

# Eastern Shore of Virginia Transportation Infrastructure Inundation Vulnerability Assessment

**Description** The Eastern Shore of Virginia Transportation Infrastructure Inundation Vulnerability Assessment (TIIVA) assessed road and railroad vulnerabilities to long-term relative sea-level in order to project where and when inundation could occur. The study consisted of two assessments: a regional transportation infrastructure inundation vulnerability assessment and a community and critical facility accessibility assessment.

**Status** The data was created during 2014.

**Citation** 2014. Eastern Shore of Virginia Transportation Infrastructure Inundation Vulnerability Assessment. Accomack-Northampton Planning District Commission.

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## Why should we care (about this resource)?

A number of studies have recently documented that relative sea-level rise is occurring and appears to be accelerating on the Eastern Shore of Virginia. A number of areas are currently vulnerable to road closures during storm events and it is expected that future elevated water levels will have increasingly significant impacts on transportation infrastructure and the communities, facilities, and economies that depend upon them. To begin to address these long-range issues, this study set out to conduct a screening-level assessment to determine 1) which transportation infrastructure is vulnerable to inundation from relative sea level rise, 2) which communities are at risk to having limited access or becoming inaccessible altogether, and 3) when these changes are projected to occur.

To accomplish these objectives, the Accomack-Northampton Planning District Commission (A-NPDC) worked in cooperation with the Virginia Department of Transportation (VDOT) to evaluate existing inundation models, digital transportation infrastructure data, local knowledge, and relative sea-level rise projections for the Eastern Shore. Two separate assessments were conducted: a regional transportation infrastructure inundation vulnerability assessment and a community and critical facility accessibility assessment.

The method of this assessment assumes the inundation scenarios are to occur under “stillwater” conditions and does not consider other mechanisms for increase in water levels including groundwater and stormwater flooding, storm surge and astronomical tides or other natural processes such as shoreline erosion that are expected to exacerbate the impacts and hasten the timing of inundation of transportation infrastructure.

The inundation vulnerability assessment determined that 33 miles of roads in the region are vulnerable to inundation sometime between 2025 and 2050 with 1 foot of relative sea-level rise above mean higher high water. This number peaks to 371 miles, or 24.5% of all roads, are potentially vulnerable in the region as early as 2090 with 6 feet of relative sea-level rise. Over 80% of all vulnerable roads identified were located in Accomack County with some of this being attributed to the communities and facilities located in tidal marshes and on barrier islands.

The accessibility assessment evaluated over 50 communities and facilities in the region that are potentially vulnerable to inundation of routes providing entrance and egress by sometime over the next 100 years or by the beginning of the next century. It is projected that seven communities including the Incorporated Town of Saxis, may be disconnected or inaccessible during high tide and stillwater conditions beginning sometime between 2025 and 2050 with 1 foot of relative sea-level rise. Additionally, the Chincoteague Causeway (SR-175) which serves as the sole access route to the Town of Chincoteague, the Chincoteague National Wildlife Refuge, and the Assateague Island National Seashore was found to be vulnerable to inundation beginning sometime between 2045 and 2090.

#### **Links for more resource information:**

Accomack-Northampton Planning District Commission [www.a-npdc.org](http://www.a-npdc.org)  
ESVA Climate Adaptation Working Group [www.a-npdc.org/CAWG](http://www.a-npdc.org/CAWG)  
Virginia Department of Transportation <http://www.virginiadot.org/>

#### **How is this resource managed?**

The Accomack-Northampton Planning District Commission and the Virginia Department of Transportation intend to utilize the data to supplement prioritization and management decisions. It is desired that the data will be updated regularly as new and improved data becomes available that would improve the data's accuracy.

#### **Why was this data created?**

These assessments are intended to support long-term planning efforts that can ultimately result in a more resilient and cost-effective management approach of transportation infrastructure that ensures the viability of coastal communities to the greatest extent possible.

#### **How was this data created?**

The analysis was conducted in cooperation with VDOT and included two separate assessments – a Regional Inundation Assessment and a Community and Critical Facility Accessibility Assessment.

