DRAFT REGIONAL COASTAL RESILIENCY DESIGN STANDARDS

HRPDC Coastal Resiliency Committee
September 25, 2020
Agenda

Background

Supporting documents

Design standards

Next Steps
Background

**OCTOBER 2018**
HRPDC adopts regional sea level rise scenarios

**FEBRUARY 2020**
VDOT Structure and Bridge Division adopts "Consideration of Climate Change and Coastal Storms"

**MAY 2020**
Virginia Beach considering new Public Works Design Standards with sea level rise and precipitation projections
THE PROBLEM

- Design standards are based on historic data
- Climate research suggests that conditions will continue to change into the future
- Recent research and analysis suggests that environmental conditions have changed since the major guidance documents
- Therefore, we are building in a way that will add to our existing and future flooding challenges
Adopting higher standards will be more expensive, but keeping the same standards will increase risk. Either way, there is a cost.
Resilient Design Guidelines

PROJECTIONS OF FUTURE CONDITIONS

Sea level rise - adopted October 2018
1.5' for 2020-2050
3.0' for 2050-2080
4.5' for 2080-2100

Precipitation - DRAFT

RECOMMENDATIONS FOR POLICIES AND REGULATIONS

Stormwater Management - DRAFT
Design storm frequencies
Design tailwater elevations
Joint probability events

Floodplain Management - DRAFT
Floodplain mapping
Design Flood Elevations
Supporting Efforts

Virginia Beach
Public Works Design Standards Manual
Joint Occurrence and Probabilities of Tides and Rainfall

VDOT
Considerations of Climate Change and Coastal Storms

VTRC
Incorporating Potential Climate Change Impacts in Bridge and Culvert Design

U.S. Army Corps of Engineers
North Atlantic Coast Comprehensive Study
# Precipitation Projections

<table>
<thead>
<tr>
<th>NOAA</th>
<th>VDOT</th>
<th>Virginia Beach</th>
<th>Nothing</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pros:</strong> Already referenced in local codes. Authoritative.</td>
<td><strong>Pros:</strong> Already in some local codes. Would apply to county secondary streets.</td>
<td><strong>Pros:</strong> Already drafted and under consideration.</td>
<td><strong>Pros:</strong> No cost or effort required.</td>
</tr>
<tr>
<td><strong>Cons:</strong> May not include future conditions. Unknown if/when will occur.</td>
<td><strong>Cons:</strong> Wide adoption not expected until 2021. Statewide standard may not reflect conditions in Hampton Roads.</td>
<td><strong>Cons:</strong> May conflict with later updates to VDOT or NOAA standards.</td>
<td><strong>Cons:</strong> Does nothing to improve resiliency of region to current or future flood risk.</td>
</tr>
</tbody>
</table>
Other Resilient Standards

Virginia Beach
NOAA Atlas 14 + 20%
Public Works Design Standards Manual 2020

VDOT Structure and Bridge Division
NOAA Atlas 14 + 20%
Consideration of Climate Change and Coastal Storms
Draft Recommendation

Localities should adopt local standards reflecting a 20% increase in the 24-hour duration rainfall above local conditions in NOAA Atlas 14

Format: tables for each locality with existing and recommended rainfall values
Design Storm Frequencies

Local governments and state agencies adopt design storm frequency requirements based on the scale and type of development.

Most localities require a 10-year design storm.
Chesapeake

< 200 Acres  10-year storm
≥ 200 Acres  50-year storm

Virginia Beach

< 300 Acres  10-year storm
300-500 Acres  25-year storm
≥ 500 Acres  50-year storm
Critical Infrastructure  100-year storm
Localities should adopt higher standards for larger projects that reflect larger contributions to runoff and additional capacity for mitigation.
## Design Tailwater Elevations

<table>
<thead>
<tr>
<th>Location</th>
<th>Elevations</th>
</tr>
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<tbody>
<tr>
<td>VDOT</td>
<td>No tidal elevation specified. 0.8 * pipe diameter default.</td>
</tr>
<tr>
<td>Norfolk</td>
<td>1.7' NAVD88</td>
</tr>
<tr>
<td>Chesapeake</td>
<td>3.6' NAVD88 (tidal)</td>
</tr>
<tr>
<td></td>
<td>2.3' NAVD88 (non-tidal)</td>
</tr>
<tr>
<td>Virginia Beach</td>
<td>Individual elevations for 9 tidal and non-tidal water bodies</td>
</tr>
</tbody>
</table>
Sea Level Rise
Virginia Beach has incorporated sea level rise into each design tidal elevation.
- 1.5' for non-critical infrastructure
- 3.0' for critical infrastructure

This includes a non-linear adjustment for some watersheds and some return periods.
Localities should adopt design tailwater elevations for individual watersheds.

Localities should incorporate sea level rise and non-linearity into design tailwater elevations.

Format: tables for each locality with design tailwater elevations for HUC12 watersheds.
COMPOUND FLOODING

- Most communities use a single combination of precipitation and tidal conditions as the design storm: (10-year rainfall + 1-year tide)

- Virginia Beach has adopted a suite of "Design Storm/Tide Joint Probability Pairs"

<table>
<thead>
<tr>
<th></th>
<th>10-YR Design</th>
<th>25-YR Design</th>
<th>50-YR Design</th>
<th>100-YR Design</th>
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</thead>
<tbody>
<tr>
<td>Tide</td>
<td>Rain</td>
<td>Tide</td>
<td>Rain</td>
<td>Tide</td>
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<tr>
<td>10-YR</td>
<td>1-YR</td>
<td>25-YR</td>
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<td>100-YR</td>
</tr>
</tbody>
</table>
Draft Recommendation

Hampton Roads localities should adopt multiple joint probability design storms that include both precipitation and tailwater conditions.

Format: policy statement and standard
Floodplain Mapping

Most localities only map and regulate development in the current FEMA-designated Special Flood Hazard Area.

Current FEMA floodplains do not account for rainfall flooding or sea level rise.
Draft Recommendations

Localities should regulate development in the 0.2% annual chance floodplain

Localities should incorporate future probabilistic floodplains with sea level rise into their comprehensive plans and floodplain ordinances

Format: policy statement and standard; mapped future floodplains (GIS and static)
Design Flood Elevations

Minimum NFIP standards only require development in floodplains to be built to the base flood elevation or 1% annual chance flood.

Current FEMA base flood elevations do not account for sea level rise.
Localities should adopt a minimum freeboard of 2' above the base flood elevation (3' for critical structures).

Localities should adopt design flood elevations based on location, expected lifespan, and criticality.

Format: policy statement and standard
Next Steps

Finalize draft deliverables (tables, GIS data layers, etc.) and distribute to localities for review and comment.

Review comments and revised deliverables at December Coastal Resiliency Committee meeting (12/11/20) for recommendation.

Present to HRPDC Board Q1 2021 (tentative) for adoption.