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George Washington Regional Commission
Coastal Zone Management
Technical Assistance Program Report FY2020*

*with granted extension

GEORGE WASHINGTON
REGIONAL COMMISSION

Virginia Coastal Zone
MANAGEMENT PROGRAM

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Product #1: Training and Coordination Activity Outcomes

A. CZM Coordination Meetings

George Washington Regional Commission (GWRC) staff and their consultant participated in the following statewide CZM-related meetings:

1. 12/18/2020 – Quarterly Coastal Planning District Commission (PDC) Meeting
2. 1/28/2021 – Coastal Policy Team (CPT) Meeting
3. 3/30/2021 – Quarterly Coastal PDC Meeting
4. 6/4/2021 – Quarterly Coastal PDC Meeting
5. 9/16/2021 – CPT Meeting

These meetings included presentations and/or discussions on CZM program updates, the CZM Resilience Project Database, the Virginia Coastal Resilience Master Plan (VCRMP), Resilience Adaptation Feasibility Tool (RAFT), native plant implementation, ecotourism, future grant focal areas, and CBPA regulations, among other topics. GWRC staff also completed the following activities:

- Facilitated a tour of the Dominion/Amazon-owned Scott II solar facility on August 27, 2021.
- Presented information on CZM-related activities to the GWRC Board monthly.
- Regularly attended meetings of the Rappahannock River Basin Commission, the York River and Small Coastal Basins Roundtable, and the Rappahannock River Roundtable.

B. Regional Environmental Managers Technical Committee Meetings

The GWRC Regional Environmental Managers Technical Committee includes city and county planning, parks and recreation, and other department staff, town managers, representatives from Virginia state agencies, including the Dept. of Environmental Quality (DEQ), the Dept. of Conservation & Recreation (DCR), the Dept. of Health (VDH), and the Dept. of Emergency Management (VDEM). Soil and Water Conservation Districts, and occasionally elected officials, as well as stakeholders and professionals from universities, nonprofits, military installations, and private organizations have also participated in Committee meetings. GWRC hosted quarterly coordination and training meetings for the Regional Environmental Managers Technical Committee on:

1. 11/17/2020
2. 3/16/2021
3. 5/18/2021
4. 9/21/2021

The purpose of the meetings was to discuss topics of mutual interest including any new or revised regulatory changes, best practices, and other matters important to the group. This group has been effective in facilitating and propagating the latest changes in the stormwater regulations and best practices. The meetings also provided opportunities to discuss grant opportunities which could further other regional environmental initiatives. In addition to other conversations about resilience and local issues, the meetings included the following training presentations:

- Overview of water quality laws and regulations – Denise Nelson, Berkley Group (11/17/20)
- Clean Water Financing and Assistance Program – Mike Crocker, DEQ (3/16/21)
- Erosion and sediment control program audits – John Saunders, Stafford County, Ben Leach, DEQ (3/16/21)
- Coastal GEMS Version 4.0 – Nick Meade, CZM (3/16/21)
- CZM's Narrative Enforceable Policies – Bettina Rayfield, DEQ (5/18/21)
- Hampton Roads PDC Resilience Initiatives and Flood Risk Outreach – Katie Cullipher, HRPDC, Ben McFarlane, HRPDC (5/18/21)
- Social equity and environmental justice – Dr. Celeste Greene, Berkley Group (9/21/21)

C. Website

GWRC has updated and maintained the "Environment" tab and its subpages on the website. Coastal Zone Management has its own page (https://gwregion.org/environment/coastal-zone-management) with information on the Regional Environmental Managers Technical Committee and the Environmental Strategic Plan. Minutes from past Committee meetings as well as toolbox resources from coastal partners starting in this grant period (October 1, 2020 – September 30, 2021) are posted on the Regional Environmental Managers Technical Committee page (https://gwregion.org/environment/environmental-committee). The tab also has a sub-page for Native Plants with information and a link to the Plant Central Rapp Natives website. The website was updated to include GWRC's approved Resilience Plan for submitting applications through DCR's Community Flood Preparedness Fund (CFPF).

D. Deliverables

1. Regional Environmental Managers Technical Committee Meeting Summaries (Appendix A)
2. Regional Environmental Managers Technical Committee Meetings Select Presentation Slides (Appendix B)

Product #2: Flood Risk Communication Program Outcomes

A. Project Summary

The purpose of the Flood Risk Communications Program is to engage local leaders, stakeholder groups, and citizens in awareness training using the FEMA Flood Risk Communication Toolkit for Community Officials to coincide with FEMA's updates to Flood Insurance Rate Maps in the region. The strategy is to create tools and materials that localities can directly plug into their social media and other channels in order to inform citizens about flooding dangers and the existence of national flood insurance. The Toolkit is available here: https://www.fema.gov/floodplain-management/manage-risk/communication-toolkit-community-officials.

The first stakeholder meeting for this project was held on November 17, 2020 as part of the Regional Environmental Managers Technical Committee meeting, but due to a confluence of factors, the Flood Risk Communications Plan is still in the draft stage. Other priorities – especially the VCRMP and CFPF – took time from the project and provided new perspectives that should be incorporated into the plan. In addition, HRPDC and DCR both gave presentations to the GWRC stakeholders on January 19, 2021 describing their own flood risk plans, which brought to light numerous improvements that could be made to the original strategy. While only two of the three stakeholder meetings initially proposed were actually held, both were extremely informative and productive discussions on the development of the Flood Risk Communications Plan.

Product #3: Benefits Accrued from Prior CZM Grants

A. Plant Central Rapp Natives Campaign

GWRC attended the Virginia Native Plants Retreat on December 7, helped promote the Plant Virginia Natives Landscaping with Natives Webinar Series, and hosted the Plant Central Rapp Natives (PCRN) meeting on February 23, 2021 and the second semi-annual meeting on August 24, 2021. GWRC will host another PCRN meeting in February 2022. GWRC also coordinated a meeting of the Maintenance Team for the native plant demonstration garden at Cedell Brooks, Jr. Park on March 25, 2021 and again on September 30, 2021.

Plant Virginia Natives now has its own website: http:///www.plantvirginianatives.org) linked to the Plant Central Rapp Natives webpage (http:///www.plantvirginianatives.org/native-plants-for-central-rapp).

B. Environmental Services Strategic Plan

GWRC used the 2020 Environmental Services Strategic Plan to create scopes of work for the Watershed Implementation Plan (WIP) 2021 and 2022 contracts and the CZM FY21 contract from October 2021 to September 2022. GWRC also applied the plan strategy to prepare a National Fish & Wildlife Foundation (NFWF) Small Watershed Grant (SWG) Technical Assistance (TA) proposal due April 22, 2021 for funding in 2022. GWRC presented the Strategic Plan at the Virginia Water Conference on March 3, 2021, the APA Virginia webinar on March 22, 2021 (https://youtu.be/Zs4TBTZvnl8), and the American Public Works Association (APWA) Mid-Atlantic Chapter Public Works Institute on April 6, 2021.

The 2020 Environmental Services Strategic Plan was instrumental in creating the GWRC Resilience Plan for the CFPF. It will continue to serve as a base for future project prioritization.

Product #4: Regional Resiliency Coordination Outcomes

A. Summary

The regional resiliency stakeholder group consists of the GWRC Regional Environmental Managers Technical Committee, with the intent to educate the stakeholder group on resilience topics and resources as well as engage the workgroup to develop the other project deliverables. GWRC hosted two meetings dedicated to advancing ecosystem and community resilience:

1. 1/19/2021
2. 7/20/2021

In addition to other local and regional resilience topics, trainings were given on the following topics:

- A presentation on the VIMS Sea Level Rise Report Card – Dr. Molly Mitchell, VIMS (1/19/21)
- A training on the Commonwealth Center for Recurrent Flooding Resiliency (CCRFR) Recurrent Flood Risk Database – George McLeod, ODU (1/19/21)
- A presentation on the Virginia Coastal Resilience Master Plan Framework – Ret. Rear Admiral Ann Phillips, Office of the Secretary of Natural & Historic Resources (1/19/21)
- The VCRMP Pre-Charette – Dr. Brian Batten, Dewberry (7/20/21)

B. Deliverables

1. Regional Environmental Managers Technical Committee Meeting Summaries (Appendix A)

Product #5: Regional Resiliency Priorities

A. Summary

The focus for much of the regional resiliency priorities this fiscal year was project identification and prioritization to take advantage of grants for flooding and climate resiliency. GWRC has continued to work with the GWRC Regional Environmental Managers Technical Committee and other stakeholders to identify those and other regional resiliency needs, such as data gaps, local capacity, etc.

GWRC drafted the GWRC Community Flood Preparedness Resilience Plan, which was distributed to localities for review and feedback and submitted to DCR for approval. DCR approved the Plan on October 4. A meeting with the localities to strategize on project proposals was held on October 13, 2021, and several since then, although most of the localities are only now beginning to approach resiliency issues. The Plan is currently undergoing additional scrutiny from elected officials in each locality to address even more specifically the needs of their communities.

B. Deliverables

The GW Region localities have yet to submit projects to the CFPF, but through multiple engagements have begun to consider which communities and needs to focus on and how best to approach fixing the issues. This builds directly on the Environmental Services Strategic Plan which was an initial list of projects in the region. Local capacity is an ongoing issue, and GWRC will continue to coordinate discussions and information between localities to determine their needs and assist with reaching regional resiliency goals. The DCR-approved draft is attached in Appendix C.

Product #6: CZM Resilience Database Contributions

A. Summary

GWRC is continuously engaging localities and stakeholders to determine which resiliency projects could be implemented in the region. GWRC has been participating in ongoing discussions about where the ultimate project database should be housed (Wetlands Watch, CZM, VCRMP, etc.).

B. Deliverables

GWRC provided a list of projects to the CZM and VCRMP databases with input from localities, available to view at the Virginia Coastal Resilience Master Plan Web Explorer Portal: https://experience.arcgis.com/experience/9e32e928ed304fa98518b71905e43085/page/Projects-and-Initiatives/. For a formatted list of submitted projects, see Appendix D.

Product #7: Virginia Coastal Resilience Master Plan Contributions

A. Summary

GWRC has participated in both the charette outreach process and in an official capacity on the VCRMP TAC and subcommittee meetings. GWRC staff also helped Vision Consulting conduct additional outreach for the Aquia and Dahlgren communities to address their ongoing flooding issues. GWRC staff also met with Commonwealth staff on September 20, 2021 and provided comments on the 90% draft of the VCRMP. In addition, a comprehensive list of outreach targets was provided to the VCRMP team in March 2021.

B. Deliverables

GWRC attended VCRMP Technical Advisory Committee meetings on:

1. 12/14/2020
2. 2/26/2021
3. 6/22/2021
4. 9/2/2021
5. 10/7/2021

Community Outreach Subcommittee meetings on:

1. 2/19/2021
2. 3/11/2021
3. 4/28/2021
4. 6/1/2021
5. 9/1/2021
6. 9/17/2021

Economic Development Subcommittee meetings on:

1. 2/22/2021
2. 3/22/2021

And pre-charette and charette meetings on:

1. 7/20/2021
2. 7/27/2021

Appendix A: Regional Environmental Managers Technical Committee Meeting Summaries

Regional Environmental Managers Technical Committee

FY20 CZM Technical Assistance (TA) Grant

November 17, 2020
1:00 p.m. – 3:00 p.m.
Digital Meeting and Conference Call

NOTES

Attendees: David Nunnally (Caroline County), Michael Newchok (King George County), Scott Rae and Tyler Gelles (Fredericksburg), John Saunders and Chris Stevens (Stafford County), Wanda Parrish and Jacob Pastwick (Spotsylvania County), Brent Hunsinger and Adam Lynch (FOR), Harry Looney (Lake Anna Civic Association), Bryant Bays (VDOF), Pat Coady and Matt Gerhart (Northern Virginia Conservation Trust), Les Johnson (UMW), Mikel Manchester (VCE), Angela Davis (DCR), Julio Reyes (VDEM), Jeff Flood (DEQ CZM), Kate Gibson (GWRC), and Bella O'Brien and Denise Nelson (Berkley Group).

Outcome 1. The GWRC board discussed and adopted (resolution 21-06) the Environmental Services Strategic Plan at their meeting on Nov.16, 2020. Notes from the discussion are **attached.**

- **Follow up action:** GWRC will post the final PDF and Excel files on the website.
- **Follow up action:** Member localities and other organizations will consider the need or value in adopting or endorsing the plan individually.

Outcome 2. The region has many environmental projects. Activities will be coordinated among:

- Coastal Zone Management, started Oct. 1, 2020
    - Technical Assistance (CZM TA)
    - Special Project: Flood Risk Communication Program (CZM SP)
    - Advancing Ecosystem and Community Resilience (CZM R), kick off in January
- Chesapeake Bay Watershed Implementation Program (WIP), 2020 contract ends Dec. 31, 2020; 2021 scope is coming soon, kick off in January
- Greenways Feasibility Study, kick off in 2021
- Chesapeake Bay Preservation Act compliance templates, starting soon
- Hazard Mitigation Plan update planning, applied for funding for August 2021 kick off

Outcome 3. DEQ is interested in receiving proposals for small amounts of funds to facilitate CBPA compliance.

- David Nunnally inquired if funds could be requested for a "stormwater-lite" pilot program.
    - **Follow up action:** GWRC will work with David to prepare a proposal.

Outcome 4. The focus for this year's CZM trainings will be water quality laws and regulations and related programs and funding opportunities (as prioritized in the Environmental Services Strategic Plan). GWRC shared overview information and links on the federal Clean Water Act and Regulations, Virginia's water laws and regulations, and DEQ guidance documents and training opportunities.

- The proposed amendments to the CBPA for resilience and trees will be presented to the SWCB in December 2020. The questions DEQ asked stakeholders at the Oct. 29, 2020 virtual public meeting are **attached**.
    - **Follow up action:** GWRC will send SWCB meeting details.
- DEQ expects efforts to consolidate stormwater regulations should be completed in December 2021.
    - **Follow up action:** GWRC will track and share details.
- The committee would like further information on conservation easements. While controversial because they secure land from development, they are voluntary and bring in federal funds, making this an economical and underutilized tool.
    - **Follow up action:** GWRC will add this topic to a future meeting agenda.
- The committee would like more information on the state revolving loan fund in relation to water quality laws and regulations.
    - **Follow up action:** GWRC will add this topic to a future meeting agenda.
- DCR is partaking in a perennial stream regulatory review and will be mapping all perennial streams in Virginia using LIDAR. The more rural counterparts need to be familiar as there is room for conflict as new streams are mapped. Public forum and guidance document on perennial streams: https://townhall.virginia.gov/L/GDocForum.cfm?GDocForumID=417
    - **Follow up action:** GWRC will track and share details.

Outcome 5. The CZM special project this year is to create a regional Flood Risk Communication Program to supplement locality outreach programs. This aligns with DCR's efforts to create a state Flood Risk Communication Program and the updates to FEMA Flood Insurance Rate Maps across the state. FEMA created non-regulatory Flood Risk Maps, Flood Risk Reports, and other flood risk data for communicating risk.

- Localities reported they provide flood risk outreach during Flood Awareness Week in March and as required for properties that have a change in status during FIRM updates.

Outcome 6. DCR's current programs and resources are described online at: https://www.dcr.virginia.gov/dam-safety-and-floodplains/fppubs.

Outcome 7. King George County Parks and Recreation is partnering with Friends of the Rappahannock to implement the Trees for Clean Water in two new buffer zones.

Outcome 8. Spotsylvania County is updating their comprehensive plan and parking standards.

Outcome 9. Stafford County is having issues with halted larger developmental projects by the DEQ due to stream mitigation challenges. They are also receiving results from DEQ on the ESC program audit. They are willing to share insights and lessons learned from the audit.

- **Follow up action:** GWRC will add this topic to a future meeting agenda.

Outcome 10. Fredericksburg is in initial phases of outreach to community members in flood zone A. Zone A does not include flood elevation data; however, the newer maps and geodatabase do include information on BFE which needs to be communicated to the community members in this zone.

Outcome 11. Friends of the Rappahannock recently provided two large tree giveaways funded by grants. Additionally, they are working on living shorelines in Caroline County. The scenic designation for the Rappahannock has been approved by the DCR and will next be voted on by County Supervisors. If it is not passed by the county supervisors, it will move to the special session of the Virginia General Assembly. This may pose issues as each member of the assembly is approving only 10 acts.

Outcome 12. Virginia Department of Forestry shared the seedling store is now open and will be until they sell out in early spring. They provide bareroot seedlings. Communities can now track tree planting with the new tracking program provided by the VDOF. Additionally, tax credits are available to localities who harvest lumber and keep the riparian buffer zone intact.

- **Follow up action:** GWRC will add these topics to a future meeting agenda.

Outcome 13. VDEM staff have been busy with a variety of efforts related to the coronavirus. They are hosting an exercise held for communities within a 50-mile radius of the North Anna nuclear powerplant. There is also a hazard mitigation plan update underway.

Outcome 14. UMW will be supporting FOR in delivering the Trees Workshop funded by VDOF. The event will likely occur in August or September of 2021.

Outcome 15. The Northern Virginia Conservation Trust is busy securing new conservation easements. They are excited to support this group in conservation and resilience planning.

Regional Environmental Managers Technical Committee

FY20 CZM Technical Assistance (TA) Grant
CY21 Chesapeake Bay Watershed Implementation (WIP) Program Grant

January 19, 2021
1:00 p.m. – 3:00 p.m.
Digital Meeting and Conference Call

NOTES

Attendees: David Nunnally (Caroline County), Chris Clarke (King George County), Scott Rae and Tyler Gelles (Fredericksburg), John Saunders and Chris Stevens (Stafford County), Brent Hunsinger and Adam Lynch (FOR), Bryant Bays (VDOF), Pat Coady and Matt Gerhart (Northern Virginia Conservation Trust), Les Johnson (UMW), Kevin Byrnes (consultant), Luke Peters (citizen), Aaron Wendt, Mark Killgore, and Jennifer Wampler (DCR), Molly Mitchell (VIMS), George Mcleod (ODU), Ann Phillips and Shurui Zhang (Governor's office), Kristy Woodall, Sara Silvers, and David Evans (DEQ), Jeff Flood (DEQ CZM), Kate Gibson (GWRC), and Denise Nelson (Berkley Group).

Outcome 1. GWRC is starting a special 3-year grant "**Advancing Ecosystem and Community Resilience Program**" that includes 2 stakeholder meetings; identifying resiliency needs, priorities, and projects; supporting development of the state project database; and supporting development of the state coastal resilience master plan (**Attachment 1**).

Outcome 2. The Virginia Institute of Marine Science offers the Sea Level Report Card.

Outcome 3. Another NOAA program, the Mid-AtlanticRegional Integrated Sciences and Assessments or MARISA, has made a two page "**Community Climate Outlook**" summary for each county and city in coastal Virginia (**Attachment 2**). These point out local weather and climate related hazards and discuss the impacts of changes in sea level rise, temperature, and precipitation. These are great summaries to share with your staff, elected officials, and citizens.

Outcome 4. Sources of climate data include:

- NWS Wakefield Daily Briefing
- NWS Wakefield Quantitative Precipitation Forecast
- NOAA/NCEI's Regional Climate Services, Eastern Region
- NOAA Southeast Climate Monthly Webinars

Outcome 5. The Commonwealth Center for Recurrent Flooding Resiliency, CCRFR offers the Recurrent Flooding Risk (**Attachment 3**).

Outcome 6. Virginia is hiring a consultant to develop the Virginia Coastal Resilience Master Plan (**Attachment 4**).

Outcome 7. GWRC is starting the 2021 grant "**Chesapeake Bay Watershed Implementation Program**" that includes tasks similar to the 2020 grant (**scope coming soon**).

Outcome 8. GWRC's is "**Chesapeake Bay Watershed Implementation Program**" that includes a task to "Coordinate training on the water quality studies of local tributaries". As such, DEQ presented the Virginia Water Quality Program (**Attachment 5**).

Outcome 9. Key contacts for DEQ's Water Quality Program include:

- General water quality planning or TMDL: Sarah Sivers, Water Quality Planning Team Lead, (703) 583-3898 or Sarah.Sivers@deq.virginia.gov
- Implementation Plans (development or implementation): Dave Evans, Nonpoint Source Coordinator, (703) 583-3835 or David.Evans@deq.virginia.gov
- Water quality assessment or data: Rebecca Shoemaker, Water Quality Planner, (703) 583-3807 or Rebecca.Shoemaker@deq.virginia.gov

Outcome 10. The DEQ offers the new Environmental Data Mapper.

Outcome 11. The Mattaponi River hit flood stage 6 times in last few months. Flooding from these rain events is significant (**Attachment 6**).

Outcome 12 King George County, supported by FOR, planted over 200 trees in November.

Outcome 13. Stafford County received a $835,000 SLAF grant for Brooks Park Stream.

Outcome 14. Fredericksburg has been successful in moving forward efforts for a pond retrofit, stream restoration, and addressing other stormwater issues.

Outcome 15. FOR will be announcing 2021 tree giveaways soon.

Outcome 16. VDOF's Trees for Clean Water grant program is open, the tree tracker is live on dof.gov, and there's a cost share opportunity for ash trees targeting the ash borer.

Outcome 17. The working agendas indicating topics and speakers for future meetings is attached (**Attachment 7**). Please share the information with your colleagues and invite them to join us.

Meeting Notes: GWRC Regional Environmental Managers Technical Committee
Tuesday March 16, 2021, 1:00PM-3:00PM
Prepared by Luke Peters

In attendance:
Andy Holden
Benjamin Leach (Spotsylvania County),
Marta Perry (Tri-County/City SWCD),
Michael Crocker (DEQ),
Sharon Conner (Hanover-Caroline SWCD),
Liz Adams
Nicholas Meade
David Nunnally (Caroline County),
Chris Clarke (King George County),
Scott Rae and Tyler Gelles (Fredericksburg),
John Saunders and Christopher M. Stevens (Stafford County),
Brent Hunsinger and Adam Lynch (FOR),
Bryant Bays (VDOF),
Pat Coady and Matt Gerhart (Northern Virginia Conservation Trust),
Les Johnson (UMW),
Kevin Byrnes (Consultant),
Mark Killgore, and Jennifer Wampler (DCR),
Jeff Flood (DEQ CZM),
Kate Gibson (GWRC), and
Denise Nelson, Luke Peters, and Rebecca Acland (Berkley Group)

Meeting Notes

- Denise and Luke will be presenting on the GWRC Environmental Services Strategic Plan on APA's next webinar.
- Denise sent out a list of grants for stream mitigation and improvement projects which all have deadlines in April. Let Berkley Group/GWRC know if they need support.
- CBPA update to include trees and climate mitigation.

Agenda: CZM TA

- TA grant revolves heavily around providing support to localities.

Training: Mike Crocker, DEQ Project Oversight Team Leader in Water Project Financing Group, michael.crocker@deq.virginia.gov, (804) 698-4012

- 3 Main Projects:
  - Water Quality Improvement Fund (WQIF)
  - Stormwater Local Assistance Fund (SLAF)
  - Virginia Clean Water Revolving Loan Fund (VCWRLF)
- Who is eligible?
  - Any local government: town, county, districts, municipal corporation, etc.
- Eligible Costs:
  - Reasonable and necessary costs associated with Clearinghouse approved BMPs, Stream Restoration Projects, Non-Point Source Nutrient Credits
- Not Eligible:
  - Labor, admin, anything not directly related.
- Most projects fall where larger municipalities are.
- Majority of projects have been stream restoration, until recently with more green infrastructure.
- Important to completing the project application: only provide support for the questions asked. They're ranked by:
  - Readiness to proceed,
  - Pollution reduction,
  - "Cost effectiveness" (getting harder to scrutinize),
  - Impaired waters,
  - Fiscal stress, and
  - Phase II MS4
- Section A) Give the project a unique identifying name and include contact for applicant and the engineer. DEQ will usually reach out to the applicant themselves unless there's a technical question.
- Section B) Be as specific as possible about where funding is coming from with back-up documentation (general funds, other non-state grants, loans/bonds, etc.).
- Section C) Double check coordinates for stream restorations.
- Section D) Opportunity to sell the project. Be specific as to what you are building and why, including limitations, constraints, and benefits. For stream restorations include photos and plans if available.
- Section E) Pollution – few issues on this section. Engineer usually handles it. Be mindful of cost/lb/TP – this is the variable that's ranked.
- Section F) Readiness to proceed is a big deal. Make sure the dates are realistic, and consider public participation, easement acquisition, etc. in that time.
- Section G) Project Budget Information – most important is to be consistent through the application and making sure the figures match what was listed in other sections. Contingency can only be 5% of the BMP.
- **Program Requirements**
- All engineers/professional services must adhere to Virginia Procurement Act (VPPA)
- Need pollutant reduction calculations, BMP certification, and environmental permits (from the Corps, etc.).

- **Local Match:** 50% match can come from general fund, bonds/loans, public private partnerships (P3s), stormwater utility funds, or grants (NFWF), etc. Also the VCWRLF and SLAF.
- Solicitation will run through June and July running concurrently with loan solicitations.
- *A loan application is not a commitment to borrow funds* (unlike a bond).
- **Q&A:**
    - Loan solicitations go out in June, they make tentative offers in September, there's public input, and then the Water Board signs off in December. Loan could close in January of next year. Could be held up by EPA's principal forgiveness schedule.

Training: John Saunders: Experience with Erosion and Sediment Control Program with DEQ

- They provide DEQ with a list of projects and they work together to choose a mixture of residential and commercial sites.
- Worked with DEQ on 10 sites.
- DEQ looks at admin, inspections, plan review, and enforcement.
- Provided them with all the comments from the plan review process, all documents such as work order items, and basically just filling out checklist. Uploaded to FTP site 30-60 days in advance of field visit.
- No surprises in the field visit – knew where DEQ was going, so they brushed up on inspections and made sure sites were in tip-top shape.
- Spent the first half of the day letting DEQ know about all their processes, how plans get reviewed, etc. Next few days were physical site visits.
- Not viewed as adversarial (us vs. DEQ), but just a way to show them issues that are concerning. Staff already knew what their weaknesses were.
- Stafford County had about 10 corrective actions, which needs to be signed by a county administrator to begin a formal agreement with DEQ.
- One of the biggest asks from DEQ and the administration is enforcement.

Ben Leach (Spotsylvania, formerly DEQ): Observations

- Got their audit results in March and failed all 4 categories.
- Updated their ordinance last week (board approved).
- Updated inspection reporting system. They do up to 2,000 inspections a month including single family homes.
- One of the key items, as John said, is enforcement. Last year they gave out maybe 1 or 2 NOVs – this year already up to over 70 notice of violations and stop work orders.
- Wants to update the site to reach out to developers and stakeholders from all backgrounds and why they would incur a fee for NOVs.
- Plan reviews now average 10-day turnout with 3-5 reviews per project.
- **Q&A:**
    - David Nunnaly: *when it comes to single family residences, DEQ was formerly flippant. What does DEQ expect in terms of family site inspections?*

- DEQ realizes it's impossible to meet the every-two-week inspection period, and to basically just come up with a strong alternative inspection program that will spot check sites and alert you to any issues. Ben Leach actually is making it out to sites every 2 weeks, but not 24 hours after every measurable rain event.

Agenda: CZM Special Project: Flood Risk Communication Plan

- Print and digital content with links to toolkits and a schedule for coordinating the messaging between all localities as well as links to additional staff training materials.
- Draft exists; will be sent out soon.
- Localities are usually good at advertising Flood Awareness Week.

Agenda: Chesapeake Bay Watershed Implementation Program

- Engage stakeholders with meetings and trainings, focused on implementing WQ and stormwater BMPs.
- Denise will send out link to Water Quality Standards Academy

Training: Nicholas Meade, CZM Program GIS Coordinator

- Demoing version 4 of Coastal Geospatial and Educational Mapping System (GEMS).
- Water and land-based natural resources, conservation planning tools, etc.
- Coastal VEVA also exists as a mixture of conservation databases.
- Feature allows you to pick up where you left off with layers turned on, etc.
- Feature that lets you drag a swipe tool to see newer satellite imagery juxtaposed with older images.
- Can open Fact-sheet tab in the background.
- Version 4 has an attribute table which shows all the open data layers and applicable filters, like "Filter by map extent" which lets you look at datapoints you're zoomed in on. Can also filter by any other variable.
- "What's Near Me" function – you can place a point on the map and look at all the layers within a given radius.
- Add Data function – you can add shapefiles from your own computer or from online with an ArcGIS account.
- New markup options – different colored pins and stickers and polygons which will automatically give you the number of acres.
- Can create a PDF of the area you're looking at.
- **Q&A:**
  - Denise Nelson: *Compare and contrast this tool with Environmental Data Mapper and others?*
  - They're built on the same platform, they just have slightly different tools. The data, however, is almost completely different. DEQ's mapper is built to house regulatory data, whereas Coastal GEMS is conservation planning and natural resource data.

- *For any datasets contained in both, do they come from the same source and are they updated frequently so there's no best place to get it?*
- If pulled from a map service, the data should be from the same source. For other data it should show when it was last updated. Some datasets are updated monthly, quarterly, annually, etc. while others are one-offs that exist just because they're the best source.
- Luke Peters: *Are impaired waterways included?*
- 303d waterways are there but not sure exactly where IWs are.

Training: FOR Brent Hunsinger and Adam Works (?) Updates

- **King George County**
  - Litter cleanups with King Geroge County staff – roadsides, parks, and rivers.
  - Tree Giveaway at Cedell Brooks Park March 20th
  - Maintain Hop Yard Landing and Wilmont Landing
  - Maintain 234 trees planted Fall 2020
- **Caroline County**
  - Living shoreline at Portobago Bay
  - VCAP projects – MOU with HCSWCD to adminster program in Caroline
  - Tree planting with Caroline High School
  - Port Royal canoe access
- **Spotsylvania County**
  - Parks and Rec tree planting April 17th
  - Community cleanup day with 150 youth
  - Maintain Hunting Run and Elys Ford
- **Stafford County**
  - 5 acre riparian buffer at Snowden Farm, partnered with NVCT and County BOS
  - Replanting flood areas at historic Port of Falmouth
  - Pet waste stations at Leeland Station
- **Fredericksburg**
  - Stream and trail cleanups
  - Small-scale urban stormwater BMPs
- Future goals:
  - Costshare/Incentives for septic pumpouts, BMPs, reforestatoin, IPs for Rapp TMDL, outreach, etc.
  - River Ambassador Program – May to September 2021, address several issues: safety, cleanups, and access issues. Hiring 2 full-time ambassadors.
- Legislation:
  - Many extra millions for water quality programs: SLAF, conservation Assistance Program, agriculture BMPs, etc.
  - Tree canopy ordinance laws
- CBPA Regulations comments due May 3rd
- Tidal Wetlands due March 31st
- Please let FOR know thoughts

Agenda: Locality Roundtable

- **Caroline County**
- Ordinance for preserving mature trees – recognize that some are a maintenance problem.
- **King George**
- FOR are a huge partner. 400 trees already given out.
- **Spotsylvania**
- Currently in the process of updated stormwater and ChesBay ordinances.
- **Fredericksburg**
- Pursuing NFWF grants for stream restoration.
- **DOF Bryant Bays**
- Emerald Ash Borer cost share program for treating healthy Ash trees – will be the last year it's available.
- **Patrick Coady**
- Interest in sorting out all GIS databases – Luke Peters will pull that info together.
- **Les Johnson**
- Look into harvesting urban trees as a resource

Meeting Notes: GWRC Environmental Managers Meeting
Tuesday May 18, 2021, 1:00PM – 3:00PM EST
Prepared by Luke Peters

Speaking: (6)
Bettina Rayfield – Manager, Office of Environmental Impact Review, DEQ
Harry Mooney – Lake Anna Civic Association
Katie Cullipher – Principal Environmental Education Planner, Hampton Roads PDC
Benjamin McFarlane – Senior Regional Planner, Hampton Roads PDC
Luke Peters – Environmental Planner, Berkley Group
Denise Nelson – Senior Environmental Engineer, Berkley Group
In attendance: (14)
John Saunders – Environmental Programs Administrator, Stafford County
Les Johnson – Project Manager, University of Mary Washington
Tyler Gelles – Senior Stormwater Manager, Fredericksburg
Marta Perry – District Manager, Tri-County/City Soil and Water Conservation District
Christopher Clarke – Parks and Recreation, King George County
Adam Lynch – River Steward, Friends of the Rappahannock
Liz Adams – All Hazards Planner, VDEM Region 7
Emily Torrey – Deputy Environmental Programs Administrator, Stafford County Public Works
Benjamin Leach – Deputy Director of Environmental Codes, Spotsylvania County
Mark Killgore – Dam Safety Engineer, DCR
Michelle McGinnis – Director of Community Engagement, Spotsylvania County
Patrick Coady – Seale & Associates | Northern Virginia Conservation Trust
Kate Gibson – Interim Director, GWRC
Rebecca Acland – Intern, Berkley Group

Meeting Notes

CZM Technical Assistance Training, Tina Rayfield:
Bettina.rayfield@deq.Virginia.gov, 804-698-4202

- Conducts EIRs on major state construction projects – airports, oil and gas drilling, etc.
- EIRs required for projects over $500k, which takes 60 days. VDOT has their own process and is exempt.
- DEQ is required by statute to coordinate with a “chief administrative officer”. Certain electric utilities also have this requirement.

