap

/Native_Data_Set_Environment:/ Version 6.2 (Build 9200) ; Esri

ArcGIS 10.6.1.9270

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/Source_Information:/

/Type_of_Source_Media:/ None

/Source_Contribution:/ Open Street Map

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/Process_Date:/ 20200713

/Process_Step:/

/Process_Description:/ Road network analysis and service

areas generation.

/Process_Date:/ 20200907

/Process_Step:/

/Process_Description:/

Inaccessible roads identified and grouped into 0.5 meter intervals corresponding to the flooding level that first renders the road segment inaccessible.

/Process_Date:/ 20201201

/Spatial_Data_Organization_Information:/

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/Point_and_Vector_Object_Information:/

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/Point_and_Vector_Object_Count:/ 11491

/Spatial_Reference_Information:/

/Horizontal_Coordinate_System_Definition:/

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/Map_Projection_Name:/ NAD 1983 UTM Zone 18N

/Transverse_Mercator:/

/Scale_Factor_at_Central_Meridian:/ 0.9996

/Longitude_of_Central_Meridian:/ -75.0

/Latitude_of_Projection_Origin:/ 0.0

/False_Easting:/ 500000.0

/False_Northing:/ 0.0

/Planar_Coordinate_Information:/

/Planar_Coordinate_Encoding_Method:/ coordinate pair

/Coordinate_Representation:/

/Abscissa_Resolution:/ 0.00010000000474974514

/Ordinate_Resolution:/ 0.00010000000474974514

/Planar_Distance_Units:/ meter

/Geodetic_Model:/

/Horizontal_Datum_Name:/ D North American 1983

/Ellipsoid_Name:/ GRS 1980

/Semi-major_Axis:/ 6378137.0

/Denominator_of_Flattening_Ratio:/ 298.257222101

/Entity_and_Attribute_Information:/

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/Entity_Type:/

/Entity_Type_Label:/ Southside_Inaccessible_GrpLev

/Attribute:/

/Attribute_Label:/ OBJECTID

/Attribute_Definition:/ Internal feature number.

/Attribute_Definition_Source:/ Esri

/Attribute_Domain_Values:/

/Unrepresentable_Domain:/
Sequential unique whole numbers that are
automatically generated.

/Attribute:/

/Attribute_Label:/ Shape

/Attribute_Definition:/ Feature geometry.

/Attribute_Definition_Source:/ Esri

/Attribute_Domain_Values:/

/Unrepresentable_Domain:/ Coordinates defining the features.

/Attribute:/

/Attribute_Label:/ name

/Attribute_Definition:/

Street name obtained from combination of Open Street Map street names and Virginia Geospatial Information Network (VGIN) names.

/Attribute_Definition_Source:/ CCRM

/Attribute:/

/Attribute_Label:/ NAMELSAD

/Attribute_Definition:/ Locality name.

/Attribute_Definition_Source:/ CCRM

/Attribute:/

/Attribute_Label:/ levels_view

/Attribute:/

/Attribute_Label:/ name_Juris

/Attribute:/

/Attribute_Label:/ cat_txt

/Attribute:/

/Attribute_Label:/ fld_start

/Attribute_Definition:/ Flooding level group(s) that the

road segment is inaccessible.

/Attribute_Definition_Source:/ CCRM

/Attribute:/

/Attribute_Label:/ Shape_Length

/Attribute_Definition:/ Length of feature in internal units.

/Attribute_Definition_Source:/ Esri

/Attribute_Domain_Values:/

/Unrepresentable_Domain:/ Positive real numbers that are automatically generated.

/Attribute:/

/Attribute_Label:/ miles

/Attribute_Definition:/

Length of inaccessible road segment in miles. Calculated from shape_length. (Shape_length is in meters.)