For the Inundation Assessment, the GIS methodology used to determine inundation vulnerability involved utilizing model outputs from the NOAA Sea Level Rise Inundation model developed for the Eastern Shore of Virginia and incorporated into NOAA's Sea Level Rise and Coastal Flooding Impacts Viewer (available at <http://coast.noaa.gov/slr/>) to determine which areas of land would be submerged. These data were then overlain with the most recent roadway network shapefile from the Virginia Base Mapping Program to determine individual vulnerabilities of road segments throughout the region.

The selection geoprocessing tool was used to extract centerlines that overlapped road segments that would be inundated under the various inundation scenarios. Road segments identified as

being inundated were then individually analyzed by A-NPDC staff to address the following issues:

- Only one inundation grid cell intersecting a road centerline feature was required to trigger an entire road segment as being defined as inundated. Analysis of inundated road segments discovered that several segments were identified as being inundated due to inadequate resolution in the inundation data layer. These situations often produced discernible patterns where embankments, causeways, ditches, etc. could be interpreted. A-NPDC staff also utilized Google maps to verify these interpretations.
- To identify road segments containing bridges or culverts that incorrectly illustrated the road segment as being inundated. Additional VDOT datasets and Google maps were used to identify existing bridges and culverts and attributes were edited for each corresponding road segment accordingly. This scenario occurs because above-ground features are filtered out of the elevation data during the development of the DEM. As result, the inundation model wrongfully assumes that a bridge is of the same elevation as the contiguous lower road segment and wrongfully identifies the road segment as being inundated.

For the Accessibility Assessment, the GIS results from the Regional Inundation Assessment described above were utilized by A-NPDC staff to identify accessibility under the inundation scenarios for 1' through 6' above MHHW. A-NPDC first contacted staff from Accomack and Northampton Counties to solicit input on which communities and critical facilities were to be included in the assessment. Once finalized, all communities and critical facilities included in the assessment were plotted on maps utilizing GIS.

A-NPDC assessed each community and critical facility to determine the number of routes that provide direct access into a community or critical facility. For incorporated towns, the jurisdictional boundaries were used to define the extent of a community. For unincorporated communities and critical facilities, the extent of a community or critical facility was defined as an area with the greatest concentration of development as best inferred by the A-NPDC staff member. A-NPDC staff then assessed each access route to characterize accessibility to the community or critical facility under each inundation scenario. The definitions for each category utilized in the assessment are as follows:

<i>Community/Facility Access Category</i>	<i>Description</i>
<b>Access Not Impacted</b>	No access routes inundated. Temporary road closures may occur during storm events.
<b>Access Limited</b>	At least one access route is inundated. The community/facility will still be accessible via other roadways. Less than half of the roadways within the community/facility are not inundated.
<b>Disconnected/Inaccessible</b>	All access routes are inundated and less than half of the roadways within the community/facility are not inundated. The community/facility would be inaccessible during high tide conditions at first and during all times at some point thereafter.
<b>Majority of Roads Inundated</b>	At least half of the roadways within the community/facility are inundated during high tide conditions at first and during all times at some point thereafter.

## **Future Directions**

The data is recommended to be updated as new and improved data become available. These data could include elevation data and scientific data that enhance current sea-level rise projections.

It is recommended that the Eastern Shore Transportation Technical Advisory Committee (TTAC) consider relative sea-level rise and other potential coastal flooding impacts when selecting and prioritizing future transportation projects. These considerations should be incorporated into the Long Range Transportation Plan, the project prioritization process for the VDOT's Six-Year Improvement Program, and other TTAC activities as appropriate. Additionally, local governments and local operators of state and federal facilities should incorporate these considerations into emergency response, comprehensive planning activities, and economic development activities.

## **Frequently Asked Questions**

*Does a road segment illustrated as being inundated mean that the road will be entirely unusable?*

When a road segment becomes inundated, it happens extremely gradually and can be exacerbated and hastened by other factors not considered in this assessment. An inundated road will first be submerged on during high tide cycles and then later submerged at all tidal conditions as sea-level gradually rises. It is expected that road flooding and closures will increase in frequency leading up to when the road becomes inundated at all daily high tides. This study also assumes that no work is done to retrofit the road so that its vulnerability is reduced.

*Does a road segment illustrated as being inundated mean that the entire segment is likely to be submerged?*

No, a highlighted road segment indicates that at least one area along that segment of road is vulnerable to inundation under that particular sea-level elevation.