- Airport projects require a public hearing and public notice and have a 90 day review period.
- SCC reviews include solar farms, compressor stations, battery storage facilities, etc. and have a 60 day review period.
- The 1972 CZM Management Act says that anything affecting the shore must be consistent with that state's CZM regulations.
- For federal projects, DEQ is only required to review those listed by NOAA. Usually includes wetlands.
- DEQ does not have any federal funds listed in their program, so they don't have to conduct federal-style reviews. They do follow federal guidelines on behalf of other entities that do get funding.
- Virginia's coastal zone is essentially every county east of i-95.
- Federal agencies use the "effects test", which means if a consequence is reasonably foreseeable they have to do a review. But they do not receive a permit until the state determines it is consistent. For unlisted projects, DEQ can petition NOAA if they want regulatory overview.
- "Effects" can be beneficial, indirect, cumulative, etc. Broad definition.
- Virginia just made changes to its enforceable policies. The regulations and laws are now in a narrative format to make them better understood. They also added new categories for nuisance and threatened species.
- DEQ's CZM program is a networked program that does work for many other state agencies (wagonwheel diagram).
- When DEQ reviews a project, they can concur, give conditional concurrence, or object. Objections ***must*** be based on enforceable policies. Federal agencies can override this by saying it's being done to the extent practicable or that there's a national interest, which DEQ can do nothing about.
- DEQ is open to localities' comments for comp plans, local permits, E&S controls, etc. The comments are always included and summarized in the report.
- DEQ's process allows permitees to see the project manager for their case.
- Some projects require EIR public notice – federal consistency and aviation projects.
- DEQ is essentially up-to-date on the public notice database.

Harry Looney, Lake Anna Water Quality Update:
Harry.Looney@lakeannavirginia.org

- Kinetic Multisports is holding multiple events at Lake Anna State Park.
- The Civic Assc. Is in the process of purchasing turbidity/water quality monitoring equipment. Transitioning to YSI [brand name] instruments.
- There are e. coli, PCBs, and invertebrate impairments in creeks leading to the lake.
- The area south of the lake is not impaired because, Harry thinks, the lake acts as a filter.
- On August 11th 2020, the Upper Pamunkey had a recreational advisory.
- The Terry's Run area of the lake suffered from red algal blooms because of these issues. There are also green algal blooms in other parts of the lake.
- Lake Anna has never had an advisory because of algal toxins, but purely due to cell counts.

- Lake Anna is part of the York River watershed. The main area of concern is the Upper Pamunkey and Lake Anna drainage area, however.
- LACA feels they should be working outside of the lake to improve water quality around the state through overarching strategy documents.
- 2021 WQIP Components:
    - Water Quality Monitoring
    - Sediment Sampling
    - Algae Monitoring – 6 stations each on North Anna River and Pamunkey
    - Remote Sensing using Sentinel 2A and 2B satellites (Copernicus program)
    - Floating Treatment Wetlands in the Pamunkey branch
    - Data Analysis and Analytics in combination with DEQ's
- *Are all landowners members of LACA by default?* No, there are about 800 families.
- The York River Roundtable does a lot of work in environmental literacy and tribal outreach.

CZM Special Project – Regional Flood Risk Communication Plan:

- Goal is to create a more comprehensive messaging strategy around flood risk, especially for citizens who might've been grandfathered into situations where they're at risk.
- Will include copy/paste messaging for PIOs to post to Facebook, Twitter, and other social media.
- The focus is on flood risk awareness in general, not just including those who are not required to buy flood insurance, and to bring the content down to a understandable level instead of targeting flood plain managers.

Katie Cullipher, Ben McFarlane, HRPDC – Get Flood Fluent:

- HRPDC has a coastal resilience initiatives:
    - Aggregating information regionally,
    - Educating stakeholders,
    - Developing technical products that account for climate change
- Regional Resilience Inventory: want to document the need for assistance and identify opportunities for collaboration.
- The Regional Resilience Projects Dashboard brings information about what the region is already doing. There are over 450 projects in 11 categories, including $173MM of completed projects and $1.7b worth of projects underway.
- HRPDC uses the ESRI StoryMap to discuss resilience questions in a narrative format.
- Communities are very invested in improving their CRS scores.
- **Educating Residents:**
- Precipitated by looking at the impacts of Hurricane Harvey in Texas (2017) and what a disaster not having insurance was for their communities.
    - Only 15% of flooded properties had flood insurance, which covered 40% of the $30b in damage.
- Many citizens have misconceptions about the need for insurance.

- Goals: educate about facts, debunk myths, and encourage people to contact an insurance agent and get a quote.
- The www.Getfloodfluent.org website and toolkit are a major component of education. They've included a calculator that will give an estimate of what insurance would cost.
- Included an interactive quiz challenge for visitors to the site.
- HRPDC is developing a media toolkit full of assets that anyone can download and use to promote purchasing flood insurance.
- Launched paid media/PR campaigns in Spring 2019 using TV, radio, digital and print. In Summer 2020 they also included streaming advertisements for cordcutters.
- 7MM impressions from social media campaigns have generated 13,087 visitors to the site, spiking around the times of the campaigns.
- In 2021 they have activities happening every season, especially Spring and Summer with Flood and Hurricane preparedness weeks and the start of hurricane season.
- Developed videos to show local experiences.
- **Web Content:**
- HRPDC is trying to identify topics they can put on the website in order to get communities' CRS scores up, with messaging straight from the FEMA CRS Manual.
- Looking into insurance calculator updates to match FEMA's changes, disclosure requirements for repetitive loss properties, and flood loss history.
- **Improving Local Policies:**
- HRPDC adopted sea level rise planning scenarios, like 4.5' between years 2080-2100.
- Taking it to the next level is creating floodplain maps that incorporate sea level rise, new stormwater standards, and building elevation basemaps that include SLR.

Les Johnson thinks it would be useful to create a geodatabase and benchmark sea level rise in all our materials. Which would be the most helpful for the localities? People need to understand that even if they're not in a FEMA floodplain, a 100 year event could cost them a lot.

Comments were due back to the Flood Fund guide May 12th, still waiting to figure out what proposals will look like. There are opportunities to add staff, do training, complete projects, etc.

Flood Preparedness Fund manual will be coming out after the June Water Control Board Meeting.

DCR funded HRPDC's calculator and other website elements through their dam safety grants. They mainly fund dam issues, but also floodplain management efforts.

CZM Resilience Updates:

- Berkley Group is investigating geodatabases and datasets regarding resiliency issues.
- To keep up with what Dewberry, the engineering firm hired by the state to manage the CZM Master Plan, visit the DCR website.
- Denise spoke with Vision, the outreach consultants, about the survey they're going to distribute. She needs information from the localities about the best places to leave physical materials as well as which communities to reach out to digitally.

- *Would it be an effective move to take a paper survey door to door in certain communities?*
- Dewberry will be joining us for the July 20th meeting to meet with PDCs. They will deliver survey results and then discuss who to target.
- Opinions on returning to in-person meetings?

Roundtable Discussion:

- Caroline County: David Nunnaly is not here.
- King George: gave away 400 trees with Friends of the Rappahannock. Sidell Brooks Jr. Park – beavers have created a dam. However, they've blocked the culvert that leads to the water treatment plant. Anyone with knowledge of how to handle that should contact Chris offline.
- Spotsylvania: Ben Leach left the meeting.
- Stafford: Brooks Park stream restoration project amendments are lengthening the scope by 100 feet or more. Will be kicked off in the Fall. Should schedule a tour for the 1st of January.
- Fredericksburg: Tyler and senior planner Mike Craig are working on their trails project, for which funding has become an issue. Likewise with stream restoration planning.
- Marta Perry: Wrapping up strategic planning efforts, will send out draft materials shortly. If localities know any farmers who haven't implemented cover crops or stream barriers, please encourage them.
- FOR: due to several deaths on the river, they are ramping up Spanish-language river ambassadors to preach safety on-site at parks. Partnering with several organizations to get this done.

Meeting Notes: GWRC Pre-Charette for CRMP
Tuesday July 20, 2021, 1:00PM –2:30PM EST
Prepared by Luke Peters

Presenting:
Denise Nelson – Environmental Engineer | Meeting Coordinator, Berkley Group
Rear Admiral Ann Phillips – Special Assistant to the Governor for Coastal Adaptation
Stuart T. Geiger
Brian Batten – State Consultant, Dewberry
Emily E. Greer

In attendance:
Adam Lynch – Friends of the Rappahannock
Angela Davis
Ashley Samonisky
Ben Leech
Brandy Buford – DCR
Brent Hunsinger – Friends of the Rappahannock
Bryant Bays – Virginia Department of Forestry
Chris R. Clarke
Matt Dalon – Program Manager CRMP, DCR
David Nunnally
Emily Sokol
Emily Torrey
Jack McGovern – City of Fredericksburg
John Saunders – Stafford County
Kate Gibson – Interim Director, GWRC
Mark Killgore – DCR
Les Johnson
Matt Jones
Daniel E. Medina
Michael Barber
Patrick Coady
Julio Reyes – VDEM
Sharon Conner – Caroline County
Steven Nelson
Tyler Gelles – City of Fredericksburg
Aaron Wendt – DCR
Connor Winstead – DCR
(540) 247-6359
(540) 658-5192
(540) 809-2066

(804) 633-4303
Luke Peters – Environmental Planner, Berkley Group
Rebecca Acland – Intern, Berkley Group

Meeting Notes

Discussing the plan for outreach in the GWRC region with Dewberry and Ann Phillips' office.

Overview of CRMP and Approach:

- The Goals and Needs come directly from the framework. Prioritize projects, establish finance, incorporate climate change, and coordinate between regions. And include equity.
- Will help GWRC with capacity needs, identifying additional needs, and align projects with state and federal initiatives.

Meeting Notes: GWRC Environmental Managers Meeting
September 21, 2021, 1:00PM – 3:00PM EST
Prepared by Luke Peters

In attendance:
Aaron Wendt – DCR-SEAS
Adam Lynch – FOR
Andy John
Benjamin Leach
Brandy Buford
David Nunnaly – Caroline County
Angela Davis – DCR
Emily Torrey
Jeff Flood – CZM, DEQ
John Saunders
Julio Reyes – VDEM
Les Johnson
Mark Killgore – DCR
Matt Gerhart – NVCT
Patrick Coady
Scott Rae – Fredericksburg
Tyler Gelles – Fredericksburg
[University of Mary Washington]
Bryant Bays – DOF
Lara Johnson – DOF
Matt Poirot – Water Quality Management, DOF
Darren Coffey, AICP – CEO, Berkley Group
Nadya Syazsa – Intern, Berkley Group
Celeste Greene – Executive Manager, Berkley Group
Luke Peters – Environmental Planner, Berkley Group

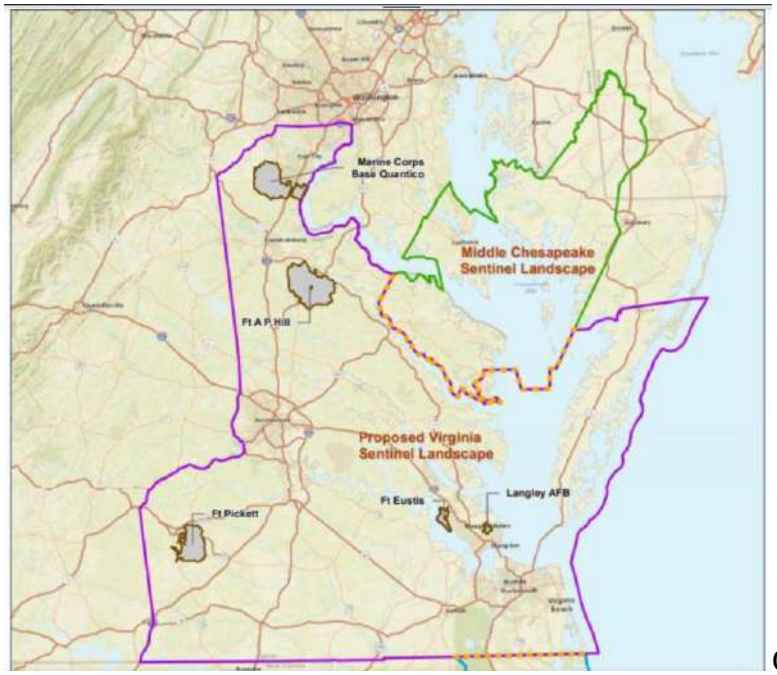
Meeting Notes

WIP presentation/meeting #4 and CZM meeting #?

WIP Updates:

- Scott: Urban Stream Restoration BMPs will no longer be accepted – keep ear open for why the 2022 guidance says this. [Find out where it says that??]

Bryant Bays, DOF Presentation on Programs Offered:

- GWRC is 69% forest – 595,377 acres, 59% is hardwood, 22% loblolly, 14% oak/pine.
- Lots and lots of hard and softwood removal (hopefully sustainable).
    - Active forest management provides a better return on environmental services.
    - More growth than removal: 23mil vs. 9mil soft, 27.5mil vs. ~15mil hard.
    - Worth $13mil.
- Eastern Region has lost 320,000 acres since 1977 due to development – leveling off recently.
- Working to prevent wildfires through education, because almost all are man-made.
- Forest management planning, costshare programs to reforest and prevent pine beetles, and creation of seedling nurseries.
- Trying to bring the carbon market to forest landowners (and create other markets).
- Increased pine productivity 2-fold. Research is also figuring out how to bring back diminished species, including American Chestnut.
- Working with individual landowners to help prevent conversion – creating conservation easements, especially to keep the land undivided (contiguous). 36,000 acres currently.
- No state forests and just 2 conservation easements in the GWRC region.
- **Sentinel Landscapes:**
    - Land: focuses on military encroachment, forests, arable land, forests, and flood and fire abatement;
    - Water: SLR, resiliency, water quality, habitat loss, and encroachment.
- David (Caroline): local forestry office has been a good partner for 15 years.
- 

Going to create a large area that focuses on both military readiness and environmental quality.

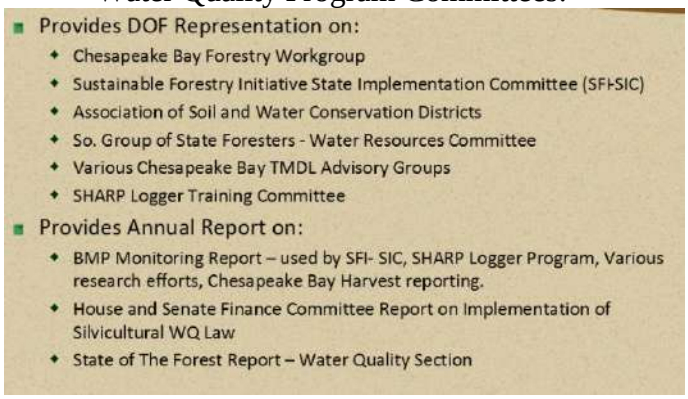
Lara Johnson, DOF: Financing and Tracking Urban Forestry Grants

- Staff of 2, gets federal money.

- Virginia Trees for Clean Water and Urban and Community Forestry Grant Program are the 2 big programs.
- VTfCW: reimbursement, requires site visit, match-what-you-can (doesn't require cash). Community engagement is required.
- UaCFGP: also RFP + reimbursement, but this one requires 50% match. This one has been doing a lot of workforce development – training students and others to care for trees planted through this program.
- Tracking Trees: https://arcg.is/WryDG (also on DOF website). They'll come verify them towards urban BMPs. Example: Woodlawn Learning Center urban orchard.

Matt Poirot, DOF – Water Quality Program

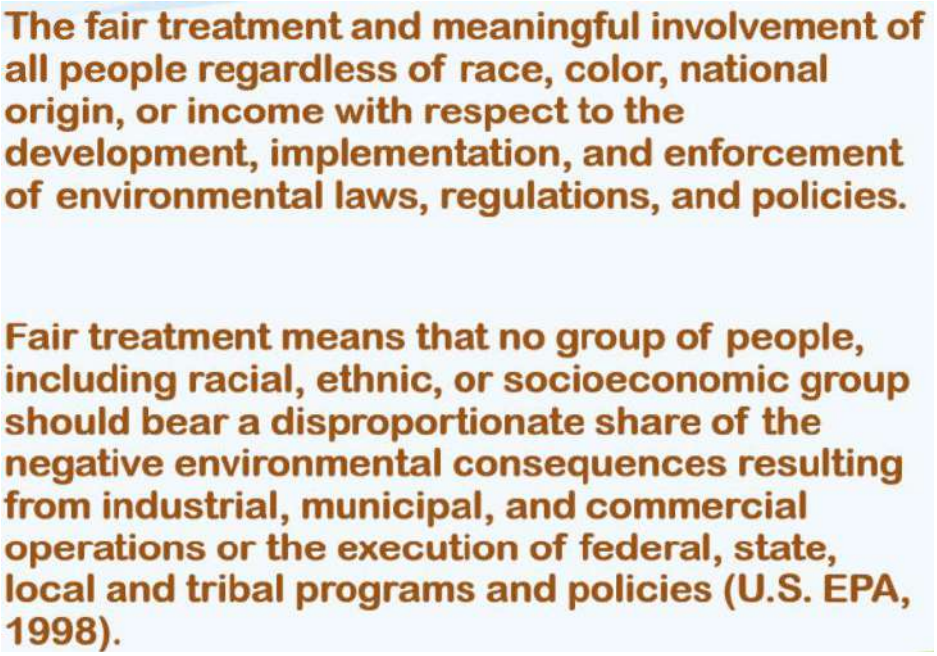
- Harvest Inspection Program: one-on-one contact with loggers, getting them to implement BMPs as part of their business models. Also informs them on Silvicultural Water Quality Law. Looked at 3,800 logging jobs last year. Avg. harvest size is 45 acres.
- Law Enforcement: civil law infringements under the Administrative Process Act. If a log-skid would put sediment in the water, they can enforce a stop-work order.
- [David Nunnally: "Can DOF work with VDOT on tree harvests adjacent to VDOT right-of-ways? Often, we see a single line of trees left standing along the roadway that are very susceptible to storm damage."]
- Work on BMP training for loggers.
- IFRIS notification system identifies Water Quality related inspections (IFRIS).
- Things that get counted: Harvesting BMPs get counted, Urban Tree Canopy (by Lara), Riparian Forest Buffer Miles, Afforestation, etc.
- Monitor 240 BMP tracts per year, selected randomly.
- Riparian Forest Buffer Program – hired a contractor through a EPA grant. No cost to certain landowners.
    - Tax Credit: 25% of the timber retained, up to $17,500/year. 2019 had 112 applications, $738,721 on $3,258,227 worth of timber. Have to leave buffer for 15 years.
- Continuity of funding is difficult for WQ projects.
- Water Quality Program Committees:



Celeste Greene, Berkley Group – Environmental Justice:

- "Social equity is about fairness, right, justice, and freedom from the effects of bias… it is a pragmatic condition that describes access to and distribution of public goods."

- Equality vs. Equity vs. Justice



- Lot of lead in old houses. Lots of pesticide exposure to farmworkers of color.
- Age, race, density, literacy, geographic factors, income, health care access, pollution concentrations, etc.
- 2010 Obama appointed first AA to lead EPA (Lisa Jackson).
- Federal Tools: Title IV, 14th Amendment, EO 12898 (1994, Clinton), Established Interagency Working Group (EPA, 11 department heads, meets monthly).
- Texts: Bullard, Dumping in Dixie, Coye & Lavelle, article in National Law Journal; Boerner & Lambert (critics), Murphy-Greene (2022) incorporate EJ more fully into agencies. “EJ and Resiliency in an Age of Uncertainty”.
- Three Goals at Dept. of Energy:
    - Identify programs with adverse impacts
    - Enhance credibility and public trust by increasing public participation
    - Improve data collection methods RE risk for minority and low-income.
- Dept. of Trans strategy: case studies showing outreach to minorities, etc.
- State Efforts:
- 2021: DEQ hired first Director of EJ (Renee!).
- Focusing on redlining and urban heat islands (Baltimore and Richmond). Working to increase tree canopy.

Appendix B: Regional Environmental Managers Technical Committee Meetings Select Presentation Slides

GEORGE WASHINGTON
REGIONAL COMMISSION

Regional Environmental Managers Technical Committee

FY20 CZM Resilience Program

CY21 Chesapeake Bay Watershed Implementation (WIP) Program

January 19, 2021 1:00 p.m. – 3:00 p.m.

Agenda

- Advancing Ecosystem and Community Resilience Program
- Chesapeake Bay Watershed Implementation Program
- Round Table

Advancing Ecosystem and Community Resilience Program

- Program Overview
  1. Coordination with member localities and stakeholders; 2 meetings
  2. Identify resiliency needs, establish priorities, and conceptualize projects
  3. Support state project database
  4. Support state master plan development
- VIMS Sea Level Report Card
- CCRFR Recurrent Flooding Risk GIS
- Virginia Coastal Resilience Master Plan Framework

Chesapeake Bay Watershed Implementation Program

- Program Overview
  1. Coordination with member localities and stakeholders; 4 meetings; website and social media marketing
  2. Facilitation of BMP reporting
  3. Development and distribution of implementation tools and resources
  4. Facilitation of regionally specific activities
- Virginia Water Quality Program
- VEGIS > Environmental Data Mapper

Round Table

- Caroline County
- King George County
- Spotsylvania County
- Stafford County
- City of Fredericksburg
- Other Stakeholders

Six Meetings and Coordinated Topics

Date (3rd Tuesdays)	CZM TA & Training	CZM Flood Outreach	CZM Resilience	WIP
November 17	X Kickoff	X Kickoff		
January 21			X Kickoff	X Kickoff
March 16	X	X		X
May 18	X	X		
July 20			X	X
September 21	X			X

GEORGE WASHINGTON
REGIONAL COMMISSION

Regional Environmental Managers Technical Committee

FY20 CZM Resilience Program

CY21 Chesapeake Bay Watershed Implementation (WIP) Program

January 19, 2021 1:00 p.m. – 3:00 p.m.

Virginia Coastal Resilience Master Planning Framework

Inundation Mapping Primer

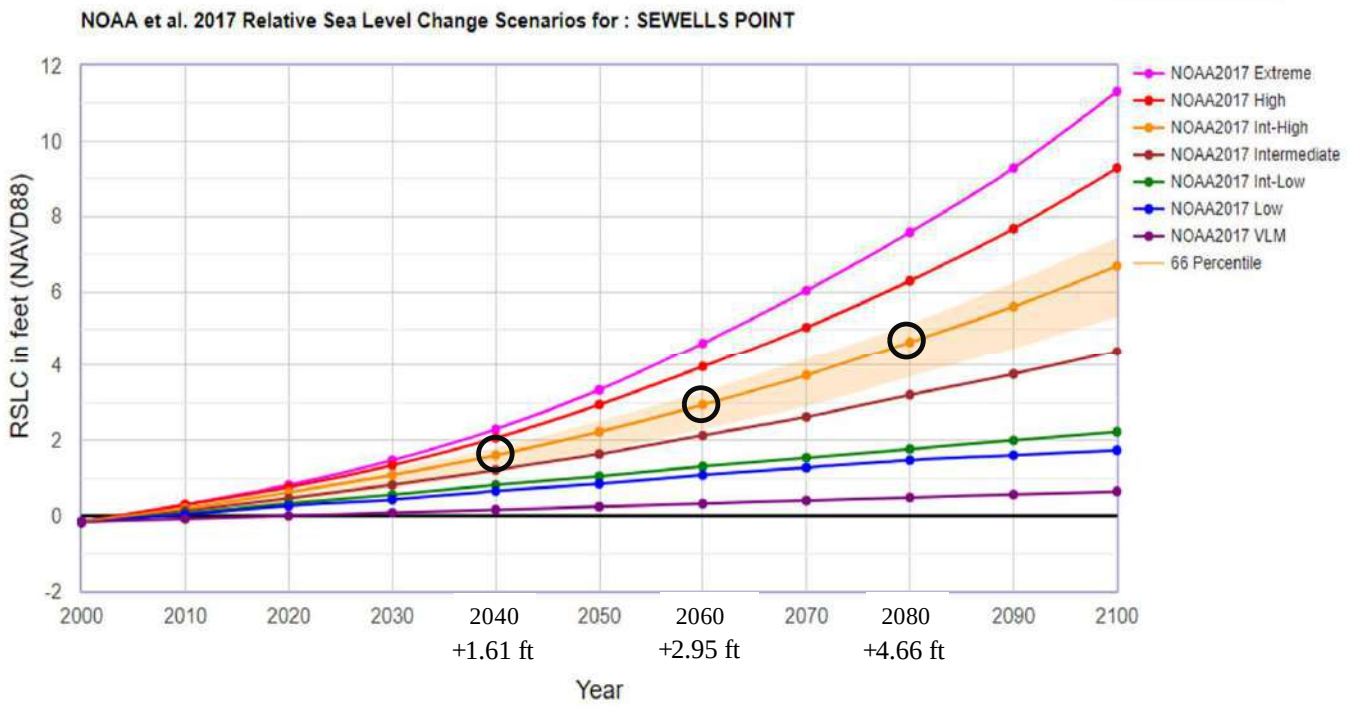
George McLeod, Old Dominion University
Director, Ctr. For Geospatial Science, Education, and Analytics
Senior Fellow, Commonwealth Ctr. for Recurrent Flooding Resiliency

Dr. Thomas R. Allen, Old Dominion University
Program Head for Sea Level Rise and Climate Science,
Institute for Coastal Adaptation and Resilience (ICAR)

What is inundation mapping in the context of the Framework?

- Sea Level Rise modeled using NOAA 2017 Intermediate-High scenario as prescribed by ODU-CCRFR report:

  Recommendations for Freeboard Standards for State-Owned Buildings in the Commonwealth of Virginia[1]
- Closely aligns with HRPDC Sea Level Rise Planning Policy and Approach[2], that recommends SLR values of:
  - +1.5' for near-term planning
  - +3.0' for mid-range planning
  - +4.5' for long-term planning
- Conforms to VIMS recommendation of using "higher curves" when modeling SLR against flood intolerant infrastructure[3]



1 Recommendations for Freeboard Standards for State-Owned Buildings in the Commonwealth of Virginia. ODU-CCRFR. October 23, 2019. https://www.naturalresources.virginia.gov/media/governorvirginiagov/secretary-of-natural-resources/images/ODU-Freeboard-Recommendations-Ver-1.5-10_31_19-FINAL.pdf

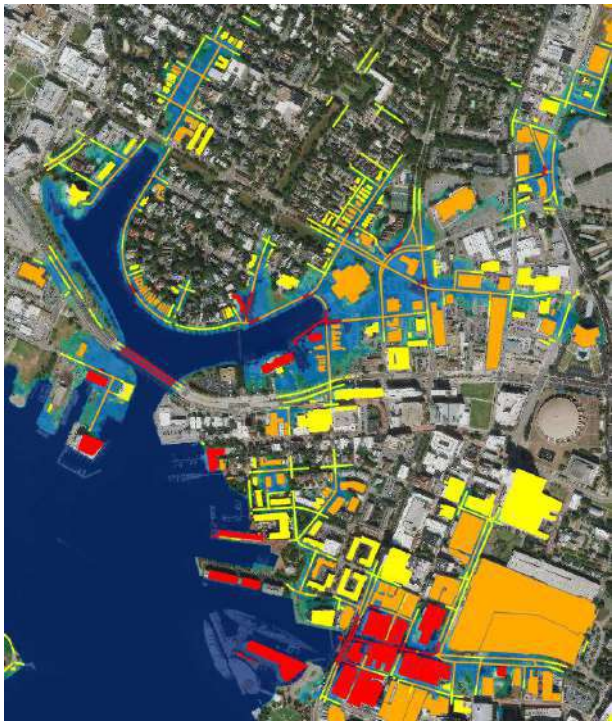
2 HRPDC Sea Level Rise Planning Policy and Approach. Adopted October 18, 2018. https://www.hrpdcva.gov/uploads/docs/05A_Attachment%20-%20HRPDC%20Sea%20Level%20Rise%20Planning%20Policy%20and%20Approach%20-%20Adopted%20101818.pdf

3 Recommendations for Sea Level Rise Projections. VIMS. February 2019. https://www.naturalresources.virginia.gov/media/governorvirginiagov/secretary-of-natural-resources/images/1c.-Sea-level-rise-projections-for-Virginia-planning-purposes-(2)-FINAL-10_31.pdf

What do the data show?

What do the data show?

2040



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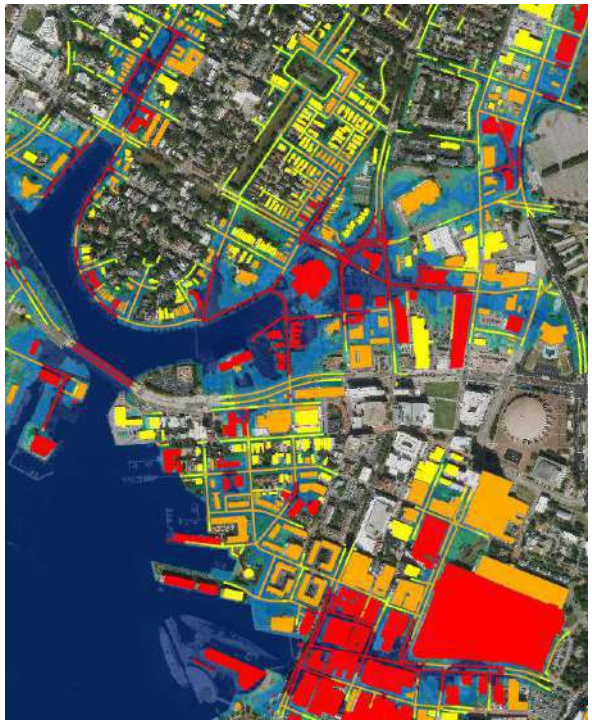

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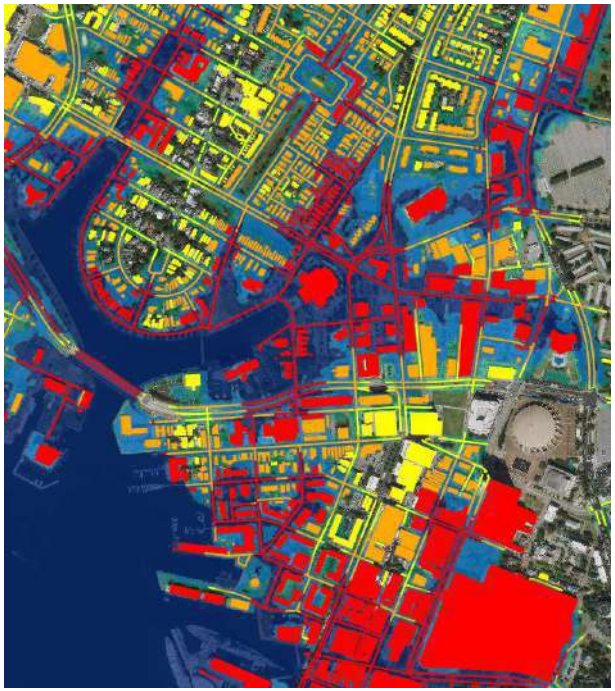


How are the data different than other sea level & flooding data?