/Attribute_Definition_Source:/ CCRM

/Metadata_Reference_Information:/

/Metadata_Date:/ 20210930

/Metadata_Contact:/

/Contact_Information:/

/Contact_Organization_Primary:/

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Center for Coastal Resources Management, Virginia Institute of Marine Science (VIMS)

/Contact_Address:/

/Address_Type:/ unknown

/Address:/ PO Box 1346

/Address:/ 1375 Greate Road

/City:/ Gloucester Point

/State_or_Province:/ Virginia

/Postal_Code:/ 23062

/Country:/ US

/Metadata_Standard_Name:/ FGDC Content Standard for Digital

Geospatial Metadata

/Metadata_Standard_Version:/ FGDC-STD-001-1998

/Metadata_Time_Convention:/ local time

Generated by mp

<http://geology.usgs.gov/tools/metadata/tools/doc/mp.html> version

2.9.12 on Thu Sep 30 10:31:41 2021

Southside Inaccessible Roads

Metadata also available as

Metadata:

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* Data_Quality_Information <#2>

* Spatial_Data_Organization_Information <#3>

* Spatial_Reference_Information <#4>

* Entity_and_Attribute_Information <#5>

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/Citation:/

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/Publication_Date:/ 20210802

/Title:/ Southside Inaccessible Roads

/Geospatial_Data_Presentation_Form:/ vector digital data

/Description:/

/Abstract:/

Roads accessibility was determined for flooding intervals of 0.1 meters of flooding, up to 3.0 meters of flooding. Access is evaluated as the ability to travel from the locality's seat (e.g., the county courthouse) to each road in that locality. In some localities (e.g., Hampton City), roads to/from the county seat itself are flooded at a particular flooding level. In these cases, based on our definition of accessibility, the entire locality becomes inaccessible. Road segments overlap where flooding levels impact portions of the road. This layer is used primarily to generate statistics on the length of road segments that are flooded at different levels. This project, Task #92.01 was funded in part by the Virginia Coastal Zone Management Program at the Department of Environmental Quality through Grant FY2019 #NA19NOS4190163 of the U.S. Department of Commerce, National Oceanic and Atmospheric

Administration, under the Coastal Zone Management Act of 1972, as amended. The views expressed herein are those of the authors and do not necessarily reflect the views of the U.S. Department of Commerce, NOAA, or any of its subagencies.

/Purpose:/

Inaccessible roads are portions of roads that experience flooding and/or experience disconnection due to flooding (i.e., the road portion itself is not flooded but access to that road section is blocked by flooding on adjacent road segment(s)). This analysis seeks to aid in planning by identifying those inaccessible roads.

/Status:/

/Maintenance_and_Update_Frequency:/ None planned

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/West_Bounding_Coordinate:/ -77.045734

/East_Bounding_Coordinate:/ -75.908749

/North_Bounding_Coordinate:/ 37.251562

/South_Bounding_Coordinate:/ 36.537417

/Keywords:/

/Theme:/

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/Theme_Keyword:/ road inaccessibility, flooding

/Theme:/

/Theme_Keyword_Thesaurus:/ ISO 19115 Topic Categories

/Theme_Keyword:/ transportation

/Place:/

/Place_Keyword_Thesaurus:/ None

/Place_Keyword:/

City of Chesapeake, Isle of Wight County, City of Norfolk, City of Portsmouth, Suffolk County, Surry County, City of Virginia Beach

/Access_Constraints:/ None

/Use_Constraints:/ None

/Point_of_Contact:/

/Contact_Information:/

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Center for Coastal Resources Management, Virginia Institute of Marine Science (VIMS)

/Contact_Address:/

/Address_Type:/ unknown

/Address:/ PO Box 1346

/Address:/ 1375 Greate Road

/City:/ Gloucester Point

/State_or_Province:/ Virginia

/Postal_Code:/ 23062

/Country:/ US

/Point_of_Contact:/

/Contact_Information:/

/Contact_Organization_Primary:/

/Contact_Organization:/
Center for Coastal Resources Management, Virginia Institute of Marine Science
/Contact_Person:/ Molly Mitchell

/Contact_Position:/ Research Scientist
/Contact_Address:/

/Address_Type:/ mailing and physical
/Address:/ P.O. Box 1346
/City:/ Gloucester Point
/State_or_Province:/ VA
/Postal_Code:/ 23062
/Country:/ US

/Contact_Voice_Telephone:/ 804-684-7188
/Contact_Electronic_Mail_Address:/ molly@vims.edu

/Data_Set_Credit:/
VIMS Center for Coastal Resources Management (CCRM), OpenStreetMap
/Native_Data_Set_Environment:/ Version 6.2 (Build 9200) ; Esri
ArcGIS 10.6.1.9270

/Data_Quality_Information:/

/Lineage:/

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/Type_of_Source_Media:/ None

/Source_Contribution:/ Open Street Map road layer

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/Process_Date:/ 20200908

/Process_Step:/

/Process_Description:/ Road network analysis and service areas generation.