- Scenario-specific data modeled exclusively for the Commonwealth's coastal planning districts
- Minor (aka "nuisance") and moderate recurrent flooding areas also modeled using NOAA threshold data
- Vulnerability of basic infrastructure (buildings & roadways) modeled state-wide
- Developed using publicly accessible data to allow for replication by other practitioners
- Full report[1] and web map data viewer[2] are available
- Data distribution mechanism is being developed

Total additional land and streets at-risk from minor flooding for coastal Virginia PDCs

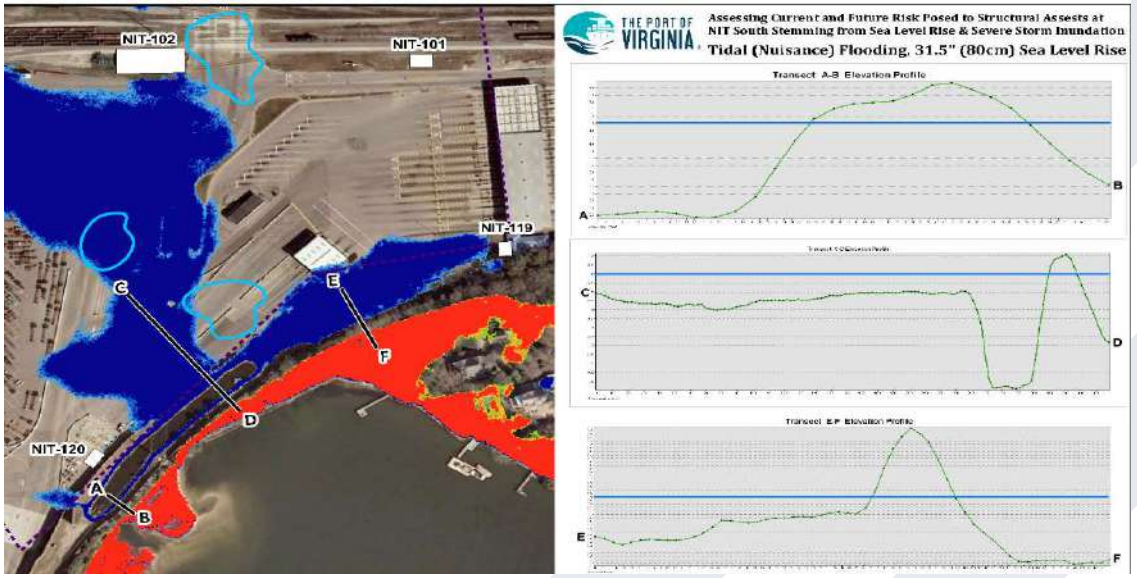
	YEAR					
	2040		2060		2080	
PLANNING DISTRICT	LAND AREA (mi^2)	STREETS (mi)	LAND AREA (mi^2)	STREETS (mi)	LAND AREA (mi^2)	STREETS (mi)
Accomack-Northampton	44	116	32	99	32	90
Crater	2	1	2	1	2	1
George Washington	3	1	2	1	2	2
Hampton Roads	53	152	48	313	58	580
Middle Peninsula	27	79	24	85	25	90
Northern Neck	10	24	9	22	10	30
Northern Virginia	1	5	1	9	1	11
Richmond	4	2	4	3	5	6
TOTAL	**144**	**380**	**122**	**534**	**135**	**810**

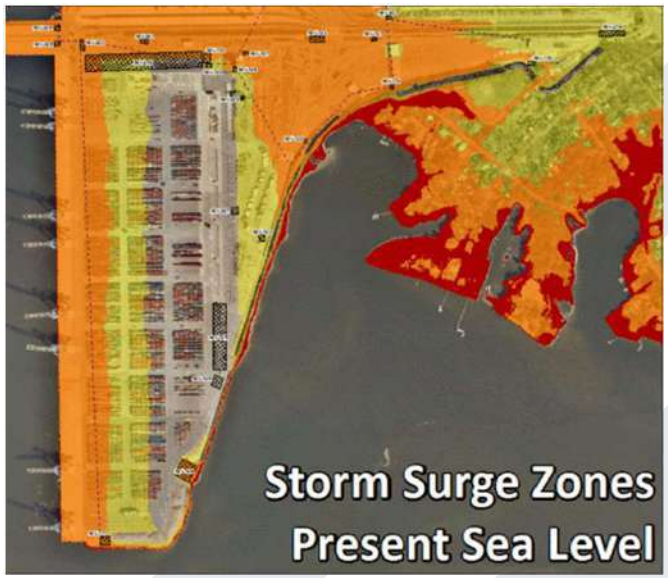
1 Future Sea Level and Recurrent Flooding Risk for Coastal Virginia. ODU-CCRFR Report #11. February 2020. https://www.floodingresiliency.org/futurerisk/

2 Coastal Virginia Sea Level with Minor and Moderate Flooding (NOAA Int-High Scenario 2017). ODU-CCRFR. Last updated February 21, 2020. https://odu-gis.maps.arcgis.com/home/webmap/viewer.html?webmap=36e758f7e2b544a980962faef1faaeb4

How can these data be used and what's next?

- Highlighting areas of critical need and promote community discussion
- Used as the basis for additional infrastructure and resource assessments (i.e. septic systems, wetlands, site-specific studies)
- Allow for calculation of general metrics relating to the potential flooding costs (e.g. value of impacted property & potential lost tax revenue)
- Foundation for improved and additional modeling:
  - Enhancing hydrological connectivity including stormwater systems
  - Rainfall
  - Storm surge
  - Increased storm activity
  - Geomorphological change
  - Probabilistic modeling





Contact Us

- George McLeod
  Director - Ctr. For Geospatial Science, Education, and Analytics at Old Dominion University
  gmcleod@odu.edu

- Dr. Thomas R. Allen
  Program Head for Sea Level Rise and Climate Science, Institute for Coastal Adaptation and Resilience (ICAR)
  Professor, Dept. of Political Science and Geography
  tallen@odu.edu

OLD DOMINION UNIVERSITY

VIRGINIA COASTAL RESILIENCE MASTER PLANNING FRAMEWORK

Principles and Strategies for Coastal Flood Protection and Adaptation

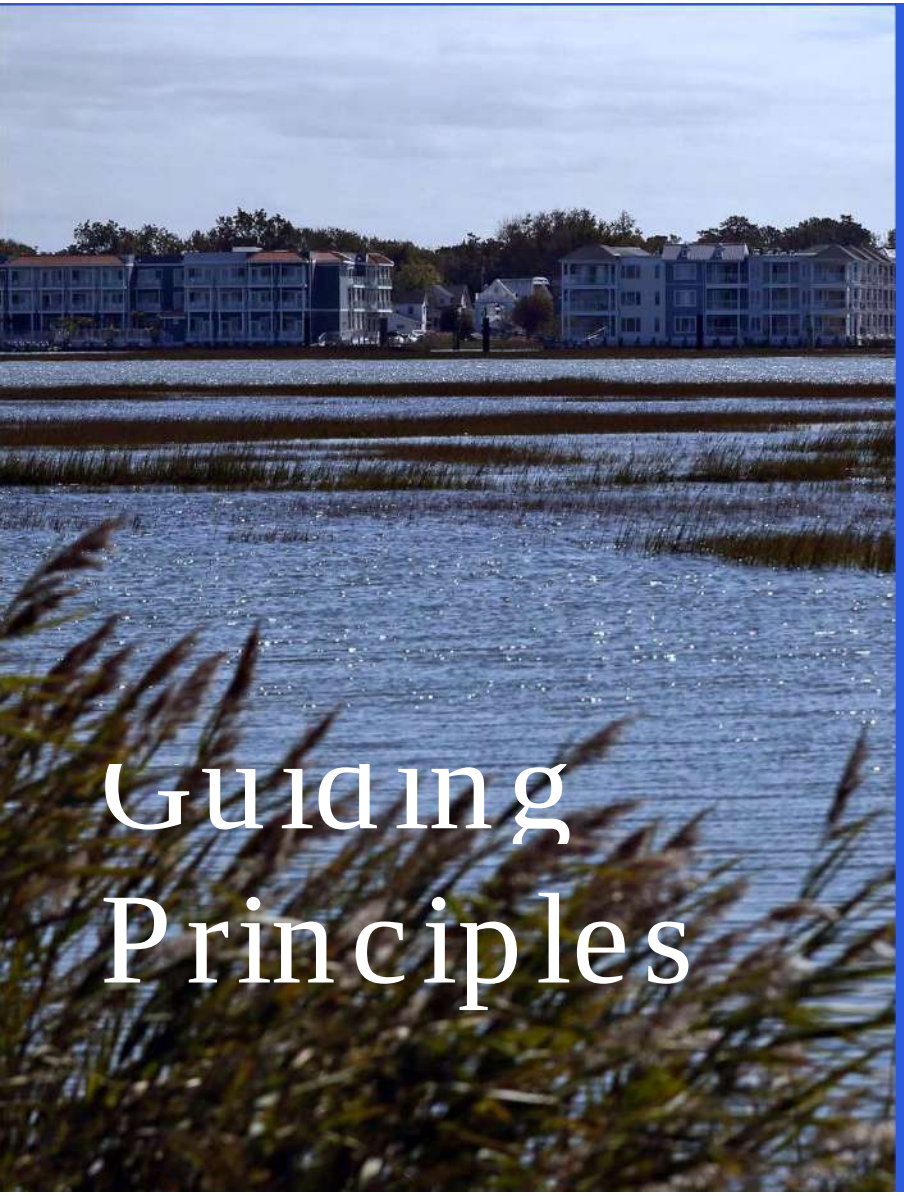
GWRC Environmental Managers Meeting
January 19, 2020

Rear Admiral Ann C. Phillips, US Navy (Retired)
Special Assistant for Coastal Adaptation and Protection
ann.phillips@governor.Virginia.gov

Email: ResilientCoastVA@governor.virginia.gov

2020 General Assembly Legislation

- (HB 1313) Chief Resilience Officer position created, SACAP authorities added, DCR Flood Protection Program coordination stakeholders expanded
- (HB 981) Community Flood Preparedness Fund monetized through Regional Greenhouse Gas Initiative (RGGI)
- (HB 1164) DEQ Mission to include "address Climate Change. . . across all programs and permitting processes" and include environmental justice
- (HB 504) Chesapeake Bay Preservation Act purpose amended to include "Coastal Resilience and Adaptation to sea level rise and climate change"
- (SB 776) VMRC, Living Shorelines as the approved shoreline management approach unless science shows not suitable.



Guiding Principles

Acknowledge Climate Change

Acknowledge climate change and its consequences and base decision-making on the best available science.

Enhance Equity

Identify and address socioeconomic inequities and work to enhance equity through coastal adaptation and protection efforts.

Nature-Based Solutions

Recognize the importance of protecting and enhancing green infrastructure like natural coastal barriers and fish and wildlife habitat by prioritizing nature-based solutions.

Region-Specific Approach

Utilize community and regional scale planning to the maximum extent possible, seeking region-specific approaches tailored to the needs of individual communities.

Cost-Effective Solutions

Understand fiscal realities and focus on the most cost-effective solutions for protection and adaptation of our communities, businesses and critical infrastructure.

Email: ResilientCoastVA@governor.virginia.gov

Primary Goals

1

Identify and Prioritize Projects

Identification of priority projects for the Master Plan

2

Financing Strategy

Establish a financing strategy

3

Incorporation of Climate Change Projections

Effective incorporation of climate change projections in state programs

4

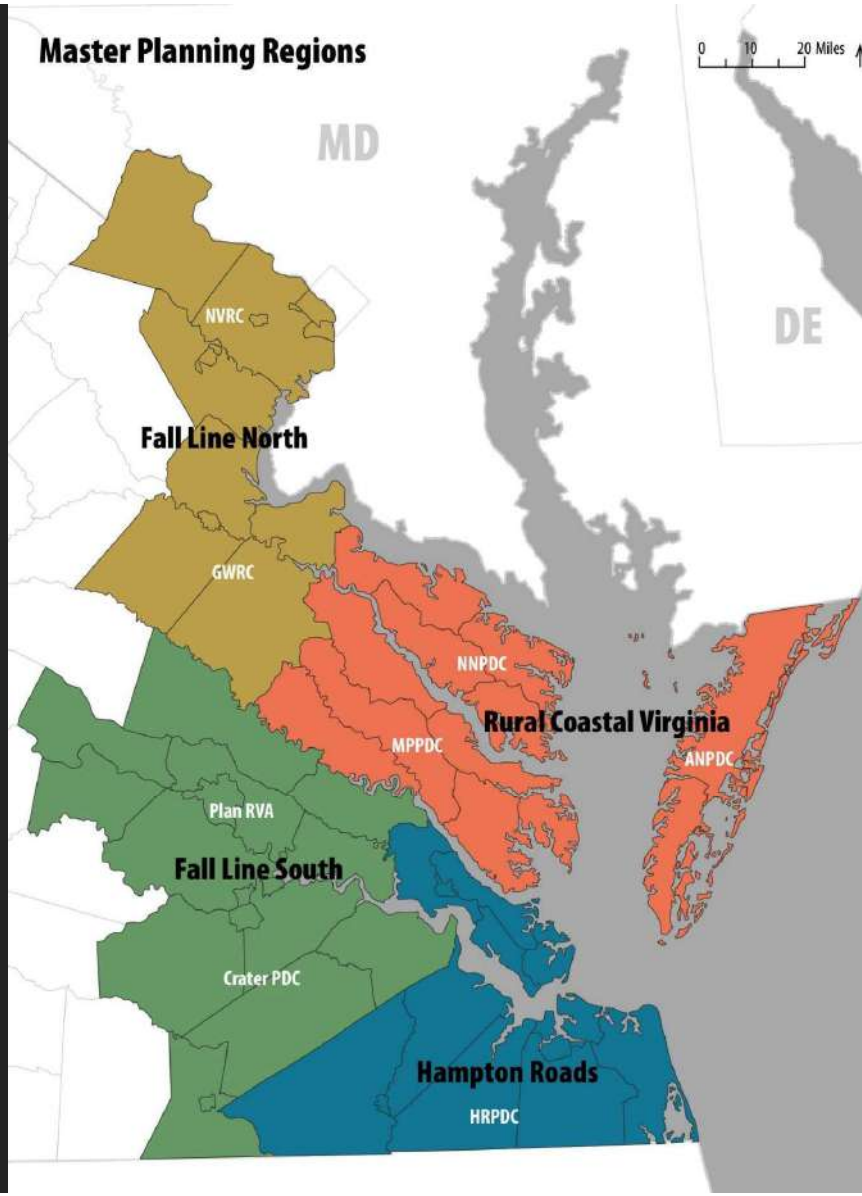
Coordinate Efforts

Coordination of state, federal, regional and local coastal efforts

Email: ResilientCoastVA@governor.virginia.gov

Four Master Planning Regions

- Hampton Roads (HRPDC)
- Rural Coastal Virginia (A-NPDC, MPPDC, NNPDC)
- Fall Line North (GWRC and NVRC)
- Fall Line South (Crater and PlanRVA)



What's next

Fall 2020

RFP

Outreach

Establish Technical Advisory Committee

Spring 2021

First FY 21 RGGI Auction
(Of four) deposits Funds to VCFPF

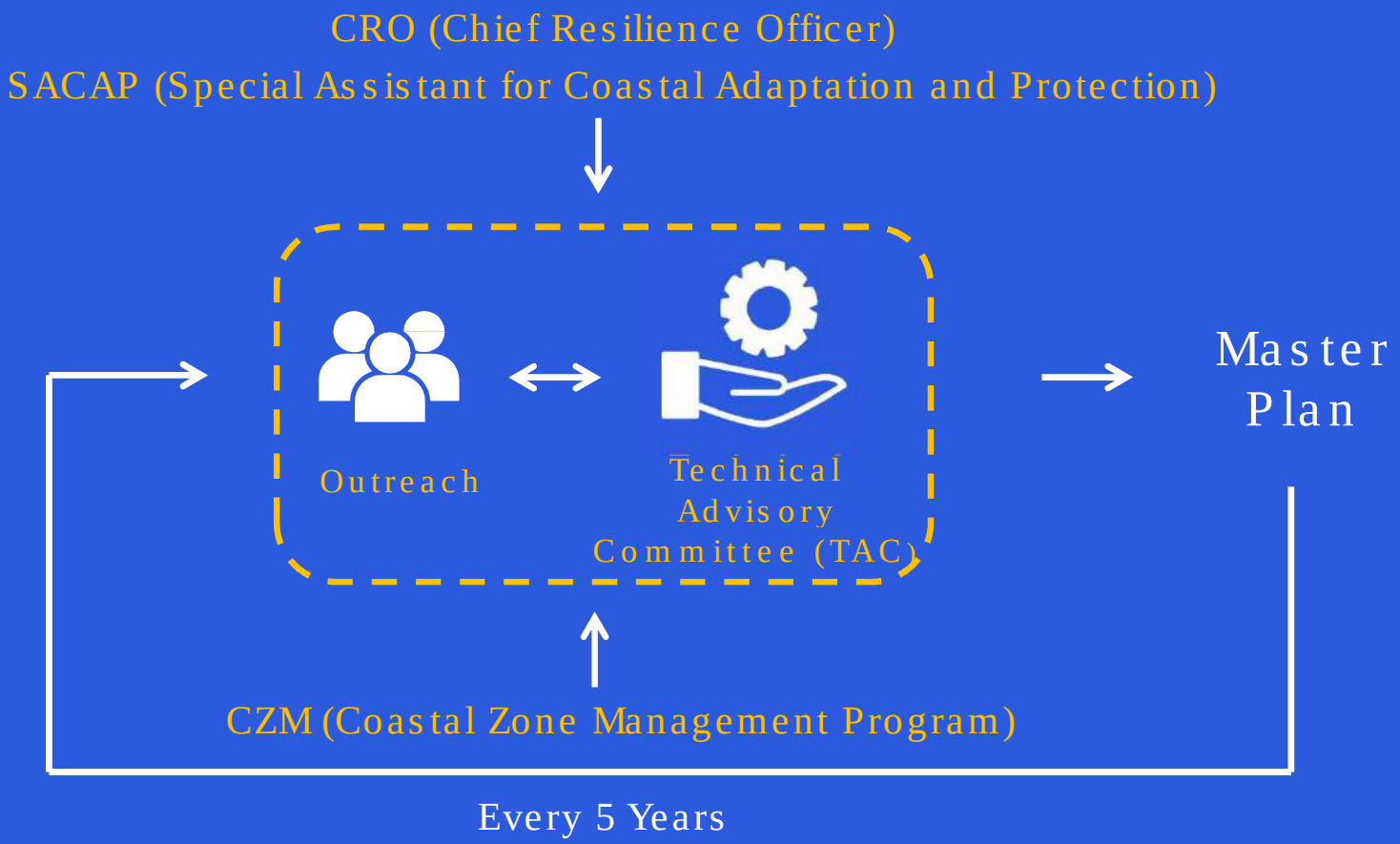
Fall 2021

Coastal Relocation Handbook

Release Master Plan

Email: ResilientCoastVA@governor.virginia.gov

Towards a Master Plan -



Email: ResilientCoastVA@governor.virginia.gov

RFP (request for proposals)

Full coastal analysis to identify critical built and natural infrastructure / identify gaps/ conduct economic impact analysis
Assist with developing database for prioritization process

TAC, CRO, SACAP → Develop protocol for prioritization → First list of priority projects

Email: ResilientCoastVA@governor.virginia.gov

Immediate Actions

Technical Advisory Committee (CRO, SACAP)

The TAC will work closely with the CRO and SACAP in creating a Master Plan and prioritized project list and financing model based on the guiding principles, goals, and actions identified in the Framework.

Coastal Zone Management Program

The nature of the TAC's work will require some significant administrative and technical support. This will include: decision option identification; stakeholder and advisor input management; data collection and synthesis; and performance monitoring. To meet these needs, we will utilize the CZM Program.

Community Engagement

A key element of our efforts going forward is direct outreach to individual communities across the Framework's four coastal regions.

Email: ResilientCoastVA@governor.virginia.gov

Questions

- Would a similar introduction and public input session be of value in your region?
- Which localities/communities should be the focus for outreach efforts near term?
- What do you consider to be the biggest adaptation and protection challenge in your locality, how can the Commonwealth best assist with that challenge?
- How do we best enable communities who need planning capacity?

Email: ResilientCoastVA@governor.virginia.gov

Public Comments email:
ResilientCoastVA@governor.virginia.gov

Virginia Coastal Resilience Master Planning Framework link: https://www.dcr.virginia.gov/crmp/framework

Clean Water Financing & Assistance Program

March 2021

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

Clean Water Financing & Assistance Program

- **Virginia Clean Water Revolving Loan Fund (VCWRLF)**
- **Water Quality Improvement Fund (WQIF)**
- **Stormwater Local Assistance Fund (SLAF)**

Stormwater Local Assistance Fund

- **History**
  - **Enabled by the General Assembly in 2013**
  - **Administered by the State Water Control Board (SWCB) and DEQ**
  - **Established to provide matching grants (50%) to local governments for planning, design, and implementation of stormwater BMPs**
  - **Six Annual solicitations issued FY14 – FY20**
  - **To date approx. $110 MM authorized for 240 eligible projects**

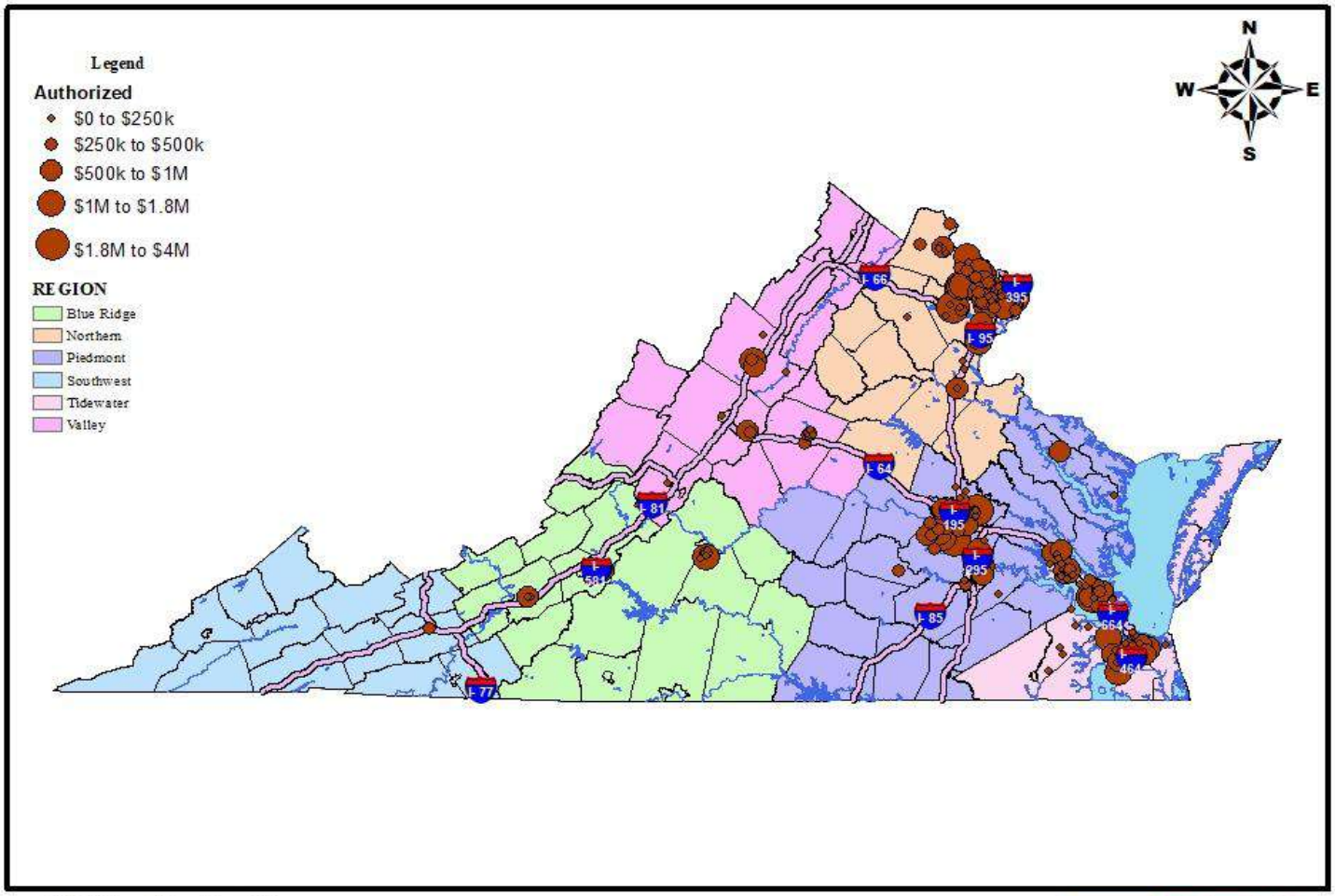
Who & What is Eligible?

- **Who can apply:**
  - **Local governments (any county, city, town, municipal corporation, authority, district, commission, or political subdivision)**
- **Eligible Costs:**
  - **Reasonable and necessary costs associated with Clearinghouse approved BMPs, Stream Restoration Projects, Non-Point Source Nutrient Credits**
  - **Engineering and Construction Costs**
    - **Geotechnical, ROW, Construction Administration, and Inspection**

Ø Ineligible Costs:

- **Municipal Employee Costs**
- **Administrative Costs**
- **BMP Operation or Maintenance**
- **Interest costs associated with borrowed funds**
- **Extraneous amenities not required for water quality**

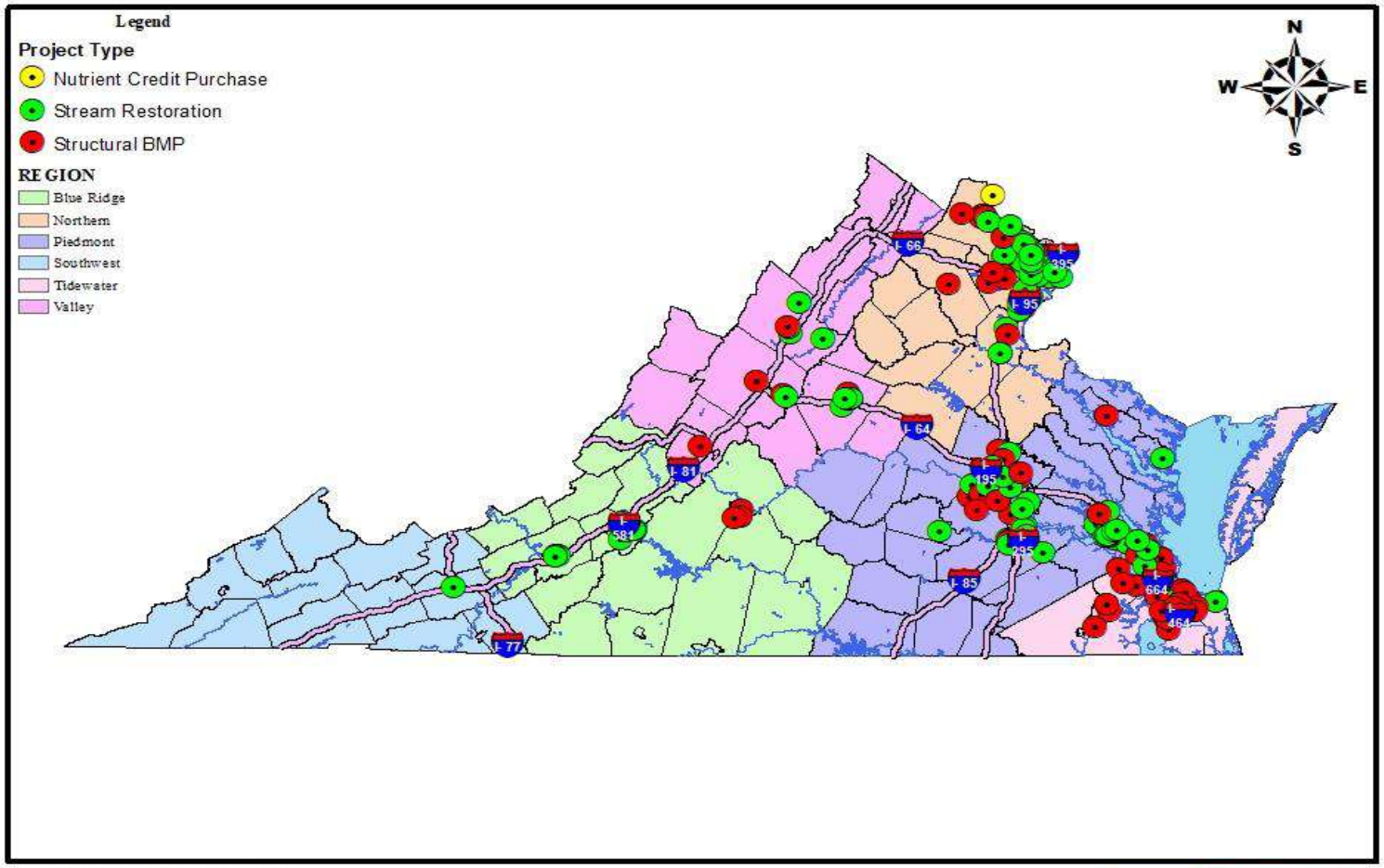
SLAF Projects by Funding Authorization



Map Produced by M. Link 12/2020

DEQ
Virginia Department of Environmental Quality

SLAF Project Locations by Type

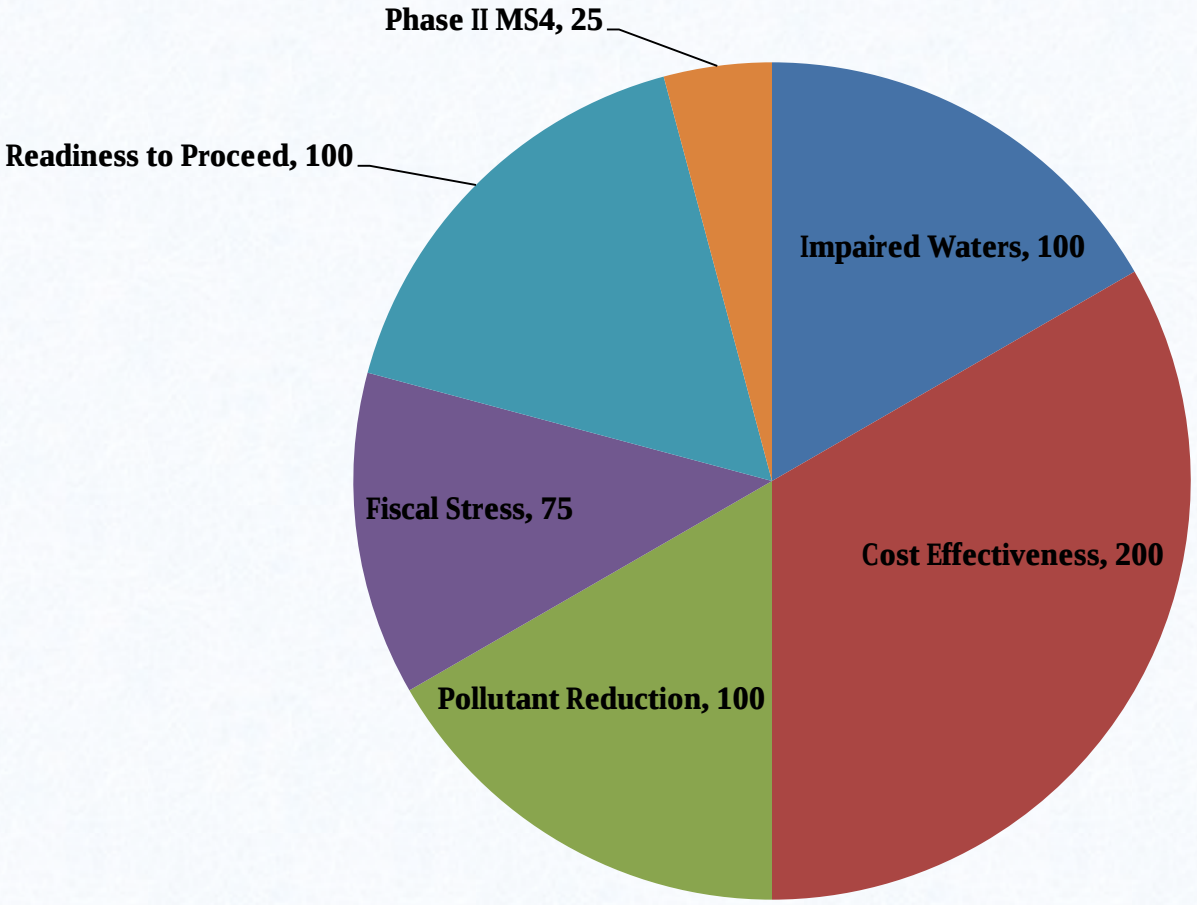


DEQ
Virginia Department of Environmental Quality

SLAF Application Process

What makes a complete project application???

Application Evaluation



Organizational Data

Section A

- **Please give the project a name that will be its unique identifier throughout the life of the project at a minimum.**
- **Make sure the contact information for both the applicant and the engineer are included.**

Proposed Funding

Section B

- **Source of funds- General funds, other non state funded grants, loan/bond proceeds. Be as specific as possible.**
- **Provide backup documentation on the source of match funds.**
- **Committed means “in an approved budget” or by way of a grant or loan commitment.**

Water Quality Data

Section C

- **Lat/Long- pick a central point for stream restorations and other BMP's. Double check you coordinates.**

Project Description

Section D

- **This is your opportunity to elaborate on things you feel the evaluators need to know about this project. Remember there are multiple people within DEQ reviewing these applications.**
- **What is the BMP you are building/retrofitting and why?**
- **Elaborate on existing conditions, limitations, constraints, benefits.**

Section D- Continued

- **For stream restorations- stream channel classification, watershed studies, BANCS, conceptual design/analysis, plans (if available). Think about the watershed when discussing specifics about a particular stream.**
- **Photographs of stream reach to be restored. (if plans are available and stationing is complete take pictures and label with station)**

Pollutant Reductions

Section E

- **This section hasn't created many issues thus far. Follow the instructions and provide the appropriate documentation.**
- **Additional information always contained in the Attachment A that comes out with the solicitation.**
- **Be mindful of cost/lb/TP. Think about this very early in the process.**

Readiness to Proceed

Section F

- **Make sure that the dates provided in the schedule table are realistic and allow ample time for plan development, public participation, easement acquisition and bid evaluation.**
- **The documents provided with the application will help DEQ in determining your state of readiness indicated in the project status table.**
- **If you indicate your design as complete and approved by the locality make sure that the plans aren't stamped "Not for Construction" or "60% design."**

Section F- Continued

- **If land acquisition is required and funds are being requested for easement acquisition please submit a ROW plan sheet depicting the easement areas for both existing and proposed easements.**
- **If funds are being requested for easements that have already been acquired make sure to include documentation that substantiates that the acquisition transaction has taken place.**

Project Budget Information

Section G

- **Most important part of this section is making sure that your figures match what has been listed in other sections of the application.**
- **Contingency can only be 5% of the BMP construction cost listed in the table of Section G.**

Program Requirements

- Engineering/Professional Services Procurement
  - Must follow VPPA
- Plan & Specification Submittal
  - Pollutant Reduction Calculations (TP)
  - BMP Certification
  - Environmental Permits
- Construction Procurement
  - Must follow VPPA
- Long Term Responsibility & Maintenance Plan

In search of Local 50% Match

- Local 50% match comes from a variety of sources
  - Local General funds/Bond Funds
  - SW Utility funds
  - Public-Private Partnership (P3)
  - Grant Funds
    - National Fish & Wildlife Foundation (NFWF)
  - Virginia Clean Water Revolving Loan Fund (VCWRLF)

Questions?

Mike Crocker, Jr
Project Oversight Team Leader
michael.crocker@deq.virginia.gov
804-698-4012

GET FLOOD FLUENT

REGIONAL FLOOD RISK OUTREACH

GWRC Regional Environmental Managers Technical Committee
May 18, 2021

Katie Cullipher, Principal Environmental Education Planner
Ben McFarlane, Senior Regional Planner
Hampton Roads PDC

HRPDC'S REGIONAL RESILIENCE INITIATIVES

Aggregate information regionally to improvec oordination and collaboration between communities

Educate stakeholders to improve resilienceat all scales

Develop technical products that account forc limate change that can be incorporated them into local plans and policies

DEVELOPING REGIONAL DATA

Regional Resilience Inventory

DOCUMENT

Document the need for state and federal assistance

IDENTIFY

Identify possible opportunities for coordination and collaboration

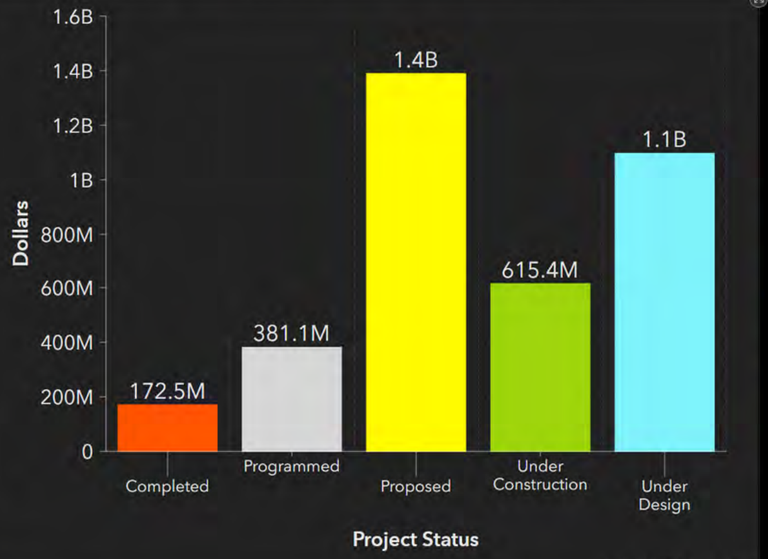
TRACK

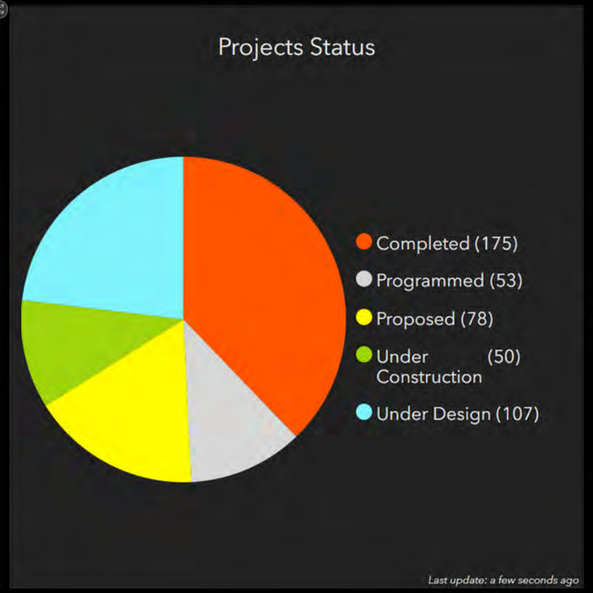
Track local progress on resiliency

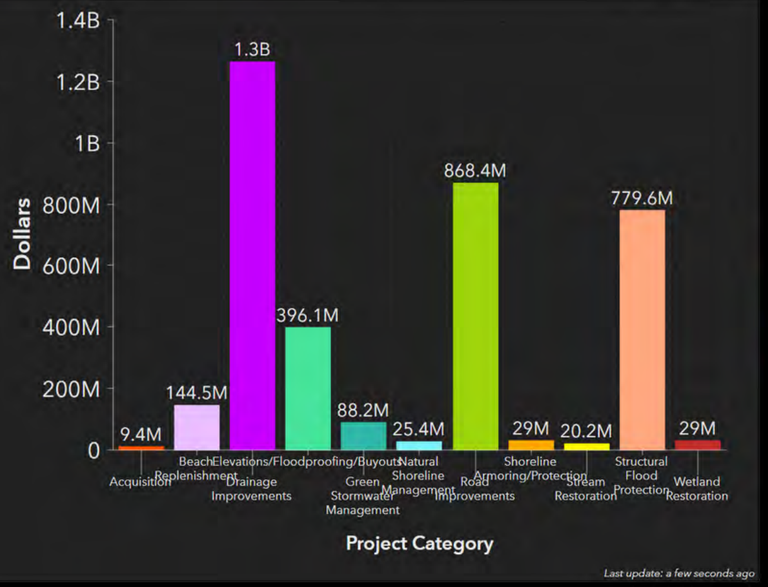
Regional Resilience Projects Dashboard

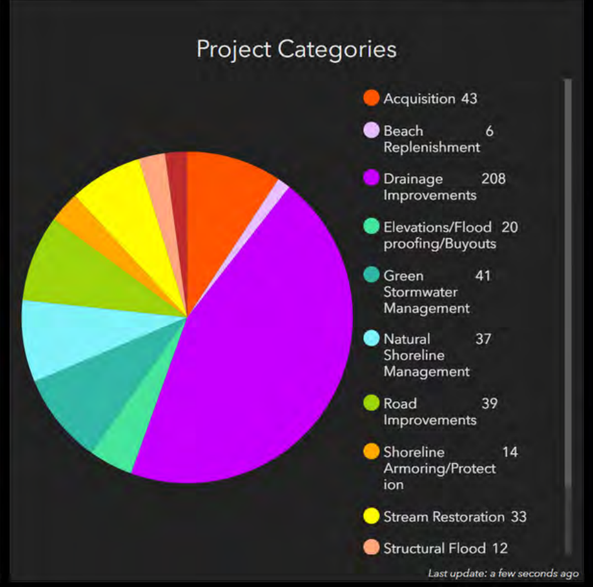
Hampton Roads Resilience Projects Last updated February 9, 2021.

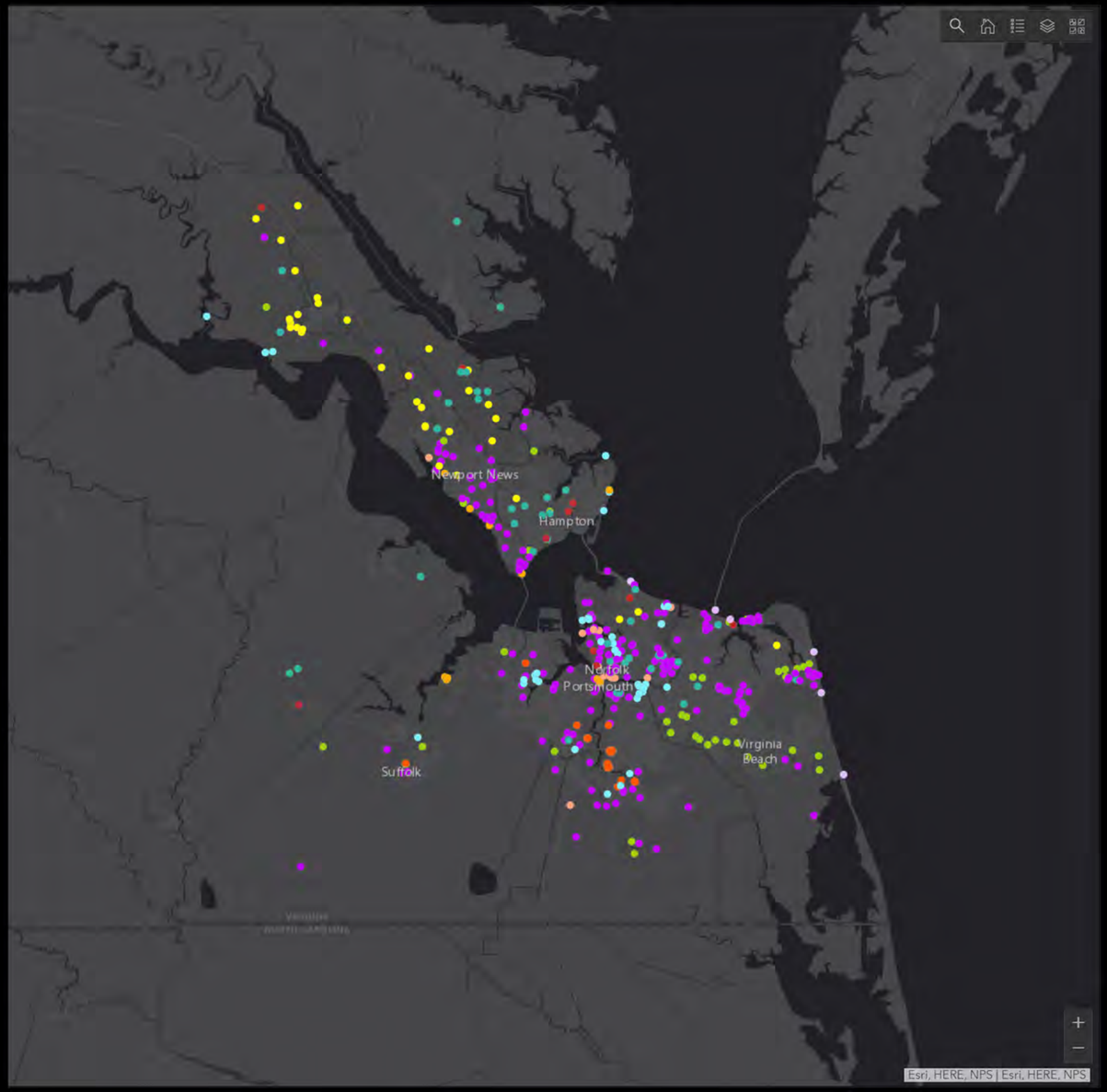
Locality All | Project Type All | Project Status All











Regional Resilience Projects Dashboard

Projects from 12 Hampton Roads Localities

Over 450 projects included in 11 categories

175 projects completed ($173 million)
157 projects underway ($1.7 billion)
131 programmed or proposed ($1.8 billion)

Online at www.HRGEO.org

Resilience Policies StoryMap

EDUCATING RESIDENTS

NOVEMBER 2017

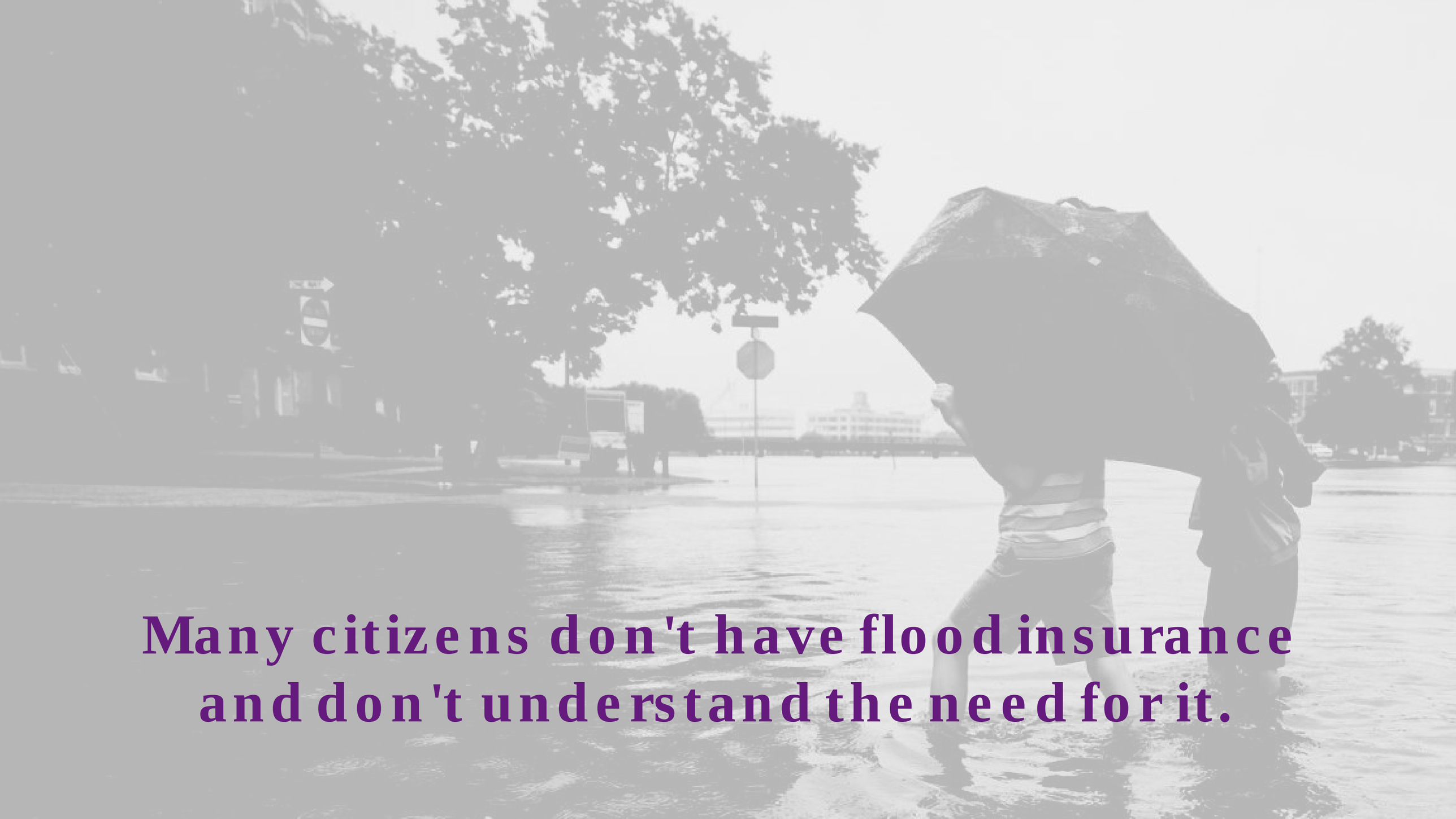
A LOOK AT HURRICANE HARVEY'S IMPACT

Over 40 inches of rain in 48 hours - 136,000 structures flooded in Harris County Flood District

15% of flooded property owners had flood insurance

40% of $30B in damage covered by insurance

Hurricane Matthew in 2016 - 11 inches of rain in 24 hours - 84% of claims in Hampton Roads were outside high-risk mapped flood zones



Many citizens don't have flood insurance and don't understand the need for it.


GET
FLOOD
FLUENT.ORG

Outreach Goals

Educate about flood issues and facts and the need for flood insurance, especially here in Hampton Roads.

Debunk flood insurance myths and misunderstandings.

Encourage people to contact their insurance agent to get a quote.

OUTREACH COMPONENTS

GET FLOOD FLUENT.ORG

Website & Toolkit

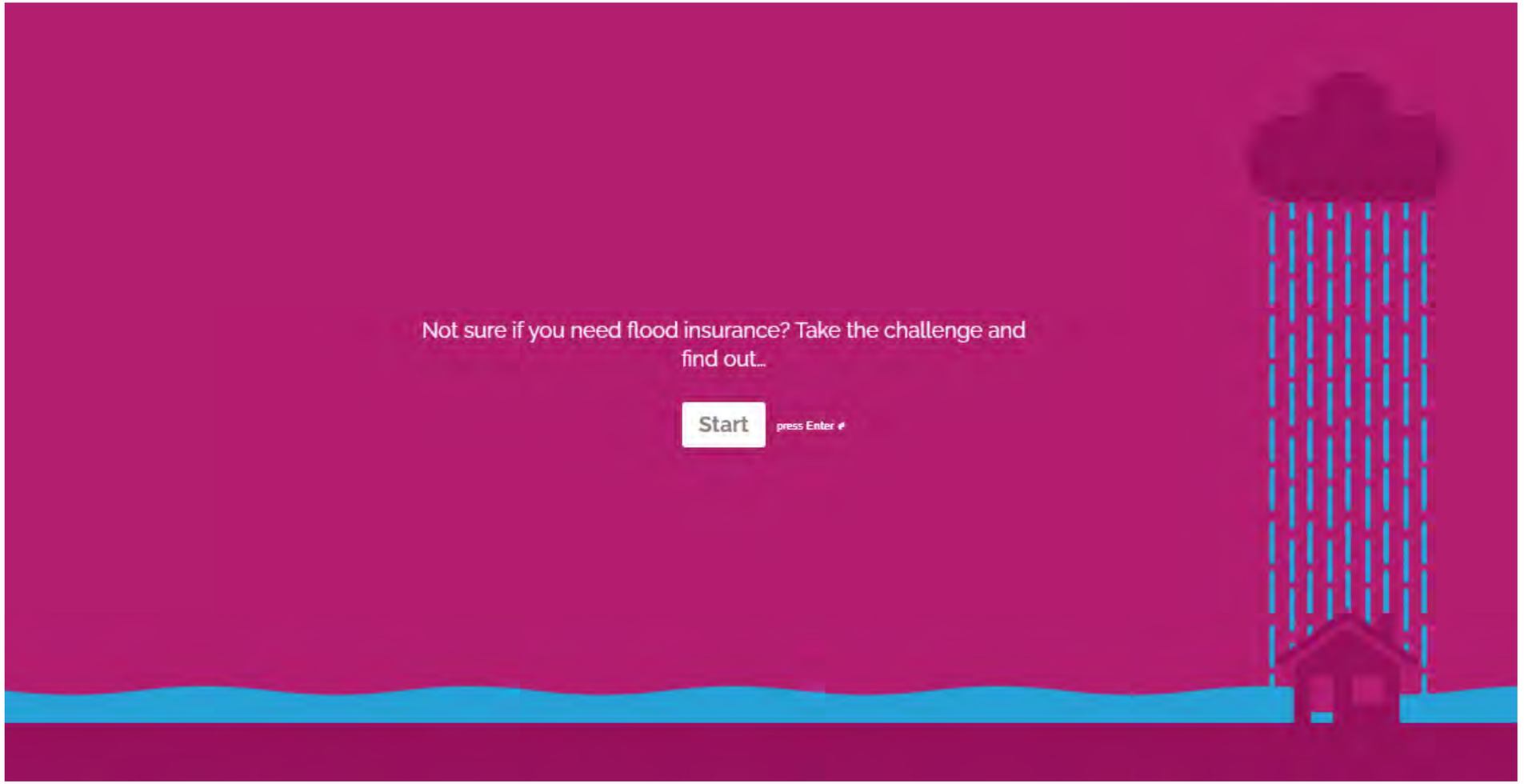
Paid Media &
Public Relations

Flood Risk &
Coverage Calculator

WHY

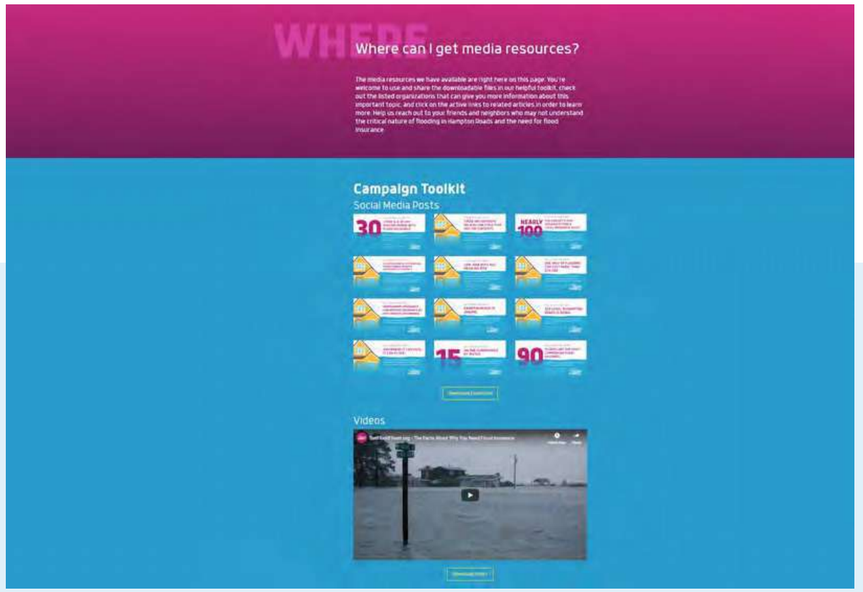
Why do you need flood insurance?

Sure, many homes and families in Hampton Roads have yet to experience flooding. If you haven't had water where it's not supposed to be, you've been lucky. But times, as they say, are a'changin. And the facts are the facts. Here goes...


Not sure if you need flood insurance? Take the challenge and find out...
Start
press Enter

CAMPAIGN TOOLKIT

logos
social media graphics
videos
print materials
related resources



Paid Media Campaigns

GET FLOOD FLUENT.ORG

Spring 2019 (May 6 - June 2)

- Radio (790 AM Talk Radio, FM 99 Rock, US 106.1 Country)
- TV (WVEC, WAVY)
- Digital (targeted display, video pre-roll, native content, social media)
- Print (Virginian-Pilot & Daily Press)

Fall 2019 (August 12 - September 1)

- Radio (790 AM Talk Radio, 95.7 R&B, FM 99 Rock, 101.3 Adult Contemporary, US 106.1 Country)
- Digital (targeted display, video pre-roll, native content, social media)

Summer 2020 (June 15-28, July 6-12)

- Radio (790 AM Talk Radio)
- TV (WAVY, WVBT)
- Digital (targeted display, video pre-roll, native content, social media)
- Advanced TV (streaming)

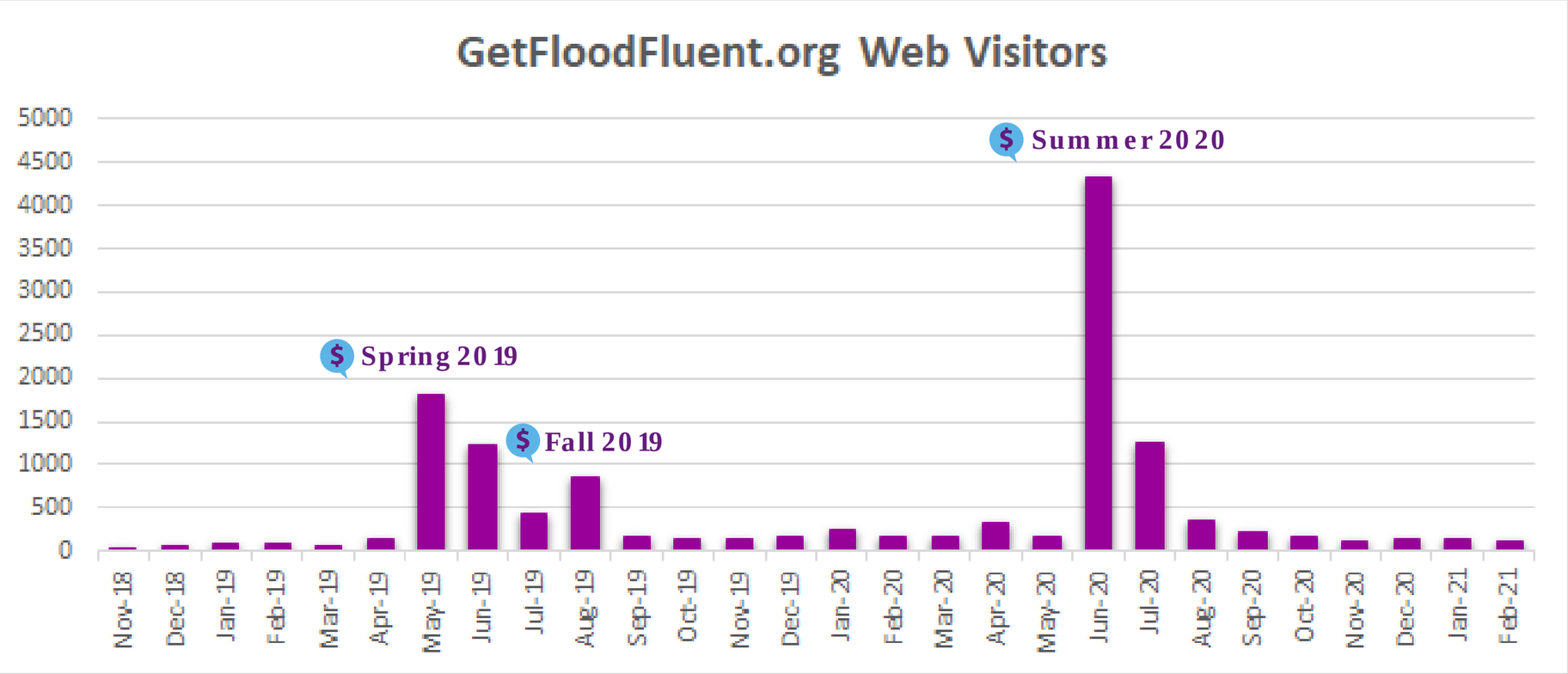
Tracking Results

Advertising Impressions 7.6 million

Clicks 7,087

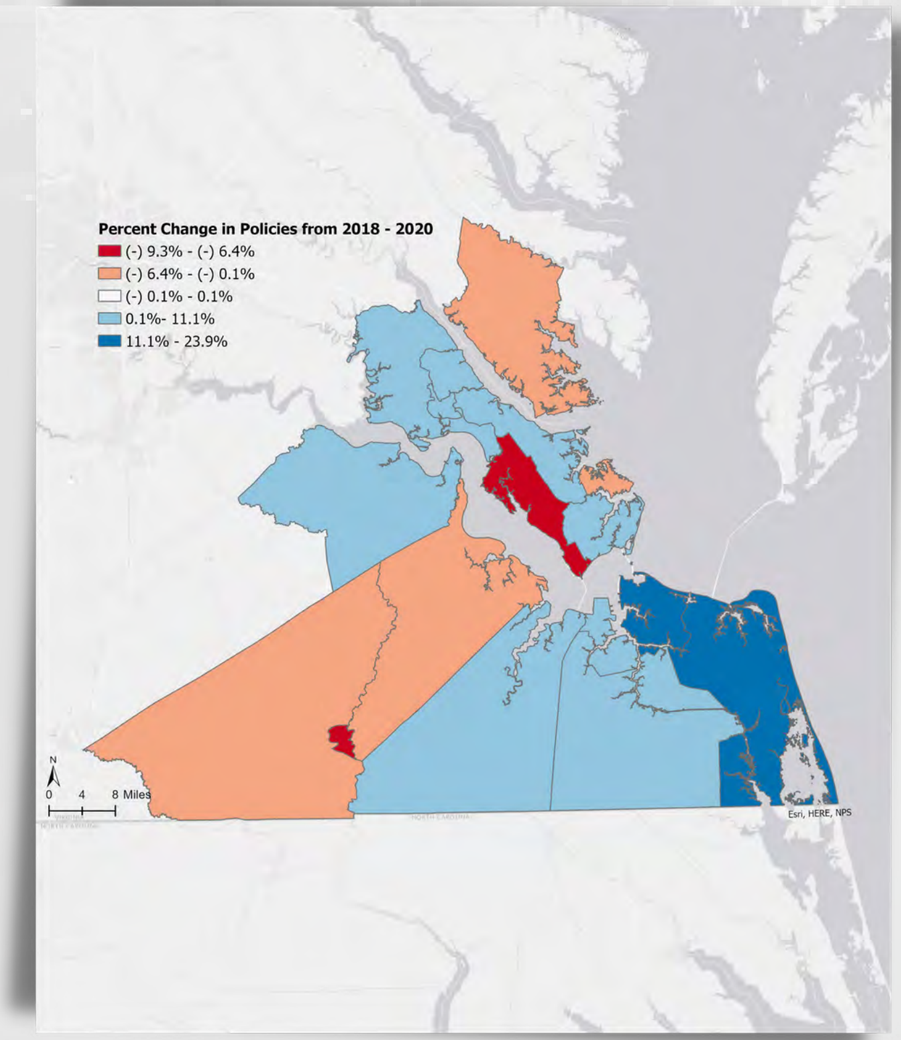
Website visitors 13,087

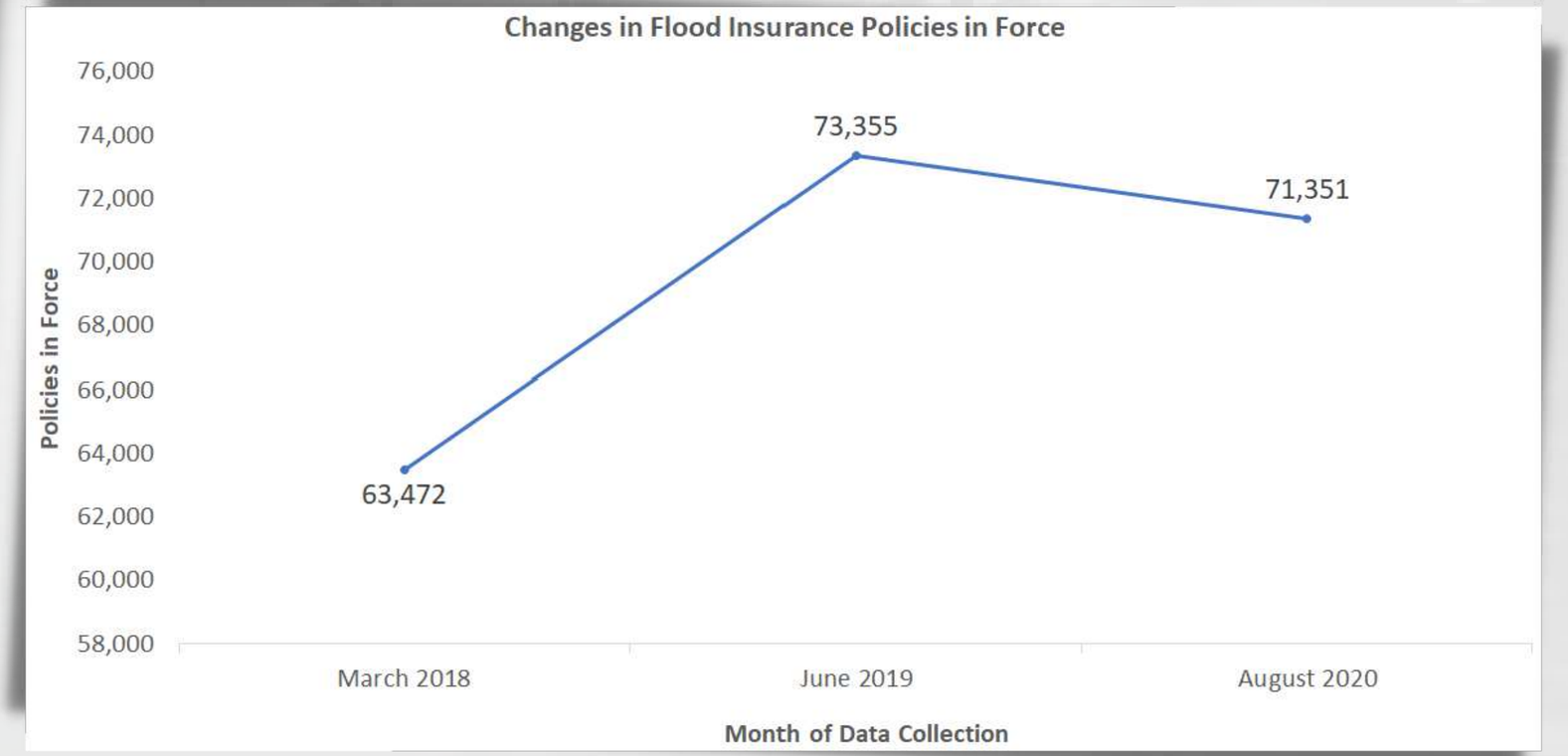
Website pageviews 39,516



Tracking Results

GET FLOOD FLUENT.ORG





2021 Promotions

GET FLOOD FLUENT.ORG

Spring

- VA Flood Awareness Week (Mar 14-20)
  - Social media & local PIO coordination
- National Hurricane Preparedness Week (May 9-15)
  - Social media & local PIO coordination