/Process_Date:/ 20201102

/Process_Step:/

/Process_Description:/ Inaccessible roads identified and statistics generated.

/Process_Date:/ 20201214

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/Direct_Spatial_Reference_Method:/ Vector

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/Map_Projection_Name:/ NAD 1983 UTM Zone 18N

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/Scale_Factor_at_Central_Meridian:/ 0.9996

/Longitude_of_Central_Meridian:/ -75.0

/Latitude_of_Projection_Origin:/ 0.0

/False_Easting:/ 500000.0

/False_Northing:/ 0.0

/Planar_Coordinate_Information:/

/Planar_Coordinate_Encoding_Method:/ coordinate pair

/Coordinate_Representation:/

/Abscissa_Resolution:/ 0.00010000000474974514

/Ordinate_Resolution:/ 0.00010000000474974514

/Planar_Distance_Units:/ meter

/Geodetic_Model:/

/Horizontal_Datum_Name:/ D North American 1983

/Ellipsoid_Name:/ GRS 1980

/Semi-major_Axis:/ 6378137.0

/Denominator_of_Flattening_Ratio:/ 298.257222101

/Entity_and_Attribute_Information:/

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/Attribute_Definition_Source:/ Esri

/Attribute_Domain_Values:/

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Sequential unique whole numbers that are

automatically generated.

/Attribute:/

/Attribute_Label:/ Shape

/Attribute_Definition:/ Feature geometry.

/Attribute_Definition_Source:/ Esri

/Attribute_Domain_Values:/

/Unrepresentable_Domain:/ Coordinates defining the features.

/Attribute:/

/Attribute_Label:/ level

/Attribute_Definition:/

Field captures the flooding level that the road segment becomes inaccessible at. Level is a text field, and represents flooding levels at 0.1 of the number in the field. For example, 06 means flooding level 0.6 meters.

/Attribute_Definition_Source:/ CCRM

/Attribute:/

/Attribute_Label:/ Network

/Attribute_Definition:/

Indicates that these road segments are inaccessible at flooding level indicated.

/Attribute_Definition_Source:/ CCRM

/Attribute:/

/Attribute_Label:/ name

/Attribute_Definition:/

Street name obtained from combination of Open Street Map street names and Virginia Geospatial Information Network (VGIN) names.

/Attribute_Definition_Source:/ CCRM

/Attribute:/

/Attribute_Label:/ NAMELSAD

/Attribute_Definition:/ Locality name.

/Attribute_Definition_Source:/ CCRM

/Attribute:/

/Attribute_Label:/ levels_view

/Attribute:/

/Attribute_Label:/ name_Juris

/Attribute:/

/Attribute_Label:/ miles

/Attribute_Definition:/

Length of inaccessible road segment in miles. Calculated from shape_length. (Shape_length is in meters.)

/Attribute:/

/Attribute_Label:/ cat_txt

/Attribute:/

/Attribute_Label:/ Shape_Length

/Attribute_Definition:/ Length of feature in internal units.

/Attribute_Definition_Source:/ Esri

/Attribute_Domain_Values:/

/Unrepresentable_Domain:/ Positive real numbers that are

automatically generated.

/Metadata_Reference_Information:/

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Center for Coastal Resources Management, Virginia

Institute of Marine Science (VIMS)

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/Address:/ 1375 Greate Road

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/State_or_Province:/ Virginia

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/Country:/ US

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Geospatial Metadata

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/Metadata_Time_Convention:/ local time

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<http://geology.usgs.gov/tools/metadata/tools/doc/mp.html> version

2.9.12 on Thu Sep 30 10:31:40 2021