Summer

- Start of Atlantic Hurricane Season (Jun 1 - Nov 30)
  - Social media & local PIO coordination
- Paid Media (Jun 14-27, Jul 5-11)
  - Radio, TV, digital, advanced TV/streaming
  - Social media & local PIO coordination

Fall

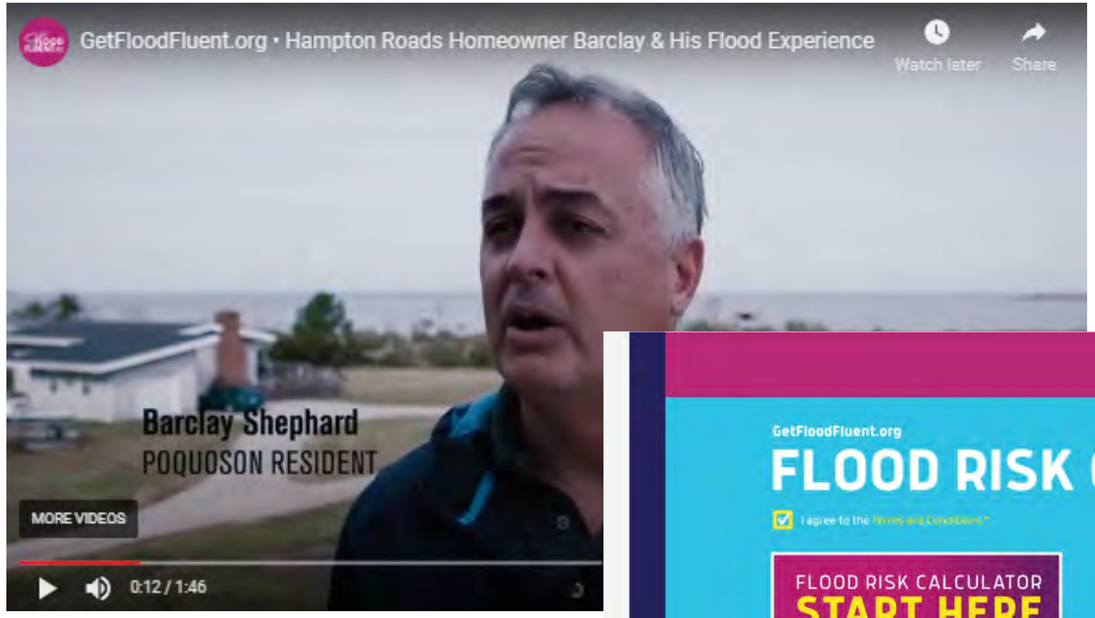
- National Preparedness Month (Sep)
  - Social media & local PIO coordination

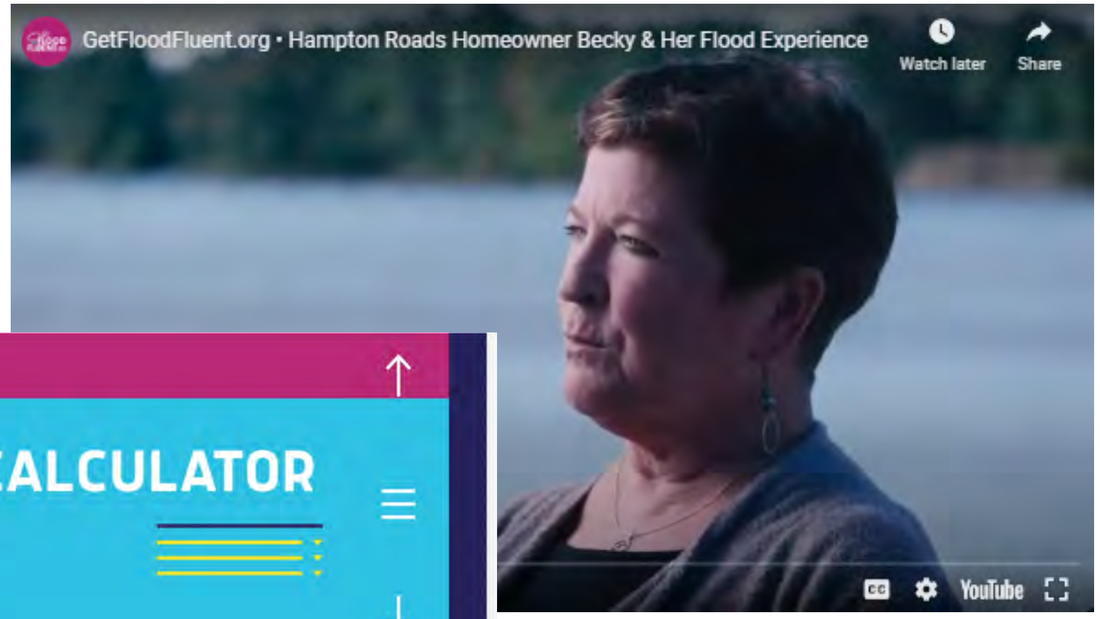
TBD

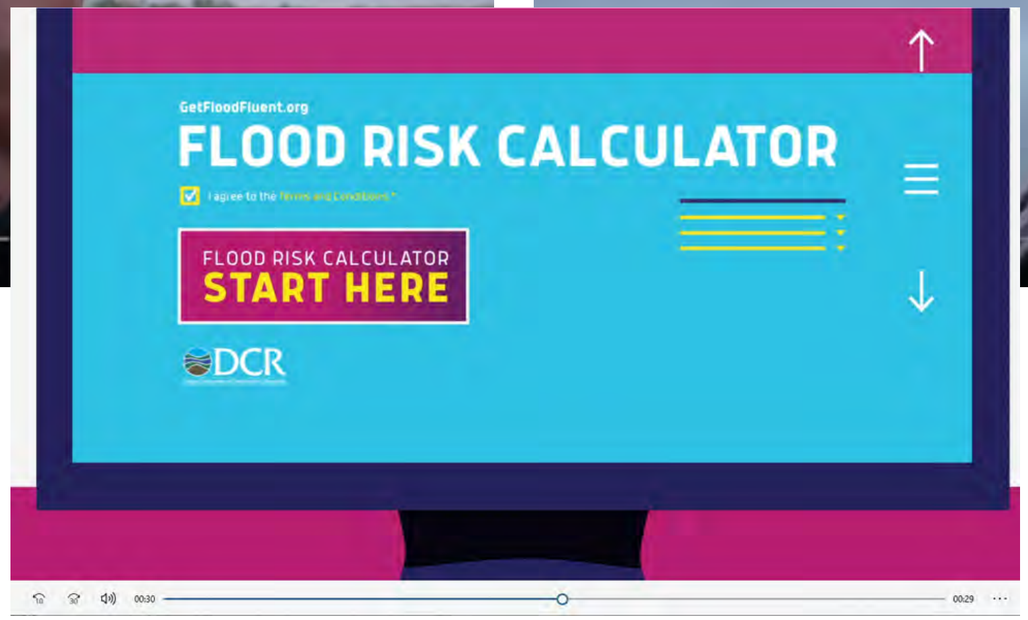
- HRSD bill messages


GET FLOOD FLUENT.ORG
ANYWHERE IT CAN RAIN
IT CAN FLOOD
See how a flood can affect you.
Then get a quick estimate of what your **flood insurance rate** might be.


WHAT'S NEW?


GetFloodFluent.org • Hampton Roads Homeowner Barclay & His Flood Experience
Watch later
Share
Barclay Shephard
POQUOSON RESIDENT
MORE VIDEOS
0:12 / 1:46


GetFloodFluent.org • Hampton Roads Homeowner Becky & Her Flood Experience
Watch later
Share
YouTube


GetFloodFluent.org
FLOOD RISK CALCULATOR
FLOOD RISK CALCULATOR
START HERE
DCR


THERE'S A FLOOD COMING

Web Content

What do I need to know about flood risk?

- Find your flood zone mapping tool
- Understanding flood zones/terms

How can I...

- Protect my home
  - Building smart, elevating structures, installing flood vents, managing rainfall
- Protect my personal property
  - Storing valuables, moving vehicles, contents coverage
- Stay safe during a flooding event
  - Stay informed. Know your zone. Turn around, don't drown.

On the horizon...

Calculator Tool Updates

Coming soon in October 20201. Assess impact of Risk Rating 2.0 on flood insurance calculator.

Disclosure requirements

SB1389 (2021) will require owners of residential real property to disclose whether a property is a repetitive loss property as defined by the NFIP (two or more claims of $1000 or more within any rolling 10-year period).

Flood loss history

Provide a template for requesting a flood loss history report from FEMA that would include the entire paid loss history of NFIP claims.

IMPROVING LOCAL POLICIES

Regional Sea Level Rise Planning Scenarios

Planning Scenarios:

1.5' - 2020 - 2050

3.0' - 2050 - 2080

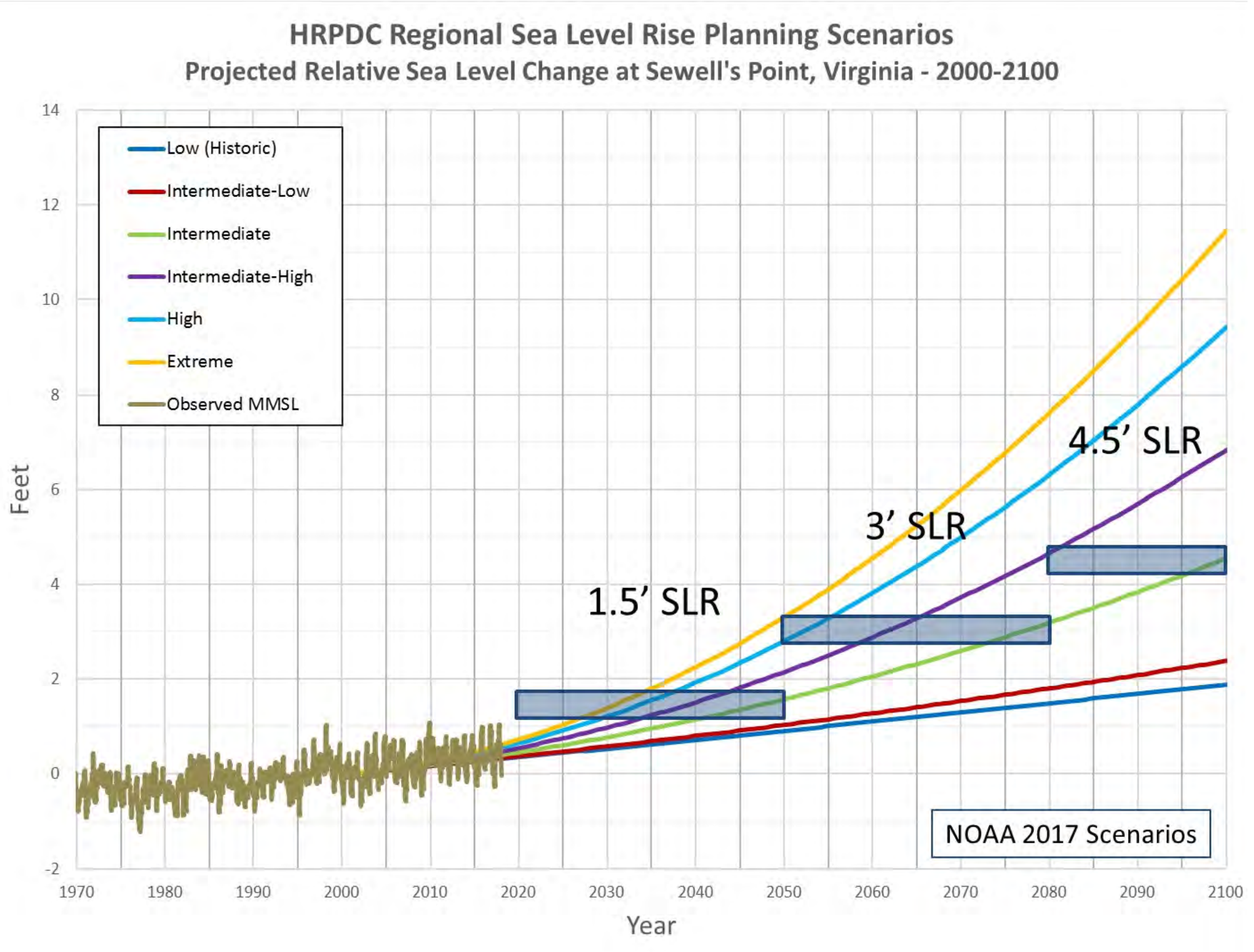
4.5' - 2080 - 2100

Engineering and Design:

1.5' - 2020 - 2050

3.0' - 2050 - 2080

4.5' - 2080 - 2100


HRPDC Regional Sea Level Rise Planning Scenarios
Projected Relative Sea Level Change at Sewell's Point, Virginia - 2000-2100
Low (Historic)
Intermediate-Low
Intermediate
Intermediate-High
High
Extreme
Observed MMSL
1.5' SLR
3' SLR
4.5' SLR
NOAA 2017 Scenarios
Feet
Year
14
12
10
8
6
4
2
0
-2
1970
1980
1990
2000
2010
2020
2030
2040
2050
2060
2070
2080
2090
2100

Resilient Design Guidelines for Floodplain Management

FLOODPLAIN MAPPING

Maps of projected future floodplains based on sea level rise projections

STORMWATER STANDARDS

Stormwater regulations that incorporate future precipitation and sea level rise

DESIGN FLOOD ELEVATIONS

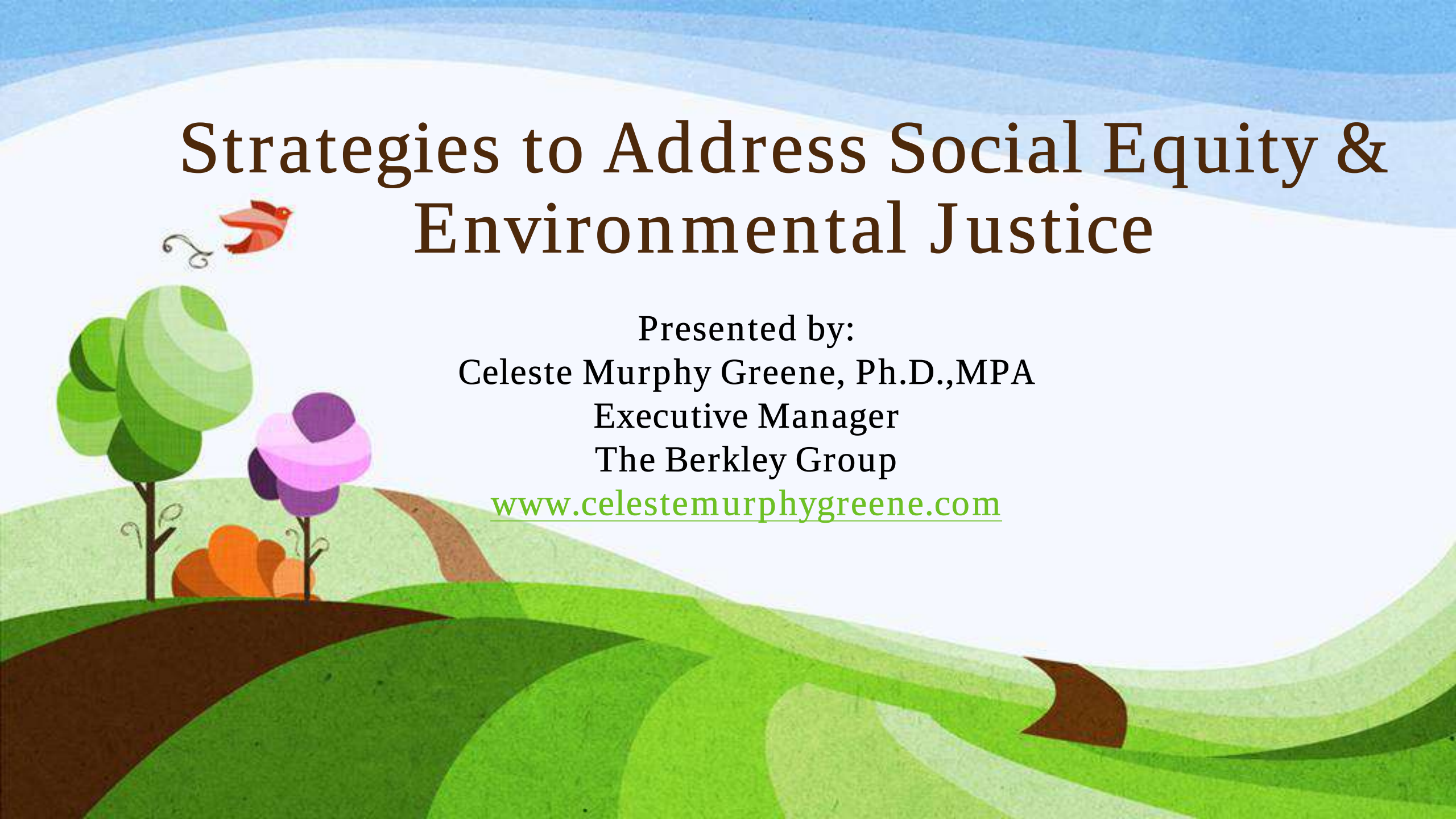
Building requirements that incorporate sea level rise

Comments & Questions

Katie Cullipher
kcullipher@hrpdcva.gov

Ben McFarlane
bmcfarlane@hrpdcva.gov

Strategies to Address Social Equity & Environmental Justice



Presented by:
Celeste Murphy Greene, Ph.D.,MPA
Executive Manager
The Berkley Group
www.celestemurphygreene.com

What is Social Equity

- **“Social Equity is about fairness, right, justice, and freedom from the effects of bias…It is a pragmatic condition that describes access to, distribution of, and outcome related to public goods” (Guy & McCandless, 2020).**

Equality vs Equity

WHOLE COMMUNITY

While each individual defines "community" differently, the "Whole Community" refers to individuals and families, including those with access and functional needs, businesses, faith-based and community organizations, nonprofit groups, schools and academia, media outlets, and all levels of government, including state, local, tribal, territorial, and federal partners that have a shared responsibility in emergency preparedness and mitigation.

Equality vs Equity vs Justice

Equality

The assumption is that **everyone benefits from the same supports.** This is equal treatment.

Equity

Everyone gets the supports they need (this is the concept of "affirmative action"), thus producing equity.

Justice

All 3 can see the game without supports or accommodations because **the cause(s) of the inequity was addressed.** The systemic barrier has been removed.

Definition of Environmental Justice

- The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.

- Fair treatment means that no group of people, including racial, ethnic, or socioeconomic group should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of federal, state, local and tribal programs and policies (U.S. EPA, 1998).

Three main focus areas of environmental justice

- The distribution of the effect of environmental problems
- The environmental policy making process
- The administration of environmental protection programs

Distribution of the Effects of Environmental Problems

- Air Quality-In 1990 437 counties in the U.S. failed to meet at least one of EPA's ambient air quality standards. Communities largely mainly Hispanic and African.
- Water Quality-Waste water from agricultural runoff has high concentrations of fertilizers and animal wastes contributing to degradation of receiving streams and rivers in rural communities often with low-come and diverse populations.
- Hazardous Waste-Generally located in low-come and culturally diverse communities.

- **Lead Concentrations: Almost 2/3 of American housing units were built before 1970 and still contain lead based paint. Lead is ingested from paint chips and dust containing lead. Children are at increased risk of lead exposure.**

- **Pesticide Exposure: Approximately 90% of the 2 million farm workers in the U.S. are people of color (Hispanic or Black). As many as 313,000 farm workers in the U.S. may suffer from pesticide-related illnesses each year.**

Factors to Consider in an Environmental Justice Analysis

- Demographic Factors: Age of population, population density, literacy
- Geographic Factors: Climate, geomorphic features, hydrophic features
- Economic Factors: Income level, health care access, infrastructure conditions
- Human Health & Risk Factors: Emissions, toxics, exposures, pollutants, pesticides, locations, concentrations, health data

Chronological History of the Environmental Justice Movement

- 1971 Council on Environmental Quality acknowledged racial discrimination impacts the urban poor and their environment.
- 1982 Warren County, NC protest
- 1983 GAO report found blacks disproportionately impacted by hazardous landfills in the South (EPA Region 4).
- 1987 United Church of Christ study found that race was the most significant variable tested in association with the location of commercial hazardous waste facilities.

- **1980s-Grassroots efforts of Hazel Johnson, Community Organizer in Chicago's Southside, Altgeld Gardens Housing Project**
- **1990 University of Michigan held *Conference on Race and the Incidence of Environmental Hazards.***
- **1990 U.S. EPA created Environmental Equity Workgroup.**
- **1992 U.S. EPA Office of Environmental Equity established**
- **1993 U.S. EPA established Office of Environmental Justice**
- **1993 National Environmental Justice Advisory Council (NEJAC)**

- **1994 Clinton signed Executive Order 12898: *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations.***
- **1995 U.S. EPA issues *Environmental Justice Strategy: Executive Order 12898.***
- **1997 U. S.EPA Office of Environmental Justice released *Environmental Justice Implementation Plan***
- ***2010 Obama appointed first African American to lead U.S. EPA, Lisa Jackson. Agency issued Expanding the Conversation on Environmentalism and Working for Environmental Justice.***
- ***2021 Biden created White House Environmental Justice Advisory Council including community members, academics, state and local officials to advise administration on EJ issues.***

Federal Tools to Address Environmental Justice

- Title VI of Civil Rights Act of 1964-Prohibits discrimination on the basis of race, color, and national origin in programs and activities receiving federal assistance.
- 14th Amendment of U.S. Constitution- "..No State shall deny any person within its jurisdiction the equal protection of the law.
- 1994 Clinton issued Executive Order 12898
- Established Interagency Working Group
  - Chaired by EPA Administrator
  - Comprised of heads of 11 departments/ agencies such as; Office of Management and Budget, Office of Science and Technology, Dept. of Ag., Transportation, HHS, and Commerce.
  - Meets on a monthly basis to continue the collaborative projects

Literature on Environmental Justice

- **Bullard (1990) in Dumping in Dixie, (considered the first textbook on environmental justice) blamed government at all level for institutional racism and discriminatory land-use policies and practices.**
- **Coye & Lavelle (1992) in the National Law Journal illustrated racial divide in the way the U.S. government cleaned up toxic waste sites and punished polluters. White communities see faster action, better results, and stiffer penalties than minority communities.**

- **Boerner & Lambert (1997)**
- **Environmental studies have methodological errors.**
- **Industrial facilities are not necessarily harmful.**
- **Hazardous studies may improve community's health through economic opportunities for community's residents.**
- **Murphy-Greene (2022) argues for the importance of infusing environmental justice principles more fully into administrative agencies such as public works, emergency management, public health, procurement, and energy suppliers.**

Three Goals for Environmental Justice at the Department of Energy

- **1) Identify and address programs, policies, and activities of the Dept. that may have disproportionate and adverse human health or environmental effects on minority populations and low-income populations.**

- ***Example: Analyze appropriate demographic data to determine the distribution of impacts of the individual operational elements on the affected communities.***

- **Core Environmental Management Project: Increase the capacity of eight Tribal governments to enhance their environmental management skills on their lands**

- **Goal 2) Enhance the credibility and public trust of the Dept. by making public participation a fundamental component of all program operations, planning activities and decision making.**

- ***Example: Develop information for public distribution describing, in non-technical terms, the projects and policies of specific program activities and the opportunities for participation by minority and low-income populations in decision making process***

Goal 3

- **Improve research and data collection methods relating to human health and the environment of minority and low-income populations by incorporating full characterizations of risks.**

- ***Example: Include environmental justice principles…in the research agenda for Dept. sponsored studies.***

EJ at Dept. of Transportation

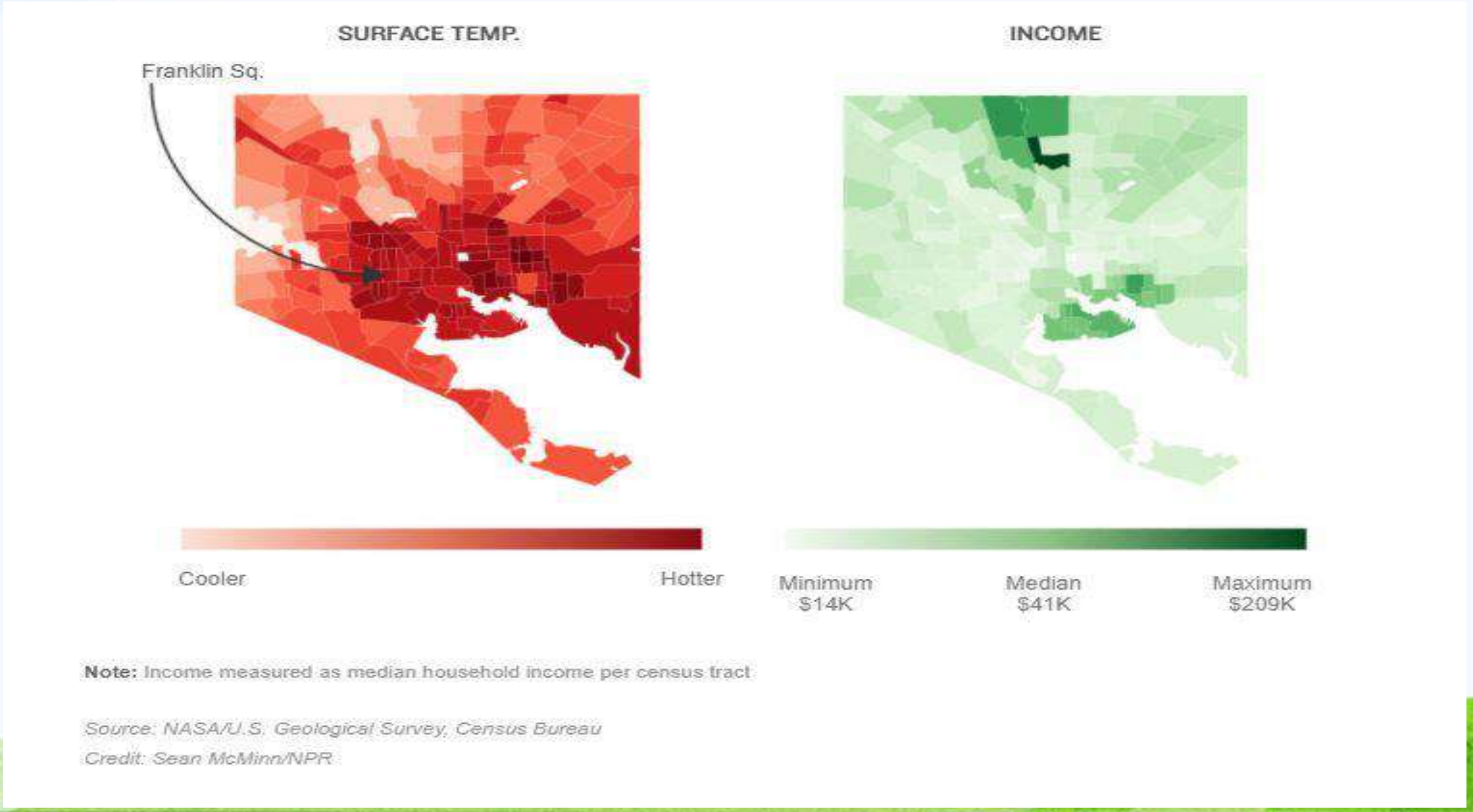
- Outreach Strategy
  - Public Engagement with minority and low income populations
  - Building relationships with stakeholders including state and local partners who help fund transportation systems
  - Coordinate with community leaders to develop locally appropriate outreach plan

  - DOT Case Studies studies:https://www.fhwa.dot.gov/environment/environmental_justice/case_studies/caseintro.cfm

Environmental Justice in Virginia

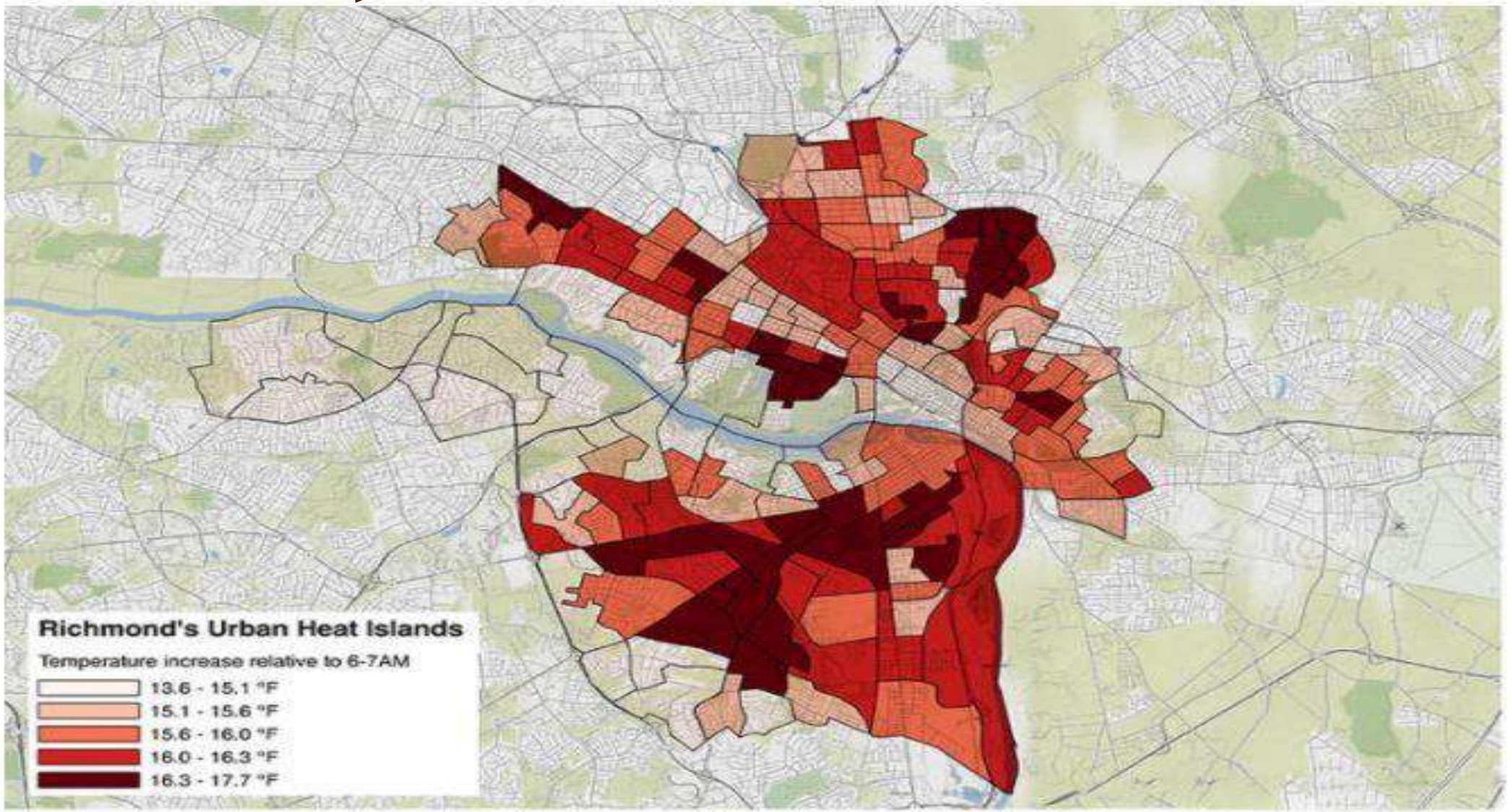
- 2020 the Virginia Legislature authorized the creation of the Office of Environmental Justice at the Department of Environmental Quality (DEQ).
- 2021-DEQ hired the first Director of Environmental Justice to implement EJ Strategy for VA.

Redlining and Urban Heat Islands
Baltimore, MD & Richmond, VA



Groundwork RVA Increasing Tree Canopy

Richmond, VA Heat Island.



Environmental Justice Strategies for Localities

- Work to integrate environmental justice and social equity into public works policies and practices
- Engage community members in public meetings pertaining to public works projects impacting vulnerable communities
- Seek input from community members in various way: focus groups, surveys, phone calls
- Ensure policies are formulated and implemented equitably
- Example: Groundwork USA working to increase tree canopy

Questions

What is the main focus of social equity?

What is the main focus of environmental justice?

How can localities best address social equity & environmental justice in practices and policies?

25

Review Question #1

- 1. Complete the sentence: Social equity is about
- A) Fairness
- B) Justice
- C) Freedom from the effects of bias
- D) All the above

Review Question #2

- Which of the following is not one of the focus areas of environmental justice?
- A) The distribution of the effect of environmental problems
- B) The environmental policy making process
- C) The administration of environmental protection programs
- D) Ensuring big polluters receive relief from costly environmental regulations

Review Question #3

- **How can local governments address social equity & environmental justice?**
- **A) Integrate environmental justice and social equity into public policies and practices**
- **B) Engage community members in public meetings pertaining to public works projects impacting vulnerable communities**
- **C) Ensure policies are formulated and implemented equitably**
- **D) All the above**

Resources

EPA's Collaborative Problem Solving Model video https://www.youtube.com/watch?v=wEIdQBtUwfg

U.S. EPA, Environmental Justice Office https://www.epa.gov/environmentaljustice

Contact Celeste Greene at the Berkley Group at: Celeste.greene@bgllc.net or visit the Berkley Group website at www.Bgllc.net

To view Celeste's publications on environmental justice, visit: www.celestemurphygreene.com

QUESTIONS?

Appendix C: GWRC Community Flood Preparedness Fund Resilience Plan

2021

George Washington Region Resilience Plan

September 2021

PREPARED FOR THE GEORGE WASHINGTON REGIONAL COMMISSION BY THE BERKLEY GROUP

GEORGE WASHINGTON REGIONAL COMMISSION

BERKLEY GROUP

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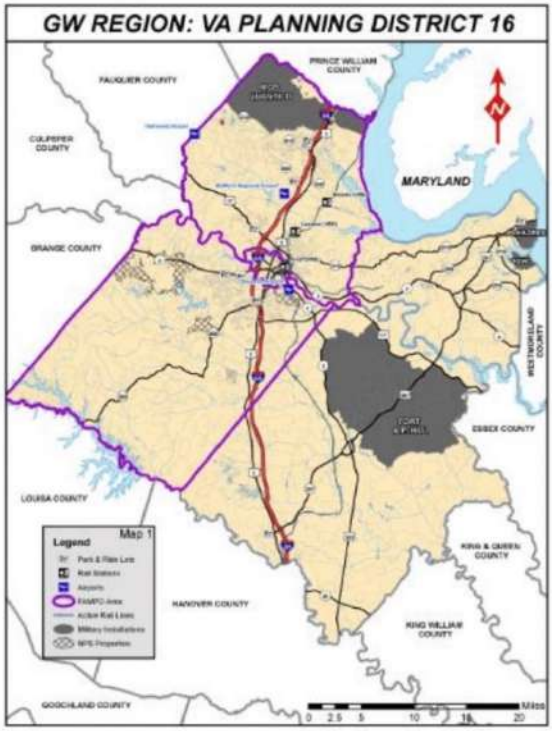
Executive Summary

The George Washington Regional Commission (GWRC) is the Planning District Commission established by legislation in 1969 by the General Assembly and chartered in 1970 for the region that is home to the City of Fredericksburg and the counties of Caroline, King George, Spotsylvania and Stafford, known collectively as "Planning District 16." Caroline County includes the incorporated towns of Bowling Green and Port Royal.



GWRC is currently home to 376,649 residents. Planning District 16 is the fourth-largest and the fastest-growing of the Commonwealth's 21 planning districts. GWRC land drains to the Potomac River to the north and the Rappahannock River in the center. Portions of Stafford and King George Counties are bordered by the Potomac River. Portions of all the localities touch the Rappahannock River. Portions of Caroline County have stream front on the Mattaponi and the Pamunkey Rivers, tributaries to the York River. All these waterways drain to the Chesapeake Bay.

Immediate, quantifiable resiliency related considerations for the region consist of sea level rise and extreme weather events. While resiliency considerations and priorities for every locality within the region will slightly differ, as will the capacity to address them, planning for regional resiliency can help reduce future disaster related response and recovery cost. This Resilience Plan will equip the George Washington Regional Commission and localities in the Region with a deeper understanding of priority actions that can be implemented to improve the region's resilience to hazards.

This Plan reviewed GWRC's resiliency needs, and found that the natural hazards identified to be the highest priority for the region include: Drought, Severe Weather (including Extreme Heat, Nor'easters, Thunderstorms, Tornadoes, and Winter Storms), Sinkholes and Landslides, and Dam Failure, all of which are likely to increase or be affected as a result of climate change. The Region has multiple resiliency assets including greenways, ecological cores, rare and priority species, floodplains, rivers and waterways, and cultural resources. These resources should be protected to effectively promote resilience throughout the entire region. Currently, 33.8% of the population in the Region is ALICE (Asset Limited, Income Constrained, Employed) and 7.2% of the population is disabled. In addition, four (4) census tracts in Caroline County, two (2) in Spotsylvania County, and one (1) in Stafford County are designated as Mildly Socially Vulnerable according to the VIMS Social Vulnerability Index. Two (2) census tracts in Fredericksburg are designated Highly Vulnerable. These populations in particular should be focused on in order to promote economic and social resiliency.

The George Washington Region should focus on the following needs to support future resiliency goals:

1. Defining what resilience means to GWRC.
2. Creating flood evacuation or snow evacuation plans for jurisdictions within the region.
3. Obtaining data and establishing a plan to address roadways that are prone to flooding within the GW region.
4. Shoring up public and private lands that are prone to recurrent flooding or will be at higher flood risk according to sea level rise and climate change models.
5. Identifying disproportionately at-risk (otherwise known as "front line") communities that need further assistance using environmental and socio-economic variables.
6. Creating a plan to strategically address the Environmental Justice populations in the GW Region.
7. Updating GIS and mapping capacity to serve the public and assist with regional planning efforts, especially related to flooding hazards and flood zones. Stafford County's GIS portal (Stafford GIS) can serve as a guide.
8. Mapping dam inundation zones in all counties and mapping high-risk dams throughout the region to protect human life and property.
9. Filling in data gaps in soil erodibility as this will impact flooding and development considerations regionally. Fredericksburg, King George, and Spotsylvania do not have data on soil erodibility readily available to the public.
10. Identification and potential mapping of regional repetitive and severe repetitive loss structures.

Purpose and Introduction

This plan seeks to increase resiliency across the GWRC region by addressing threats to human life and property from flooding, severe weather, and other natural events. It attempts to do so with 5 major criteria in mind: being project based, with projects focused on flood control and resilience; incorporating nature-based solutions to the maximum extent possible; including all parts of the GW Region regardless of race or socioeconomic status; coordination within the region to achieve goals based on mutually-agreed-upon timelines; and being based on the best-available science. Each of these criteria are outlined in this or other regional plans here:

1. It is project-based with projects focused on flood control and resilience.

See the GWRC *Environmental Services Strategic Plan*, detailed on pg. 49 of this Resilience Plan.

2. It incorporates nature-based infrastructure to the maximum extent possible.

The solutions and planning principles outlined in this Resilience Plan and the projects listed in the *Environmental Services Strategic Plan* incorporates nature-based stormwater and flooding BMPs to the greatest extent possible.

3. It includes considerations of all parts of a locality regardless of socioeconomics or race.

This Plan considers solutions that involve every member of the community at every step of the process, and seeks to identify and target the GW Region's most vulnerable communities. See "Social Assets" on pg. 12 of this plan for a detailed breakdown as well as "Appendix G: Considering the Whole Community" on pg. 78.

4. It includes coordination with other local and inter-jurisdictional projects, plans, and activities and has a clearly articulated timeline or phasing for plan implementation.

The *Environmental Services Strategic Plan* has detailed timelines and cost estimates for projects throughout the region.

5. Is based on the best available science, and incorporates climate change, sea level rise, storm surge (where appropriate), and current flood maps.

This plan attempts to quantify the resiliency challenges that climate change will bring using the best available data and science. See "Natural Hazards", pg. 16, which includes specific plan elements related to flooding, climate change, flood maps, and vulnerability to sea level, with specific considerations for each locality in the region.

Definition of Coastal Resiliency

The definition of resilience for the George Washington Regional Commission was developed through adaptations of national, state and local language.

National: The ability to prepare and plan for, absorb, recover from, and more successfully adapt to adverse events; the ability to adapt to changing conditions and withstand—and rapidly recover from—disruption due to emergencies (NOAA).

Virginia: The ability of natural and built coastal environments to withstand and recover from hazardous events such as extreme weather, storm surge, and recurrent flooding; focusing on increasing resilience to sea level rise and natural hazards (including extreme storms and riverine flooding) with structural and natural infrastructure projects and programs.

GWRC Strategic Plan Definition: Reduce or prevent losses of coastal habitat, life, and property caused by shoreline erosion, storms, relative sea level rise, and other coastal hazards in a manner that balances environmental and economic considerations (VA CZM Goal 4).

Existing Plans, Programs, and Data

Regional Plans

Regional Green infrastructure Plan (2017)
This plan documents the status of green infrastructure implementation, discusses local government tools for supporting green infrastructure implementation, displays successful case studies, and provides recommendations for future implementation. GWRC concluded that developing a collaborative approach based on green infrastructure will be the best method to achieving voluntary actions. This plan relates to the resiliency of the region through the safety of the built and natural environments.

Environmental Management Strategic Plan (2020)
The purpose of the strategic plan is to identify the region's environmental service's needs, coordinate the requirements of related programs, create a list of strategies, and develop an implementation plan. The items in this plan transcend the commission's environmental services department to interact with economic development, human services, and transportation programs. Through the planning process GWRC works with regional stakeholders to develop a multi-year strategic plan for coastal zone management that aligns with the goals and focus areas of the CZM Program, and responds to the needs of the local jurisdictions of Planning District 16. The conceptual development and prioritization of projects ranges from planning activities to "shovel-ready" designs.

GO Virginia Region 6 Growth and Diversification Plan Update (2019)
The purpose of GO Virginia is to create more and higher paying jobs through incentivized collaboration, primarily from out-of-state revenue, which diversifies and strengthens regional economies. This update to the 2017 plan identifies economic trends and drivers, priority industry clusters, and the demand for a trained workforce and then provides investment strategies and recommendations to strengthen the region's economy, including establishing a Center for Resiliency Innovation.

Good Jobs Here Strategic Plan (2020)
Good Jobs Here is a broad-based effort to create, measure, execute, and foster economic growth and job creation in the Fredericksburg region. Utilizing a GO Virginia grant, GWRC partnered with leading local organizations to create a shared understanding of current data, analysis, strengths and opportunities for this region.

Septic System Study (2018)
This study determined that the local health district does not have the capacity or tools to properly document septic systems and pump outs as required in 5-year intervals by the CBPA. The study recommended developing a pilot regional program that would aid local governments and VHD better coordinate respective efforts to monitor and maintain septic systems. This study relates to the resilience of the region through human and environmental health.

FAMPO Community Engagement and Equity Plan (2021)
FAMPO developed procedures and guidelines to evaluate existing equity, community engagement, environmental justice, and limited English proficiency inclusion in the region's transportation planning process. These procedures might be beneficial in planning for the resilience of region as it creates a consistent procedure every locality could adopt.

Water Quality Assessment Integrated Report (2020)
DEQ identified impaired waterways in Virginia collected from 2013 through 2018. The implementation plans local to GWRC all address bacteria impairments:

- Carter Run, Great Run, Deep Run, Thumb Run - Stafford (2006)
- Upper York - Spotsylvania (2013)
- Fairview Beach - King George (2016)
- Mattaponi River - Caroline, Spotsylvania (2020)

GWRC Hazard Mitigation Plan (2017)
This Hazard Mitigation Plan is the sum of many actions that can be taken at the local and regional level, setting goals, developing strategies, and outlining tasks and schedules to reduce or eliminate long-term risk to human life and property from a variety of natural hazards. This plan relates to the resilience of the region through identifying natural hazard priorities, and the safety of the built and natural environments.

APPENDIX B lists the resiliency related goals, objective, and projects of the plans mentioned above, from which resiliency projects can be aggregated.

Programs

Watershed Implementation Plan (WIP)

Virginia developed a Watershed Implementation Plan in ongoing phases (2010, 2012, and 2019) to incorporate strategies to reduce nutrient pollution in our waterways. The Chesapeake Bay Total Maximum Daily Load (TMDL) is designed to ensure that all pollution control measures needed to fully restore the Bay and its tidal rivers are in place by 2025. Specifically in Virginia, the TMDL calls for a 20.5% reduction in Sediment delivered to the bay. This will be achieved through stormwater Best Management Practice (BMPs). GWRC and other communities across Virginia, in cooperation with the Virginia Department of Environmental Quality (DEQ), have been developing strategies to reduce nutrient pollution in our waterways through the Chesapeake Bay TMDL Phase III WIPs.

In 2019, the state compiled and provided PDCs with plans that recommended voluntary implementation of the following BMPs for the GWRC region by 2025:

- Nutrient Management Plan, 37,212 acres
- Conservation Landscaping practices, 1,250 acres
- Dry Extended Detention Pans, 9,154 acres
- Dry Detention Ponds, 4,926 acres
- Wet ponds and Wetlands, 8,205 acres
- Infiltration Practices, 6,007 acres
- Filtering Practices, 5,228 acres
- Tree Planting - Canopy, 648 acres
- Forest Buffer and Planting, 360 acres
- Forest Harvesting Practices, 6,882 acres
- Runoff Reduction, 177 acres
- Bioretention/Rain Gardens, 2,522 acres
- Vegetated Open Channels, 262 acres
- Bioswale, 36 acres
- Impervious Surface Reduction, 1,497 acres
- Permeable Pavement, 7 acres
- Stormwater Treatment, 1 acre
- Erosion and Sediment Control Level 2, 2,874 acres
- Non-Urban Stream Restoration, 23,983 feet
- Urban Stream Restoration, 8,032 feet
- Urban Shoreline Management, 1,119 feet
- Non-urban Shoreline Management, 1,019 feet
- Urban Shoreline Erosion Control Vegetated, 399 feet
- Septic Pumping, 9,469 units
- Septic Denitrification - Conventional, 7,080 units
- Septic Connection, 4,841
- Septic Secondary Treatment - Conventional 600 units
- Septic Secondary Treatment - Enhanced, 22 units
- Septic Denitrification - Enhanced, 13 units
- Septic Effluent - Enhanced, 4 units

Coastal Zone Management (CZM)

DEQ administers the CZM annual grants from the National CZM Program. A portion of these funds are administered to the state's eight coastal PDCs to provide annual technical assistance to localities.

The Virginia CZM Technical Assistance Program provides GWRC with annual funds to advance coastal management at the local level. Contracts between PDCs and governing state agencies must include three minimum standards:

1. Coordination. PDC's should hold quarterly meetings of local government representatives directly involved in the management of coastal resources to share information on issues.
2. Training. PDC's should provide at least four training opportunities related to one or more of CZM program goals.
3. Issue Analysis / Special Projects. Each PDC should undertake one project during the grant year that helps advance one or more of the coastal resource management goals.

CZM special projects typically deal with resiliency issues. Previous GWRC CZM special projects include:

- Land Cover Data Layer Classification
- Environmental Chapter for the Caroline County Code of Ordinances
- Assessment and draft strategy for a Plant GWRC Natives Campaign
- Forest Retention Data Gathering
- Stormwater Best Management Practices Signage
- City of Fredericksburg and Caroline County Community Rating System Project
- Plant Central Rappahannock Natives Campaign Support
- Regional Green Infrastructure Planning

Data

APPENDIX A is a table of relevant and useful resilience related databases- what entity produced the dataset, the use/purpose of the dataset, and if the data is downloadable.

APPENDIX C has tables for each locality with 2020 data on the impaired waterways throughout the region. The health of the region's waterways affects the regional economic, social, and environmental resiliency.

APPENDIX D contains maps of the watersheds that GWRC is located within and the associated impaired waterways.

APPENDIX E is a table with GWRC priority species of greatest conservation need. Identifying and protecting vulnerable species is important for the resilience of the region's ecosystem and environment.

APPENDIX F is a table of conservation strategies and actions for the GW region, retrieved from the Virginia Wildlife Plan.

Regional Assets

The assets of the region have been grouped into three categories: Natural and Built Environment, Economic, and Social.

Natural and Built Environmental Assets

Special Habitats:

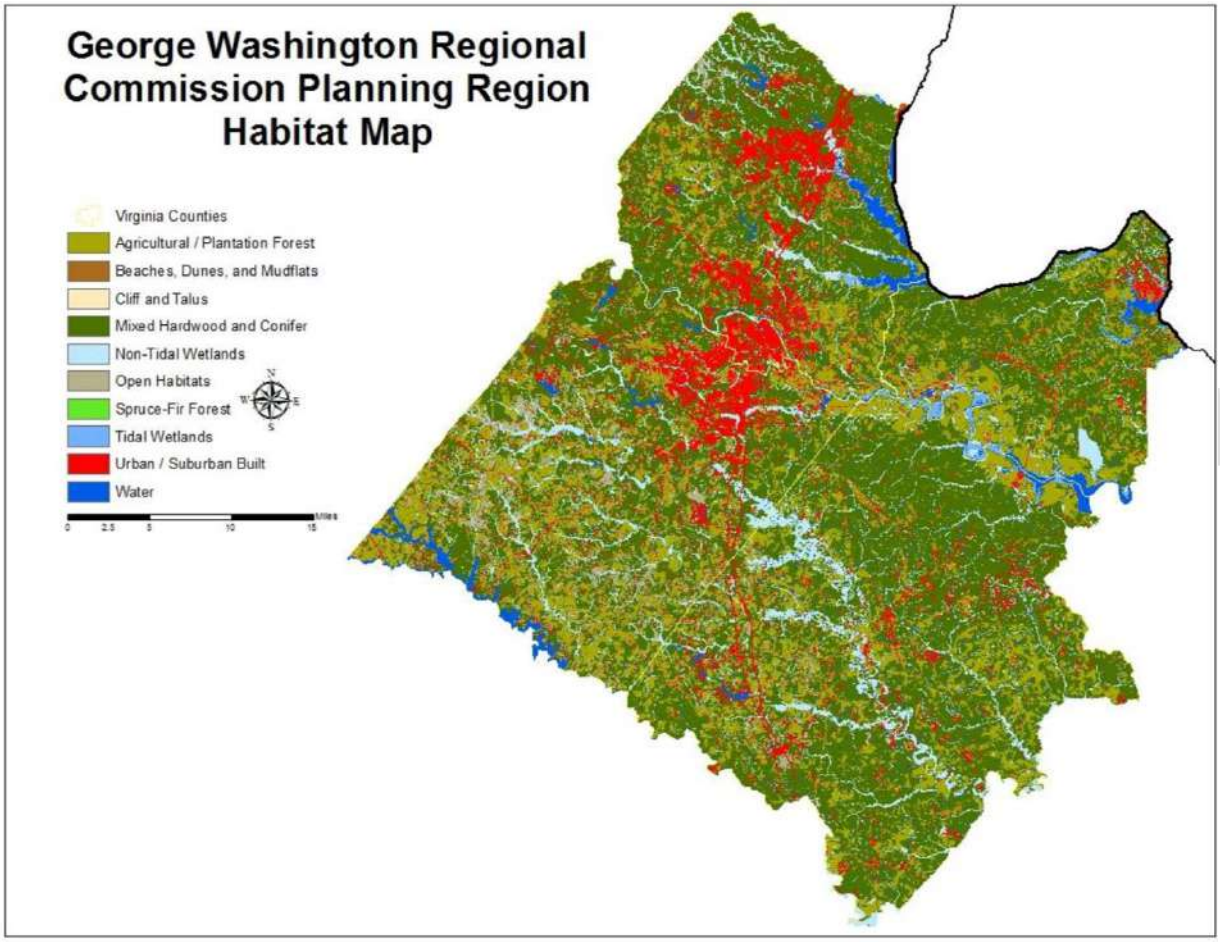


Figure 2. GWRC Species Habitat
Source: DCR, Natural Heritage 2014.

Of Virginia's 883 Species of Greatest Conservation Need (SGCN), 76 are believed to either occur, or have recently occurred, within the George Washington Planning Region. Of these 76 species, 30 SGCN are dependent upon habitats provided only within the region. Appendix E lists priorities species throughout the region with the greatest conservation need. Appendix F is a table summarizing conservation strategies and actions for the region.

Conservation Lands:

Having recognized the importance of the local habitats to both resident and migratory wildlife, state, federal, and private entities have made significant investments to conserve lands within the planning region. Conservation mechanisms range from conservation easements to state parks, forests, and wildlife management areas to National Wildlife Refuges (NWR). Significant conservation assets, in terms of size, include:

- Rappahannock River Valley National Wildlife Refuge,
- Fredericksburg and Spotsylvania National Military Park,
- Lands' End Wildlife Management Area,
- Mattaponi Wildlife Management Area,
- Pettigrew Wildlife Management Area,
- Lake Anna State Park,
- Widewater State Park,
- Prince William Forest Park,
- Crow's Nest Natural Area Preserve,
- Chotank State Natural Area Preserve, and
- Caledon State Natural Area.

These properties contain a diversity of open water, forest, agricultural, and wetland habitats (Figure 3). They have been conserved to provide a range of conservation, recreational, and economic benefits such as habitat protection and restoration, ecotourism, and fishing and hunting opportunities. Additionally, various military installations, such as Marine Corps Base Quantico and Fort A.P. Hill, support viable habitats and wildlife populations.

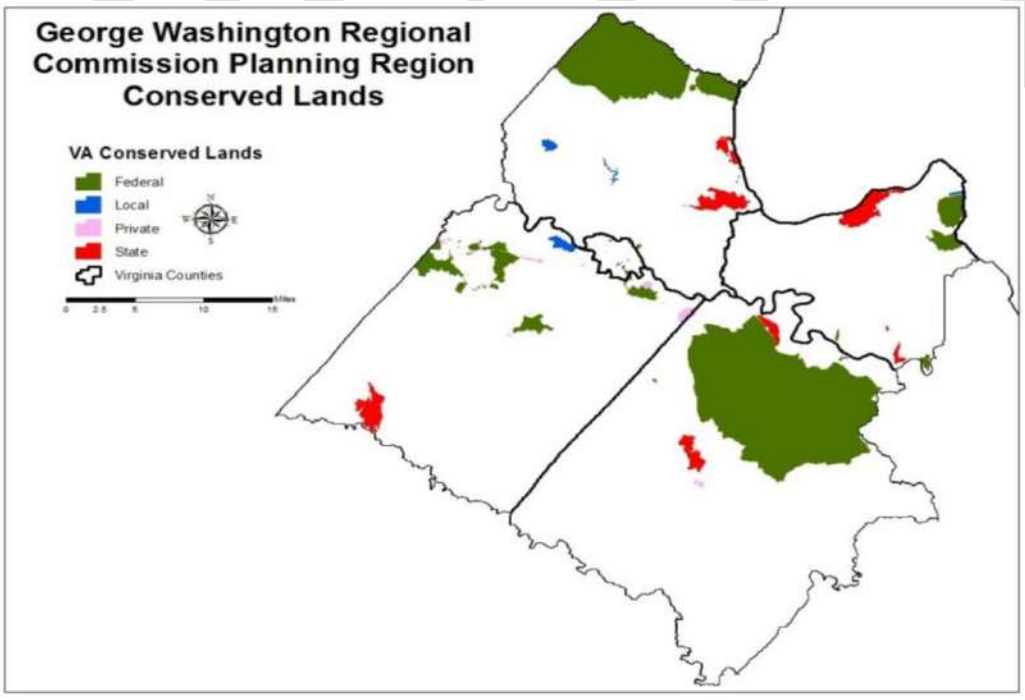


Figure 3. GWRC Conserved Lands
Source: DCR, Natural Heritage (2014).

Ecological Cores:

Ecological cores are patches of natural land with at least 100 acres of interior cover which provide habitat for a large variety of species, including forest, marsh, and maritime dependent species. The Virginia Natural Landscape Assessment (VaNLA) provides an analysis, using satellite data, that has identified, prioritized, and linked the important land networks throughout Virginia. Preserving and maintaining these landscapes can help ensure they continue to provide ecosystem services such as cleaner air and water filtration. Ecological cores can also provide recreational opportunities and open space resources. The following map shows which areas of the counties and cities within the GW region contain ecological cores. A higher rating (with red being the highest) indicates the amount of ecosystem services that ecological core provides. Examples of ecological services that cores provide include: wildlife and plant habitat, biodiversity conservation, water resource protection, erosion control, and carbon sequestration. The GW region should have strategies to preserve ecological cores, such as using them as park lands for low-impact recreation (hiking, bird watching, etc.) and other conservation efforts.

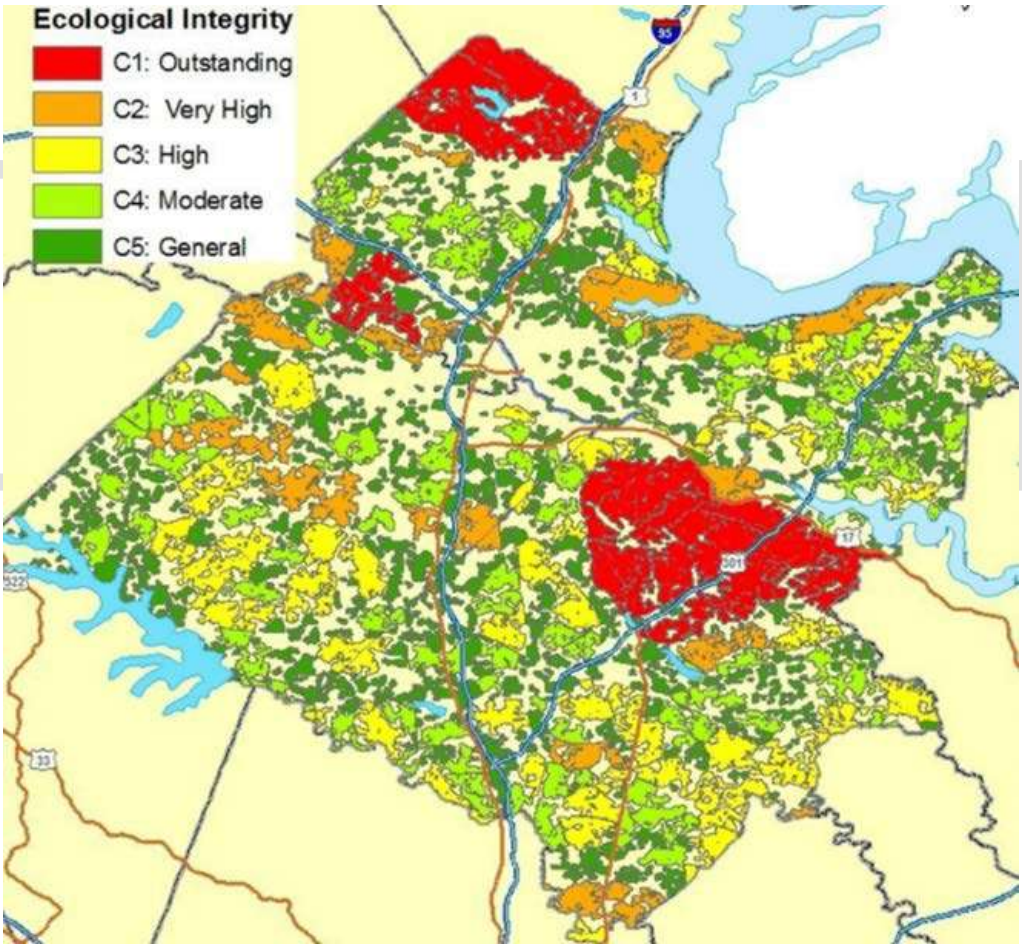


Figure 4. GWRC Ecological Cores.
Source: Regional Green Infrastructure Plan (2009)

Resource Protection Areas (RPAs):

Resource Protection Areas are defined as lands at or near the shoreline that have an intrinsic water quality value due to ecological and biological processes they perform, or that are sensitive to impacts that may result in significant degradation to the quality of state waters. RPAs in a natural condition provide for the removal and/or reduction of sediments, nutrients, and potentially harmful toxic substances in runoff. RPAs include the following sensitive land areas:

- Tidal wetlands;
- Nontidal wetlands connected by surface flow and contiguous to tidal wetlands or tributary streams;
- Tidal shores;
- Other lands deemed by the governing body as necessary to protect the quality of state waters; and
- A buffer area not less than 100 feet in width located adjacent to and landward of the components listed above, and along both sides of any tributary stream. In Spotsylvania County the total amount of land designated as RPAs is estimated to be 12,000-acres, or roughly 5% of the County's total land area. The City of Fredericksburg's RPAs and Resource Management Areas are visualized below.

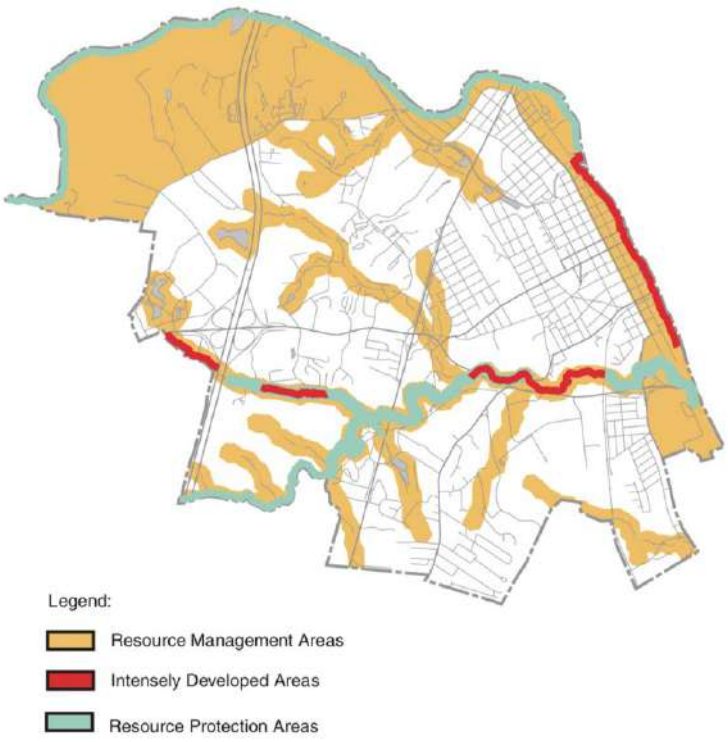


Figure 5. Fredericksburg RPAs and RMAs.

Resource Management Areas (RMAs):

Resource Management Areas are defined as lands that if improperly used, developed, or destroyed from environmental hazards would have a potential for causing significant water quality and environmental

degradation, diminishing the functional value of the land. The regulations require RMAs to be contiguous to the entire inland boundary of the Resource Protection Area. RPAs and RMAs must be taken into consideration when making land use and development decisions.

The regulations require the following to be considered for inclusion in the Resource Management Area:

- Floodplains;
- Highly erodible soils, including steep slopes;
- Highly permeable soils;
- Nontidal wetlands not included in the Resource Protection Area; and
- Other lands necessary to protect the quality of state waters.

Development Vulnerability

Preserving the previously stated ecological cores and protecting rare species should be a resiliency goal for the GW region. The Virginia Development Vulnerability Model determines the predicted relative risk of conversion from natural, rural and other open space lands to higher density and urbanized land uses. As shown in Figure 6 below, current high-density development is concentrated in the City of Fredericksburg and adjacent areas in Stafford and Spotsylvania Counties. This data can help to identify areas where development should be limited in ecological cores or other lands that should be protected in order to preserve ecological integrity and continue to benefit from the ecosystem services they provide.

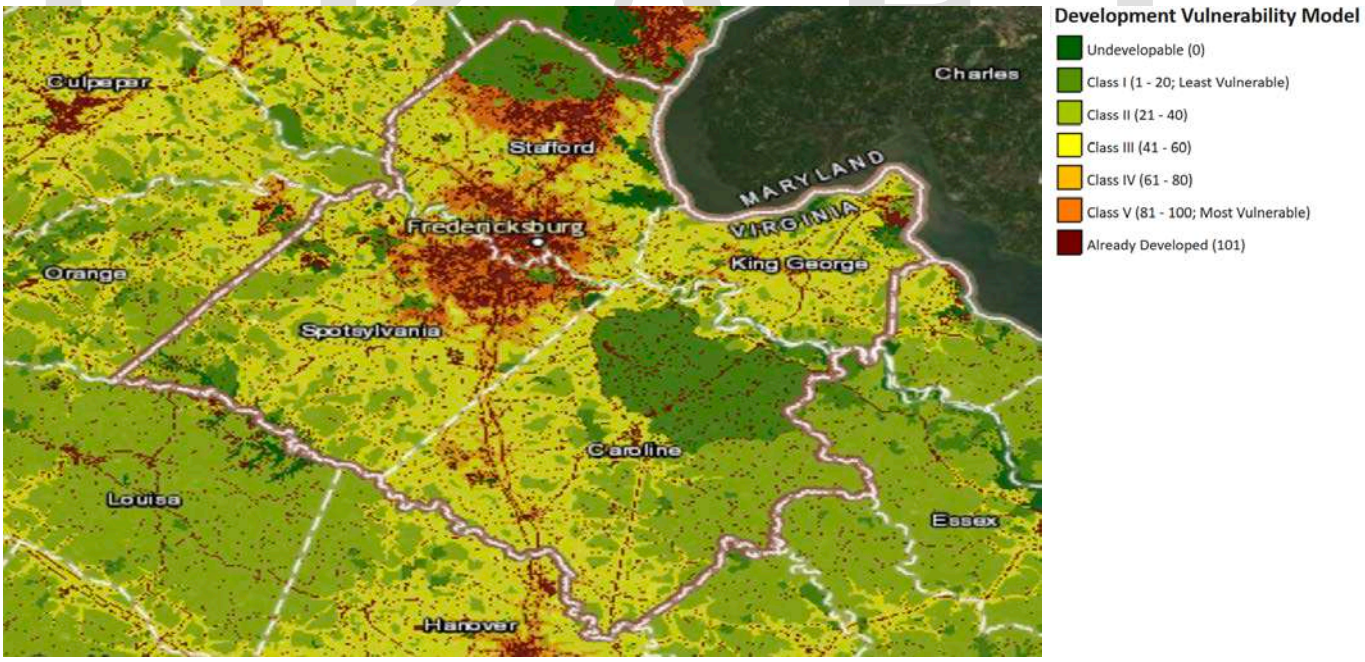


Figure 6. GWRC Development Vulnerability
Source: Virginia Department of Conservation and Recreation, Natural Heritage Program

Cultural Areas, Tribal Zones, Historical Areas:

Cultural and historical sites provide a valuable resource for communities. These destinations can encourage tourism, and protecting them from flooding, and other natural disasters is essential. Historic

and cultural areas assist localities with community character and provide opportunities for community events and other essential services. The following are listed resources by county and city:

Table 1: GWRC Historical, Cultural, or Tribal Resources

County/City	Types of Historical, Cultural, or Tribal Resources	Link
Caroline County	Contains a variety of Native American/Tribal sites, civil war sites, cemeteries, local parks, historical towns such as Bowling Green, and historical properties and buildings.	https://co.caroline.va.us/DocumentCenter/View/413/Chapter-5-Cultural-and-Historic-Resources-PDF
King George County	Contains state and local parks, Tribal sites, historical properties and buildings, and archaeological sites.	https://www.dhr.virginia.gov/historic-registers/king-george-county/
Stafford County	Contains historic districts, archaeological sites, historic manors, churches, cemeteries, courthouses, national state and local parks and trails. Additionally, this County is home to a state recognized Indian tribe (the Patawomeck Tribe).	https://www.dhr.virginia.gov/historic-registers/stafford-county/
Spotsylvania County	Contains national, state, and local parks, civil war battlefield sites, historic iron mines, and tribal sites.	https://www.spotsylvania.va.us/737/History-Culture https://www.spotsylvania.va.us/DocumentCenter/View/2110/Appendix-C---Historic-Resources-PDF
Fredericksburg	Contains national and local parks, civil war battlefield sites, historic district, and cemeteries. Additionally, this County is home to a state recognized Indian tribe (the Patawomeck Tribe).	https://www.fredericksburgva.gov/DocumentCenter/View/334/Historic-Preservation-Plan?bidId=

Community Environmental Opportunity:

The Community Environmental Profile indicates what the current state of the natural, built, and social environment is of the GW region. This information can provide the GW region with information where resilience BMPs and green infrastructure can provide additional co-benefits. The Community Environment Profile includes the following indicators:

- Air Quality: includes measures of pollution from the EPA, including on-road and, non-road, and non-point pollution. It also includes the EPA measure of neurological, cancer, and respiration risks.
- Population Churning: the rate at which people move in and out of a given community.
- Population Density: the population density of a given community.

- Walkability: A measure of multiple variables, including residential and employment density, street connectivity, and public transit accessibility.

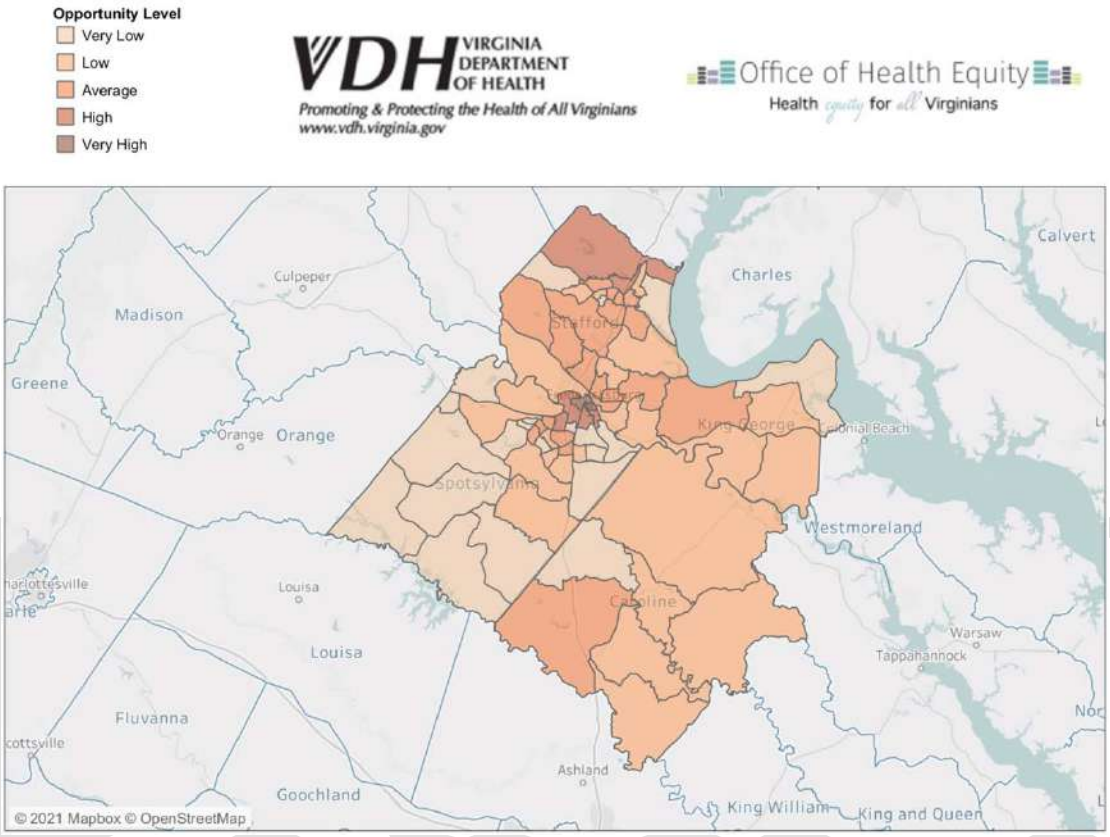


Figure 7: Community Environmental Opportunities
Source: https://apps.vdh.virginia.gov/omhhe/hoi/community-environmental-profile

Economic Assets

Community Economic Opportunity:

The following map provides the Economic Opportunity Profile for the GW region, based on Virginia's Department of Health (DOH) Health Opportunity Index. The Economic Opportunity Profile provides a visual for the impact place has on a citizen's ability to participate in the economic life of a community. Factors influencing economic opportunity include access to jobs, labor participation rates, and the distribution of income within a community. Understanding these factors can help planning efforts in calculating co-benefits in terms of resiliency. In particular, green jobs and other environmentally sustainable growth strategies can bring new jobs to the region and provide other new opportunities for residents. It can also help focus in on the communities that could most benefit from economic revitalization.

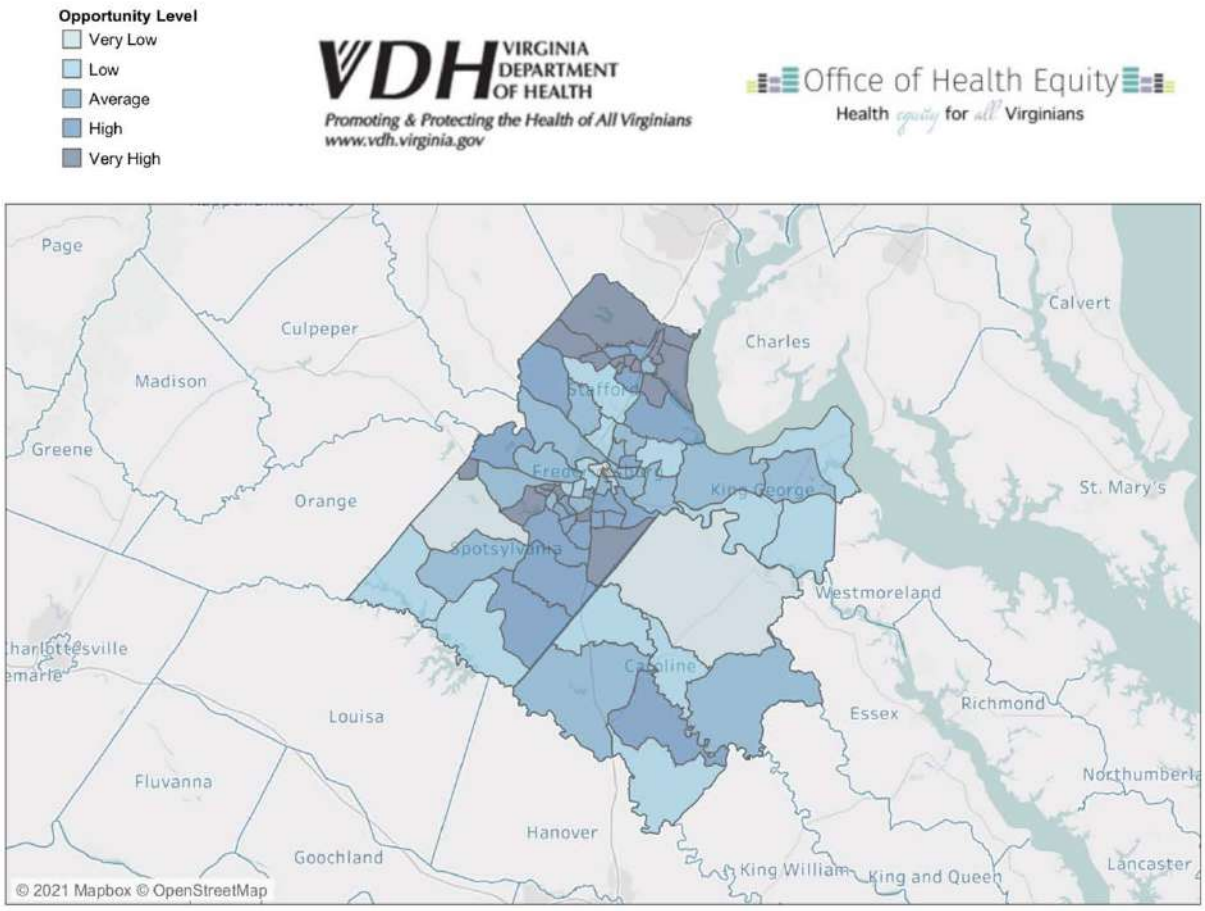


Figure 8. Economic Opportunity for the GW region
Source: https://apps.vdh.virginia.gov/omhhe/hoi/economic-opportunity-profile

Household Trends:

As of 2010, there were 112,048 households in the GW Region, including the 28,339 additional households added since 2000 (a 34% increase). With moderate economic growth projected in the Fredericksburg, Washington DC-Northern Virginia area, and Richmond metro economies for years to come, continued household growth is likewise projected for the GW Region, reaching an estimated 223,710 households by 2040. With the projected growth in households throughout the region, increased development is inevitable. To ensure more resilient and equitable communities and housing conditions, all new development should be located away from areas prone to flooding or other environmentally sensitive areas.

Economic Trends & Drivers:

To create economic resiliency for the GW Region the largest employers should be actively included throughout the planning process to inform and engage prominent businesses.

The 10 largest employers in the George Washington Region include:[1]

1. U.S. Department of Defense
2. Stafford County Schools
3. GEICO
4. Spotsylvania County Schools
5. Mary Washington Hospital
6. U.S. Federal Bureau of Investigation
7. Wal-Mart
8. University of Mary Washington
9. Stafford County
10. Spotsylvania County

An assessment of economic and labor market conditions conducted in the GO Virginia Region 6 Growth and Diversification plan yielded these findings:[2]

- Private sector jobs account for a smaller proportion of total employment in Region 6 (76%) than the state of Virginia (82%)
- Employment growth for the region has slowed to the statewide trend, and the Fredericksburg area grew at a faster pace than other parts of the region.
- The unemployment rate in the GW Region has been continuously lower than that of the United States and the Commonwealth of Virginia. This is attributable to the high number of U.S. Military and Government workers that reside in the Region.
- The Professional, Scientific & Technical Services sector increased by 739 jobs; Other Services increased by 474 jobs; and Health Care and Social Assistance increased by 438 jobs. These three sectors lead year-over-year employment growth.
- 60% of the region's workers commute to employment outside the region.
- Fredericksburg is the regional center for administration, professional services, finance, higher education, medicine, and commerce.

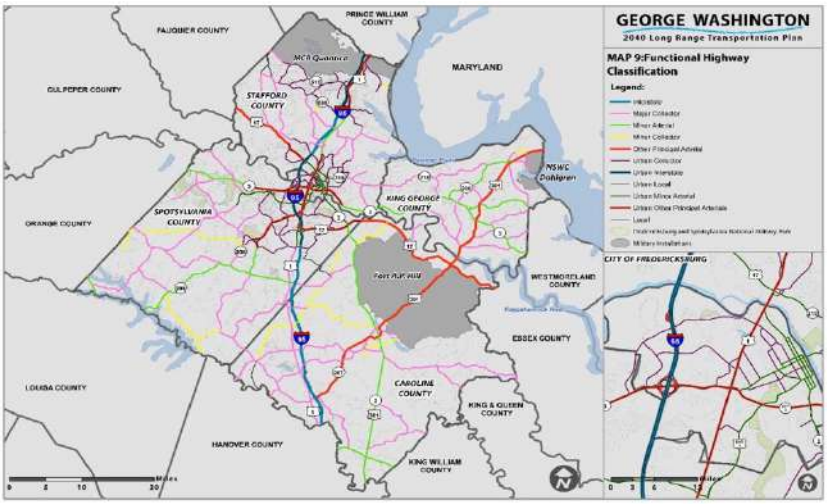
The findings above indicate that the economic development of the region would significantly benefit from expanding the region's private sector resiliency marketplace, through attracting and increasing companies that can provide services and products to meet the needs for the protection of coastal land, infrastructure, and water quality. This may also decrease the proportion of those who commute out of the region for work.

Transportation:

Due to the rapid growth of the George Washington Region, traffic congestion levels have risen considerably over the past 30 years. Interstate 95 carries more than 160,000 vehicles per day through the Fredericksburg region and experiences recurring congestion and incident delays. As of 2015, over half of the workers that live in GW commuted to work outside of the Region, with an average travel time to work of 35.4 minutes. Roads are critical infrastructure for residents to commute to work or travel, and figure heavily into resiliency considerations.

[1] *Source:* VEC, GO Virginia Region 6 Plan.
[2] Region 6 includes the GW region and the counties of Essex, Gloucester, King and Queen, King William, Lancaster, Mathews, Middlesex, Northumberland, Richmond, and Westmoreland.

The corridors of choice for these commuters are Interstate 95 and Jefferson Davis Highway/Cambridge Street (US-1), which bisect the region and serve as major north-south transportation routes for commuters, vacationers, business travelers, local resident trips, and long-haul truck traffic. The Rappahannock River, which flows through the Region, presents a significant barrier to north-south auto travel and is a choke point as many alternate routes (US 17, VA 3) funnel traffic to the limited crossings in the Fredericksburg Vicinity. Fredericksburg is also a strong regional employment center in its own right, which brings a large number of people into the City on a daily basis.



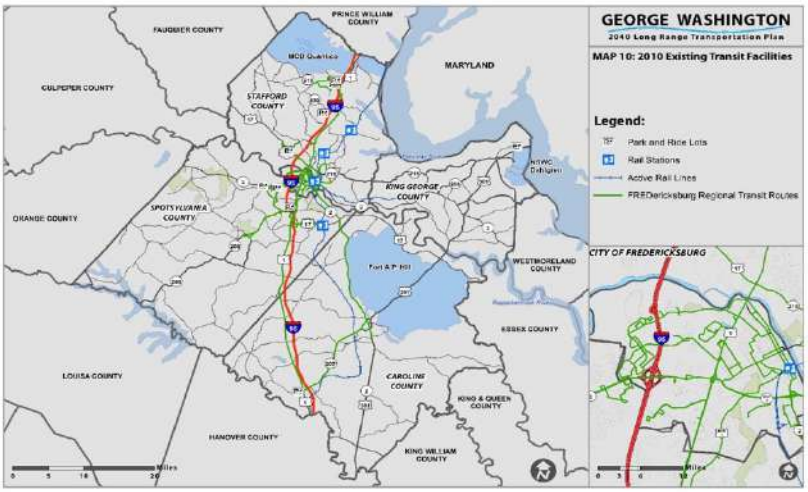


Figure 9 & 10. George Washington Region Transportation Network
Source: FAMPO/GWRC TDM STUDY

Transportation and infrastructure are a critical component of healthy and resilient communities, even more so during a natural hazard or emergency. The Transportation Demand Management (TDM) for the localities in the region should determine the potential congestion that would arise in the event of a natural disaster or emergency. Major roadways and other critical transportation infrastructure must be incorporated into resiliency planning as it impacts human health and economic resilience of the region. When establishing Emergency Evacuation Routes for the region, factors that must consider include but are not limited to: accessibility, connectivity, congestion, and the capacity of travel corridors. Flooding events in particular are a major concern.

Fiscal Stress:[3]

Fiscal stress describes the ability of a locality to provide services to their citizens – a lack of revenue, dwindling tax base, or too much debt can place a burden on the government services that citizens depend on. "The fiscal stress index illustrates a locality's ability to generate additional local revenues from its current tax base relative to the rest of the Commonwealth. Revenue capacity is a computation of how much revenue a jurisdiction could generate if it taxed its population at statewide average rates. Revenue effort is a ratio of actual tax collections by a locality to its computed revenue capacity. Median household income represents the level at which exactly half of the households in a jurisdiction earn more and the other half earns less."

In the GWRC region, this primarily affects Fredericksburg, which is listed as "above average" due to its poor "revenue effort", or ability to generate its own revenue (from real estate taxes, personal property taxes, local option sales taxes, and other local sources).

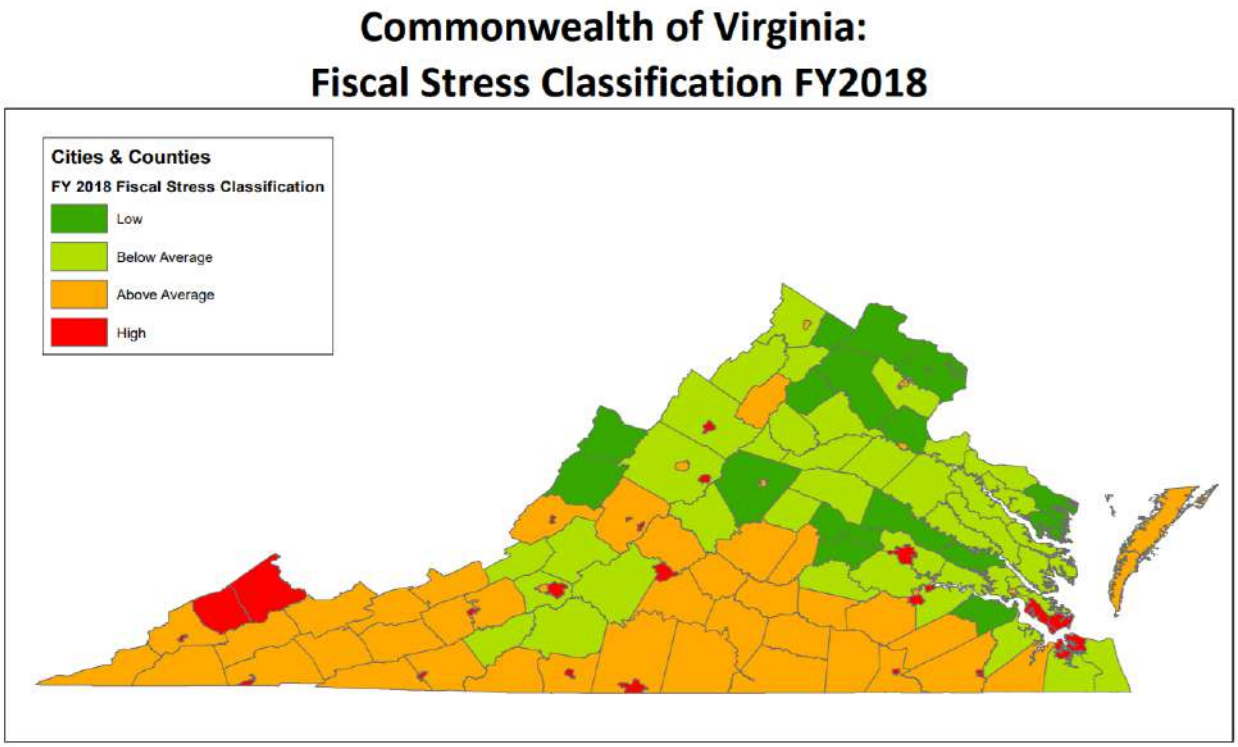


Figure 11. Fiscal Stress Index Map
Source: Virginia Department of Housing and Community Development, Commission on Local Government

[3] For more information, see the Department of Housing and Community Development's July 2020 report: https://www.dhcd.virginia.gov/sites/default/files/Docx/clg/fiscal-stress/fiscal-stress-report.pdf

Social Assets

Populations that are predicated to be disproportionately impacted by regional hazards must be equitably centered in resiliency planning as those individuals are more vulnerable to disasters based on social and economic factors.

Environmental Justice Groups for the George Washington Region include:

1. Minority Populations
2. Low Income Populations
3. Disabled Populations
4. Older Adult Populations
5. Limited English Proficiency Populations

Minority Populations:[4]

African American

As of 2010, persons with African American ancestry make up roughly 17.5% of the total regional population. Stafford has the lowest percentage of African Americans (15.1%) living within the county; following Stafford County is Spotsylvania County at 16.58%, King George County at 17.2%, the City of Fredericksburg with 21%, and finally Caroline County with the highest percentage at 29.1%. Naturally, with Caroline County having the highest percentage within the region, it has relatively high percentages split up amongst its six census tracts. Five of the six tracts have 20.1-40% of their populations comprised of African Americans, with the sixth tract representing 40.1-53.5%. The remaining municipalities with an exception to Fredericksburg have a relatively even percentage distribution of persons with African American heritage. The City of Fredericksburg has five census tracts; the one on the southeastern portion of the city has between 40.1% and 53.5% of the population with African American heritage. The middle two tracts have between 0% and 10%, with the remaining two on the western half of the city with aggregations between 20.1% and 40%.

Asian American

As of 2010, Asian American demographic makes up a relatively small portion of the overall population, with an average of 2.1% for the entire FAMPO and GW Region. To the contrary of the data observed for African American populations, Asian Americans have a higher concentration in the more urbanized areas of the region. Stafford County has the highest percentage with 2.6%, whereas Caroline County has the lowest with 0.4%, followed by King George County with 1.05%, City of Fredericksburg with 2.05% and Spotsylvania County with 2.17%. Most of this population group lives along and to the west of the I-95 corridor.

Latino/Hispanic

As of 2010, the Regional percentage of the Hispanic/Latino population is roughly 6.2%. Stafford County leads this segment with approximately 7.97% of its population descending from Hispanic/Latino heritage. King George County follows closely behind with 7.73%, Spotsylvania County with 6.36%, Caroline County with 3.55%, and finally the City of Fredericksburg with 3.15%. Much like the distribution of the Asian American population group, Hispanic/Latinos have higher concentrations along and to the west of the I-

[4] Demographic data collected from FAMPO Long Range Transportation Plan.

95 corridor, with a majority located in the urbanized areas of Fredericksburg and northern Stafford County.

Limited English Proficiency Population:[5]

About 3.14% of the Region's population has limited English Proficiency, with Fredericksburg having the highest percentage at 4.5%. Stafford County is next with 4.2%, followed by Spotsylvania County with 3.3%, Caroline County with 1.5% and finally King George County with 0.7%. The Fredericksburg and North Stafford urbanized areas have the highest concentrations of Limited English speakers, with King George and Caroline Counties having the lowest percentage. Individuals or households that have limited proficiency in English must have equal access to information which may require translations of resilience documents to be created.

ALICE Population:[6]

Asset Limited, Income Constrained, Employed (ALICE) households are households that are above the federal poverty line, but still have limitations and do not have as much economic flexibility and who may struggle to keep up with a standard household budget. Most of the jurisdictions within the region are above the state average for ALICE populations of 29%. Lower-income households are more vulnerable to extreme weather events and climate change as these individuals have less recourse to adequately prepare for and recover from environmental hazards.

Table 2: ALICE in GWRC 2018

County	ALICE Population	% Population Below ALICE Threshold
City of Fredericksburg	10,582	54%
King George County	9,103	26%
Spotsylvania County	45,223	37%
Stafford County	48,418	29%
Caroline County	10,911	44%
Regional Total	**124,237**	**33.8%**

Source: U.S. Census, ACS, 2019

[5] For more information on LEP populations visit https://apps.vdh.virginia.gov/omhhe/clas/leppopulation/
[6] For more information see www.unitedforalice.org.

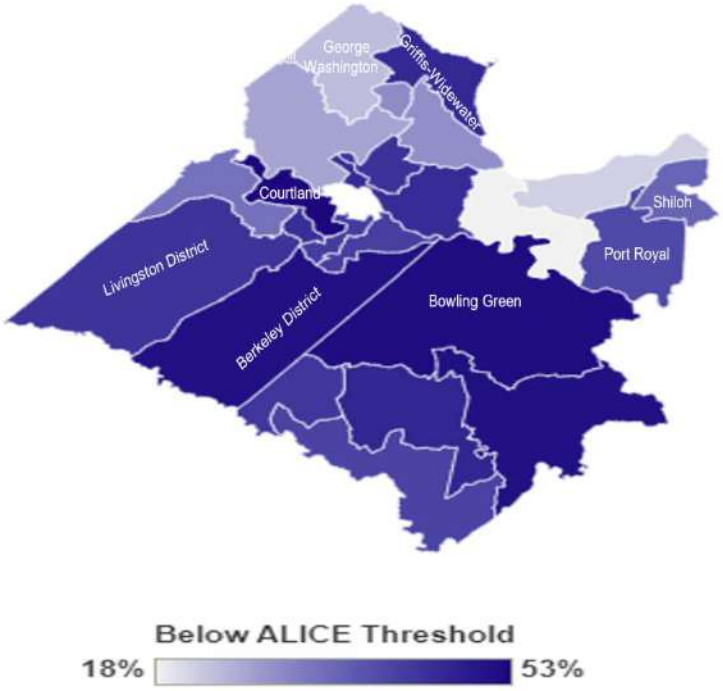


Figure 12. ALICE Households by District
Source: Good Jobs Here Report

Disabled Individuals:

Individuals with disabilities are also vulnerable from extreme weather events. People with disabilities may not have the social support they need in order to evacuate during extreme weather events and may not have the financial resources available to relocated. It is vital that communities have a plan in place to address households with individuals who have disabilities and other special needs.

Table 3: Disabled Individuals in GWRC 2019 (Census Data)

County	Disabled Individuals	% of Population
City of Fredericksburg	2,381	8.2%
King George County	2,066	7.7%
Spotsylvania County	10,897	8%
Stafford County	9,173	6%
Caroline County	2,550	8.3%
Regional Disabled Population	27,067	7.2%

Source: U.S. Census, 2019 American Community Survey

Older Adults:

As of 2010, about 6.4% of the Region's population is comprised of Older Adults, with the City of Fredericksburg having the highest percentage at 11.07%. Caroline County comes in second with 10.9%; King George County is next with 7.22%, followed by Spotsylvania County with 6.35% and finally Stafford

County with 4.55%. The southern and eastern portions of the Region have the highest percentages of Older Adults living there.

Natural Hazards

Environmental events that could result in harm to property or human welfare are an important consideration in Regional resiliency. Natural hazards were identified in the Regional *Hazard Mitigation Plan*, which also developed actions, tasks, mitigation strategies to reduce risk. Below, the natural hazards for the George Washington Region are identified then further defined.

1. Dam Failure
2. Drought & Extreme Heat
3. Wildfires
4. Earthquakes
5. Sinkholes & Landslides
6. Flooding
7. Hurricanes & Thunderstorms
8. Tornadoes
9. Winter Storms & Nor'easters
10. Climate Change

Hazard Overview:

The natural hazards identified to be the highest priority for the region include: Drought, Severe Weather (including Extreme Heat, Northeasters, Thunderstorms, Tornadoes, Winter Storms), Sinkholes and Landslides, and Dam Failure. Identifying the natural hazards that pose the most risk to the city and counties in this Region enabled GWRC to create mitigation strategies for each community. The table below presents community-specific sections where those natural hazards affect each member jurisdiction differently. Low, Medium, and High are the indicators of the probability of occurrence of each hazard.

Table 4: Community Specific Natural Hazards

	GWRC Regions				
Priority for Identified Hazards	**Caroline County**	**Fredericksburg**	**King George County**	**Spotsylvania County**	**Stafford County**
Dam Failure	Low	N/A	Low	Low	Low
Drought and Extreme Heat	Medium	Medium-High	Medium-High	Medium	Medium-High
Wildfires	Medium-High	Medium-High	Medium	Medium	Medium-High
Earthquakes	Low	Medium	Medium-High	Medium-Low	Low
Sinkholes and Landslides	Low	Medium-Low	Low	Low	Medium-Low
Flooding and Erosion	Low	High	Medium-High	High	High
Non-Rotational Wind	Medium-High	High	High	High	High
Tornadoes	Medium-High	High	High	Medium-High	High
Winter Storms and Nor'easters	Medium-High	High	High	High	High

Dam Failure:

Dam failure can occur if hydrostatic pressure behind the dam exceeds its design capacity or the crest of the dam is overtopped and rushing flood water scours the base of the dam. The Virginia Soil and Water Conservation Board established the Virginia Dam Safety Program to provide for safe design, construction, operation, and maintenance of dams to protect public safety. Dams cannot be constructed or altered until the VSWCB issues a permit; all dams are subject to regulations.

Dams are classified with a hazard potential (low, significant, high) depending on the downstream losses anticipated in event of failure. Hazard potential is unrelated to structural integrity of a dam, rather the potential adverse downstream impacts should a dam failure occur. Below are the classifications of dams within the region.

Table 5: National Inventory of Dams in GWRC Region

Community	Downstream Hazard Potential		
	High	Significant	Low
Caroline County	3	35	51
City of Fredericksburg	0	0	0
King George County	1	1	8
Spotsylvania County	5	7	9
Stafford County	7	11	6
GWRC Total	**16**	**54**	**74**

Data Source: GWRC Hazard Mitigation Plan

A dam break inundation zone is the area downstream of a dam likely to be inundated or otherwise directly affected because of a dam failure. Identifying zones that have been classified as high and significant hazard potential help the communities within the region better prepare areas that would be disproportionately affected by a dam failure. Stafford County is the only part of the region that has a publicly available map of dam break inundation zones.

Stafford County has 22 listed dams, 20 of which are subject to DCR regulations. Two dams are located on the Quantico Marine Corps Base and are federally owned and therefore not subject to DCR regulations.

Fredericksburg's "Pond D" dam (No. 630004 in DCR's Dam Safety Inventory System), an earthen embankment impounding Smith Run before connecting to Hazel Run and the Rappahannock River, is anticipated to be classified as a "high-hazard" dam. The City has already retained consultants to develop the appropriate certification documents (e.g. Emergency Action Plan, dam failure analysis, mapping of dam break inundation zone, etc.) and is refining the hazard classification documentation relative to the spillway design storm requirements (0.9 PMP vs. 0.6 PMP). Overtopping protection measures will be implemented, three of which have been evaluated by the City. Fredericksburg will incorporate resilience elements that are nature-based; coordinated with a similarly-located, under-design, wet-pond [TMDL] retrofit, and based upon the best available science.

No.	DCR Dam No.	Name of Dam	Hazard Potential Classification
1	17901	Lunga Dam	High
2	17902	Potomac Creek Dam #1	High
3	17904	Breckinridge Dam	High
4	17906	Hidden Lake Dam	Significant
5	17907	Little Lake Arrowhead Dam	High
6	17908	Lake Arrowhead Dam	High
7	17910	Kennedy Dam	Significant
8	17911	Aquia Creek Dam	High
9	17912	Lake Curtis Dam	High
10	17913	Potomac Creek Dam #2	High
11	17914	Henderson Dam	Low
12	17915	Rocky Pen Run Regional Pond #4 Dam	Low
13	17916	Rocky Pen Run #2A Dam	High
14	17917	Celebrate VA Pond #12 Dam	Low
15	17918	Hartlake #1 Dam	Low
16	17919	Hartland #2 Dam	Significant
17	17920	Walden Ten # 1 Dam	Low
18	17922	Seven Lakes Dam	High
19	17923	Bridle Lake Dam	High
20	17924	Pt. Stone Dam	Low
21	17925	Leeland Lake Dam	High
22	17926	Rocky Pen Run Reservoir Dam	High

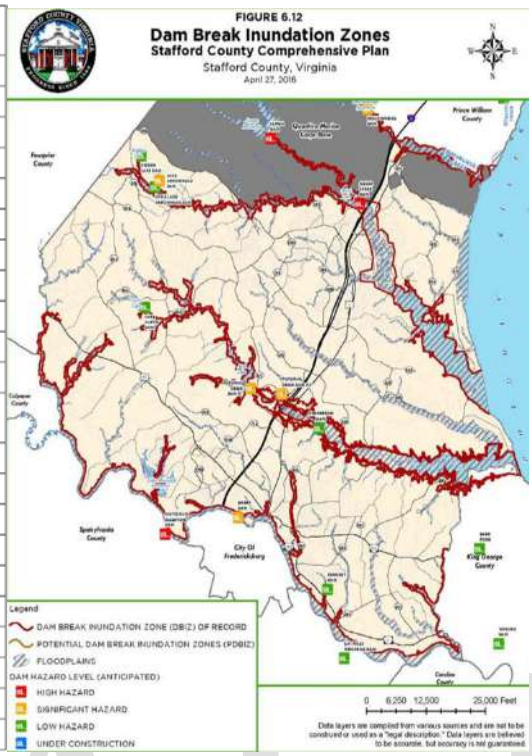


Figure 13. Stafford County Dam Inundation Zones
Source: Stafford County

Drought & Extreme Heat:

A drought is a period of drier-than-normal conditions that results in water-related problems. In a one-year time frame, droughts are considered large when the 12-month rainfall averages approximately 60 percent of normal. On a multi-year time scale, 75 percent of the normal rainfall indicates a serious problem. High summer temperatures can exacerbate the severity of a drought. Drought and extreme heat can impact regional agriculture, wildlife, and habitat. Agriculture remains a major industry in the GWRC region; although the number and size of farms across the region has decreased in the last 20 years, the economic impact of farms have increased.

Extreme Heat results from high daily temperatures combined with high relative humidity. High relative humidity retards evaporation, robbing the body of its ability to cool itself. Incidents of excessive heat in GWRC are defined by Heat Watches and Heat Warnings issued by the National Weather Service (NWS). While the severity of extreme heat is quite small compared with the rest of the nation, the entire GWRC region is subject to high temperatures, with occasional summer days reaching over 100 degrees Fahrenheit, often accompanied by high humidity. There are intersectional threats related to heat, with the elderly and those socioeconomically stressed and/or without the means to afford air conditioning being especially vulnerable.

Wildfires:

An uncontrollable fire spreading through vegetative fuels, possibly consuming structures. Geographically, wildfire risk as determined by the Virginia Department of Forestry (VDOF) varies across the GWRC region. Approximately 62.7% of the GWRC region is located within a high fire risk zone.

Table 5: Critical Facilities for Wildfire Risk

Locality	Total at Risk Critical Facilities
Caroline County incl. Towns of Port Royal and Bowling Green	12
City of Fredericksburg	5
King George County	29
Spotsylvania County	71
Stafford County	54
George Washington Region Total	**171**

Data Source: GWRC Hazard Mitigation Plan

Earthquakes:

Defined as a series of elastic waves in the crust of the earth, caused by abrupt easing of strains built along geologic faults and by volcanic action, and resulting in movement of the earth's surface. Earthquakes can affect hundreds of thousands of square miles and cause extreme damage to property, cause injury and loss of life, and disrupt the social and economic functions of the affected area. The GWRC region lies in an area of moderate seismic risk, with a peak acceleration of 6 to 10g, which is considered a moderate hazard probability.

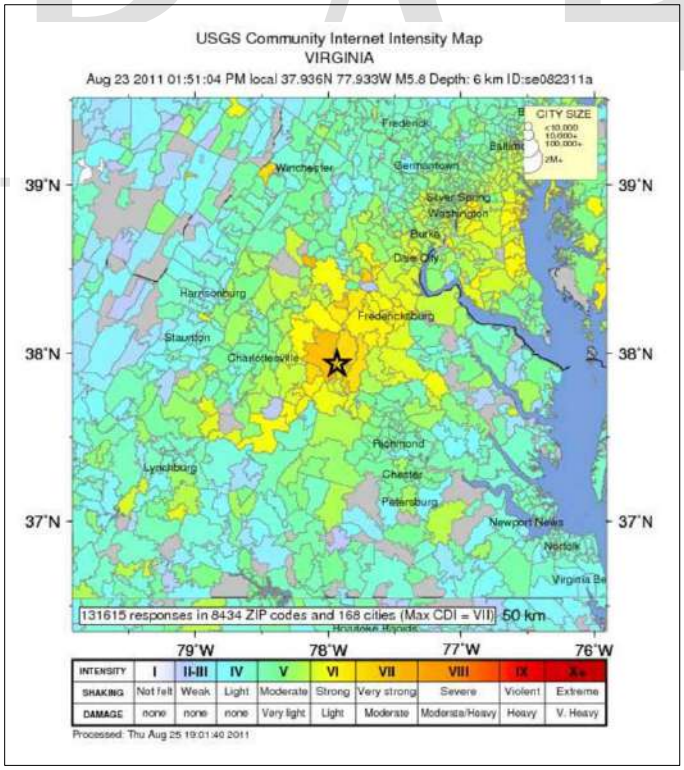


Figure 14. GWR Earthquake Intensity
Source: USGS Community Earthquake Intensity Map (2011)

Sinkholes & Landslides:

Sinkholes are depressions in the land surface caused by subsurface conditions. Naturally occurring sinkholes are largely associated with karst topography, where changing groundwater conditions may cause a sudden loss of stability in the roofs of cavernous openings, causing sudden sinkholes. The GWRC region is not considered to be within a karst area.

A landslide is the movement of any mass of rocks, soil, or debris down a slope. Usually triggered by heavy rainfall, rapid snow melt, stream incision, or earthquakes. Certain man-made changes to the land can greatly increase the likelihood of landslides. The steady urbanization of the GWRC region makes the possibility of landslides caused by man made changes to slopes by the location of buildings and infrastructure, including roads, on or near steep slopes, more common. Landslide potential is considered high is Stafford County, moderate in King George County, and low in Spotsylvania County, Caroline County and the City of Fredericksburg.

Flooding:

The most frequent and most costly natural hazard throughout the United States is flooding. Excess water from snowmelt, rainfall, or storm surge accumulates and overflows onto adjacent floodplains. There are four basic types of flood that afflicts Virginia's communities, depending on the region of the state examined: coastal flooding, urban flooding, flash flooding, and riverine flooding. The GWRC region is most susceptible to urban flooding and flash flooding. Low-lying areas adjacent to rivers, streams, or creeks are susceptible to riverine flooding. In addition, portions of the Potomac and Rappahannock Rivers in the region are subject to tidal flooding. Urban Flooding often occurs in highly impervious areas.

Table 6: Critical Facilities in 100-year floodplain

Locality	Total at Risk Critical Facilities
Caroline County incl. Town of Port Royal and Bowling Green	0
City of Fredericksburg	17
King George County	3
Spotsylvania County	11
Stafford County (excl. Quantico)	1
George Washington Region Total	**32**

Data Source: GWRC Hazard Mitigation Plan

While many floodplain boundaries are mapped by FEMA's National Flood Insurance Program (NFIP), floods sometimes go beyond mapped floodplains or change course due to natural processes or human development (e.g., filling in floodplain or floodway areas, increased impervious surfaces from new development within watershed, etc.). All the jurisdictions in GWRC are mapped by NFIP and participate in the program. FEMA's HAZUS tools estimate the risk from severe weather, including earthquakes.

King George County has 26 properties enrolled in NFIP; none of the insured properties are classified as Repetitive Loss property. FEMA's HAZUS estimates the displacement of 49 households as the result of a hypothetical 100-year flood event, with 20 people seeking emergency shelter within the community.

The City of Fredericksburg has 164 properties enrolled in the National Flood Insurance Program, of which 4 are classified as Repetitive Loss properties. Repetitive Loss of property is defined as any insurable building for which two or more claims of more than $1,000 were paid by the NFIP over any rolling 10-year period since 1978. For these properties, NFIP promotes permanent solutions to repetitive flooding problems, either through structural measures or by removal of structures within high risk flood areas. HAZUS estimates the displacement of 167 households as the result of a hypothetical 100-year flood event, with 290 people seeking emergency shelter within the community.

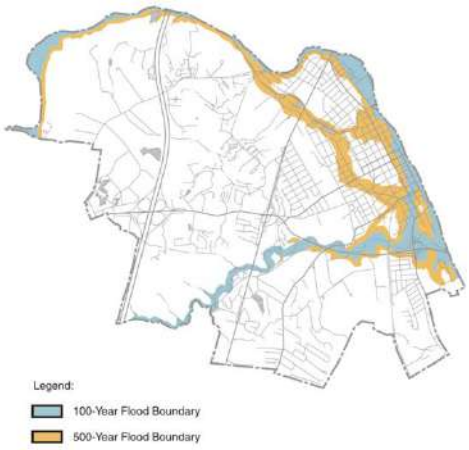


Figure 15. City of Fredericksburg Flood Zone Map
Source: City of Fredericksburg

Spotsylvania County has 135 properties enrolled in NFIP; none of the insured properties are classified as Repetitive Loss properties. HAZUS estimates the displacement of 344 households as the result of a hypothetical 100-year flood event, with 20 people seeking emergency shelter within the community.

Caroline County has a low flood threat, with only nine flood events recorded since 1996. HAZUS estimates the displacement of 123 households as the result of a hypothetical 100-year flood event, with 79 people seeking emergency shelter within the community. The number of properties enrolled in NFIP was not publicly available.

Stafford County has 288 properties enrolled in NFIP, 8 of which are classified as Repetitive Loss properties. HAZUS estimates the displacement of 394 households as the result of a hypothetical 100-year flood event, with 665 people seeking emergency shelter within the community. A 100-year event has a one percent chance probability of occurring in any given year. Within Stafford, 12% (20,918 acres) of land is in a 100-year floodplains hazard area. Stafford County Government offer a free interactive Flood Zone Map that shows potential flood zones within the County, shown in Figure 6 to the right.

Figure 16. Stafford Flood Zone Map
Source: Stafford County

Stafford County has an average of 1.43 floods a year, and the probability of future occurrences was found to be high. Local representatives and past planning efforts have noted several areas within the community that are affected by frequent flooding. These include:

- Repeated road closure due to flooding and debris at:
  - River Road;
  - Vista Woods, Grafton Village, and Argyle Hills;
  - Harrell Road at the CSX Crossing; and
  - Aquia Drive, requiring emergency access to Decatur Road.
- Riverine flooding in several neighborhoods including:

    - The Falmouth area, which is often evacuated; and
    - The Aquia Harbour area with over 1,000 homes affected.
- Tidal flooding at the marina area

The localities mentioned above that experience extreme or repetitive flooding should consider limiting development and focusing mitigation strategies in identified flood areas. Mitigation strategies for the identified areas could include but not limited to:

- Comprehensive land use planning
- Zoning Regulations
- Building Codes
- Floodplain development regulations
- Property protection measures (building relocations, building elevation, retrofitting, etc)
- Natural resource Protection (wetlands, erosion and sedimentation control, etc.)

Hurricanes & Thunderstorms:

Hurricanes and tropical storms, as well as tropical depressions, are all tropical cyclones. Hurricanes and tropical storms bring heavy rainfall, storm surge, and high wind, all of which can cause significant damage. These storms can last for several days, and therefore have the potential to cause sustained flooding and high wind conditions. Numerous hurricanes and tropical storms occur along the eastern seaboard each year, with direct landfall occurring somewhere along the eastern United States approximately once every three years. While the region is somewhat protected from the full strength of a hurricane, its expansive nature makes the region vulnerable to high winds, flooding, and tornadoes that often accompany these other extreme weather events. VDEM rates Virginia's overall wind risk as high and the GWRC communities are no exception. Historical occurrences of high winds generated by hurricanes and tropical storms are a strong indication of future events. According to *Minimum Design Loads for Buildings*, the design wind speed for the GWRC region is less than 90 mph.

Thunderstorms are defined as localized storms, always accompanied by lightning, and often having strong wind gusts, heavy rain and sometimes hail or tornadoes. Thunderstorms can produce a strong out-rush of wind known as a downburst or microburst, or straight-line winds which may exceed 120mph. The entire GWRC region is at risk for thunderstorm damages. There have been seven people injured and well over $100,000 in property damage caused by lightning strikes in the GWRC since 1993.

Tornadoes:

Tornadoes are one of nature's most violent storms. A tornado is a rotating column of air extending from a thunderstorm to the ground. In Virginia, most tornadoes occur from April to October, although tornadoes can strike at any time during the year. Tornadoes are not more likely to strike one jurisdiction than another in the GWRC area. Each jurisdiction is considered to have roughly the same probability of experiencing a tornado. Every locality in the GW region has a medium-high to high tornado risk compared with the rest of the state, which is still relatively low compared to other regions of the US.

Winter Storms & Nor'easters:

Winter Storms can combine different types of precipitation including snow, freezing rain, and ice, as well as high winds, and cold temperatures. These storms can range from being a minor inconvenience to

crippling and potentially life-threatening events. Winter Storms can be very disruptive, particularly in areas where they do not occur frequently. It is quite common for the rain-snow line to fall within, or near, the GWRC region. Heavy snow often falls in a narrow 50-mile wide swath approximately 150 miles northwest of the low-pressure center. The GWRC region often finds itself within this 50-mile wide swath of dangerous winter weather.

Nor'easters are slow moving, low-pressure systems that typically form either in the Gulf of Mexico or in the Atlantic Ocean. Although typically associated with winter storm events, Northeasters can occur during anytime of the year. Low-pressure systems develop into storms that bring strong northeast winds, heavy rain/precipitation and storm surge to coastal areas. The GWRC region is prone to experiencing the effects of Atlantic forming storms; because these storms are very large, they are likely to affect the entire eastern seaboard.

Climate Change:

The potential risks of climate change can have broad effects on the GWRC region, including on its public health, infrastructure, agriculture, tourism, and emergency services. The GWRC region should expect the following in the future:

- More frequent, and more intense, precipitation events punctuated by deeper episodes of drought.
- Drier winter and summer seasons, which could deplete reservoirs and challenge agricultural production.
- Increased storm surges along tidal portions of the Potomac and Rappahannock Rivers, caused by rising sea level and stronger Atlantic tropical storms.
- Stronger storms coming at a greater frequency, which may threaten lives, damage infrastructure and cause significant power outages.
- Increasing summer heat waves that could threaten public health.

Community Climate Change Outlook

As the climate continues to change, so has the frequency and intensity of natural and climate related hazards. The residents of the George Washington Region will face a worsening variety of weather and climate related hazards such as heatwaves, flooding, and storm surges. Below are the community climate outlooks of each jurisdiction within GWRC. The indicator areas for these communities are sea level rise, temperature, and precipitation. Sea level rise will contribute to more frequent and sever coastal flooding, agriculture losses, and property damage, predictions for sea level rise in 2070 indicate that private property will be submerged and the Region's coastlines will be permanently reshaped. Temperature rises associated with climate change pose a risk to human health, local fisheries, agriculture, and infrastructure. Predictions for the increase in number of days above 95°F every year is associated with increases in cooling costs and heat-related illnesses. Precipitation and heavy downpours in the Region have increased in frequency and intensity, causing property damage, septic backups, well contamination, and impacts to water quality in local streams and ultimately the Chesapeake Bay.

Stafford County

Since 1950, sea levels in Stafford have risen over 1 foot, and sea levels will rise 2-6' by 2070, permanently reshaping Stafford's coastline. Compared to 1950 Stafford sees 12 more days per year in excess of 95°F. By 2070, Stafford can expect 29 to 80 days above 95°F every year. Heavy downpours in Stafford have

increased in frequency and intensity, Stafford can expect up to 30% more days of heavy rainfall (≥ 2 inches) by 2070.

Spotsylvania County
Sea levels in Spotsylvania have risen over 1 foot since 1950, and are predicted to rise by 2-6' by 2070. Compared to 1950 Spotsylvania sees 12 more days per year in excess of 95°F. By 2070, Spotsylvania can expect 29 to 81 days above 95°F every year. Heavy downpours in Spotsylvania have increased in frequency, and Spotsylvania can expect up to 35% more days of heavy rainfall (≥ 2 inches) by 2070.

King George County
Sea levels in King George County have risen over 1 foot since 1950, and are predicted to rise by 2-6' by 2070. Compared to 1950 King George sees 14 more days per year in excess of 95°F. By 2070, King George can expect 35 to 84 days above 95°F every year. Heavy downpours in King George have increased in frequency and intensity, and the county can expect up to 40% more days of heavy rainfall (≥ 2 inches) by 2070.

Caroline County
Sea levels in Caroline County have risen over 1 foot since 1950, and are predicted to rise by 2-6' by 2070. Compared to 1950 Caroline County sees 12 more days per year in excess of 95°F. By 2070, Caroline County can expect 30 to 82 days above 95°F every year. Heavy downpours in Caroline County have increased in frequency and intensity, and the county can expect up to 35% more days of heavy rainfall (≥ 2 inches) by 2070.

City of Fredericksburg
Sea levels in Fredericksburg have risen over 1 foot since 1950, and are predicted to rise by 2-6' by 2070. Compared to 1950 Fredericksburg sees 12 more days per year in excess of 95°F. By 2070, Fredericksburg can expect 28 to 79 days above 95°F every year. Heavy downpours in Fredericksburg have increased in frequency and intensity, and the county can expect up to 30% more days of heavy rainfall (≥ 2 inches) by 2070.

Climate Change Related Flooding:

A study on future climate change related sea level rise and recurrent flooding risk of Coastal Virginia was conducted by the Commonwealth Center for Recurrent Flooding Resiliency (CCRFR). The report produced in 2020 analyzed existing data on coastal land elevation, sea level rise projections, subsidence, and building and transportation assets. Recent efforts by Dewberry for the Virginia Coastal Resilience Master Plan will add to the concreteness and accuracy of this data.

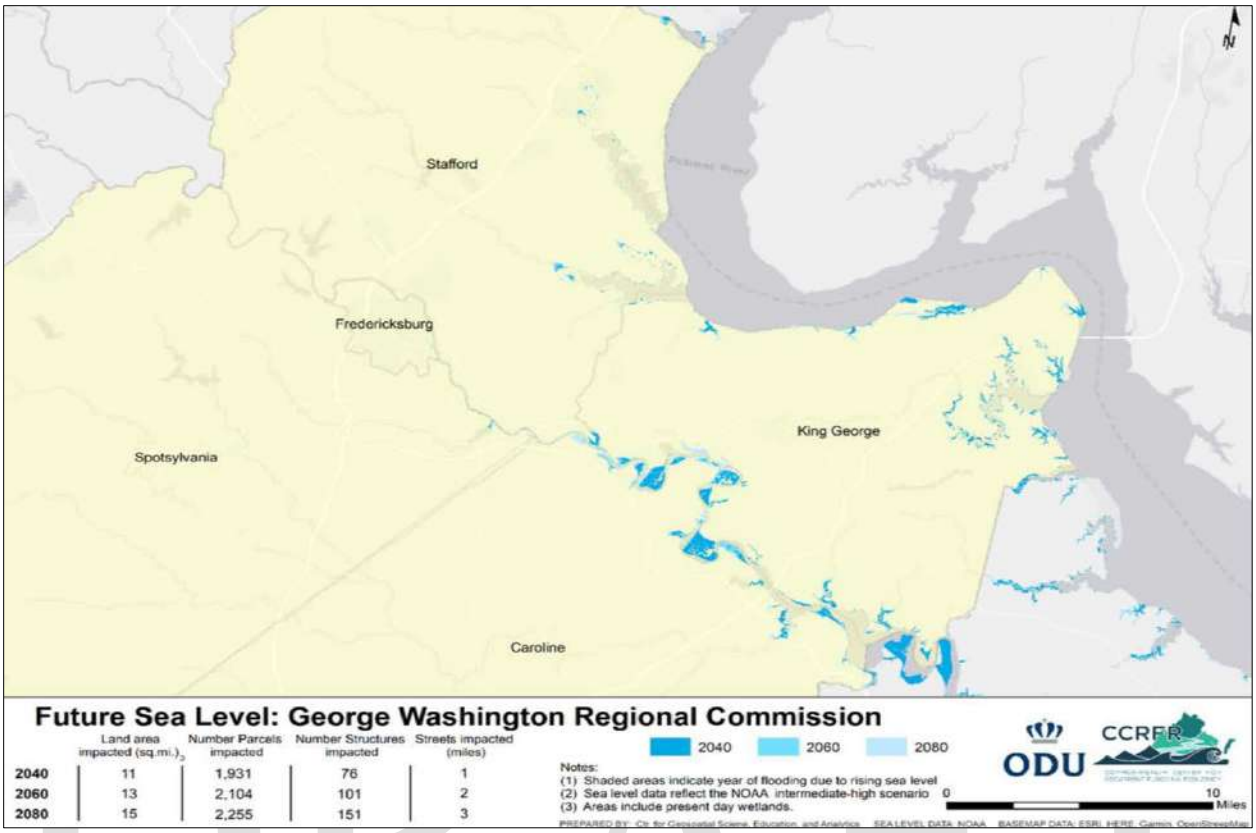


Figure 17. Future GWRC Sea Level
Source: CCRFR

Virginia land cover data in conjunction with modeled sea level were analyzed to predict areas that will be inundated in the future. It was determined that present day land area (including wetlands) in GWRC that will be flooded by sea level rise is as follows:

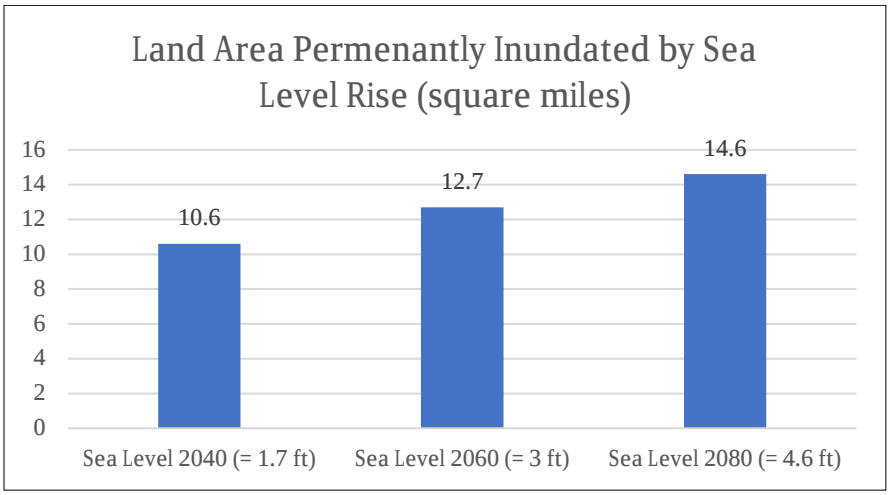


Figure 18. Sea level rise impacts on the land within GWRC
Data Source: CCRFR

Data from the Virginia GIS clearinghouse was obtained to approximate impacts of future sea level rise on real property parcels, buildings, and major roads. For the purposes of this analysis, parcels were deemed impacted if any inundation that partially or wholly overlays with predicted sea level rise.

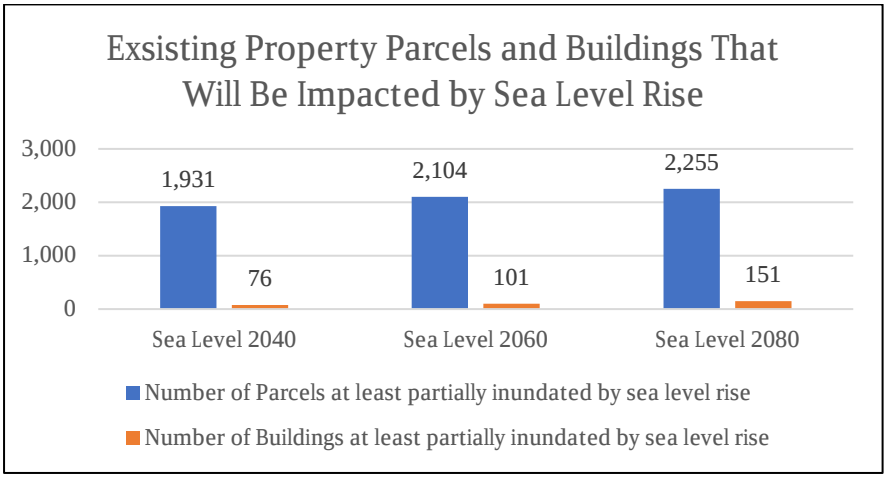


Figure 19. Sea level rise impact on GWRC property and buildings
Source: CCRFR

Table 7: Total street flooding from sea level rise in GWRC

	Year		
	2040	**2060**	**2080**
Miles of Roadway Flooded	1	2	3

Physical Vulnerability from Sea-Level Rise

The following map provides the physical vulnerability due to flooding from sea-level rise, obtained from AdaptVA. This map indicates that Stafford County and King George County have low to moderate risk from flooding due to sea level rise. Although the risk level is not high, jurisdictions should focus on flooding best management practices (BMPS) along water bodies located in these jurisdictions, particularly rivers and energetic waterways.

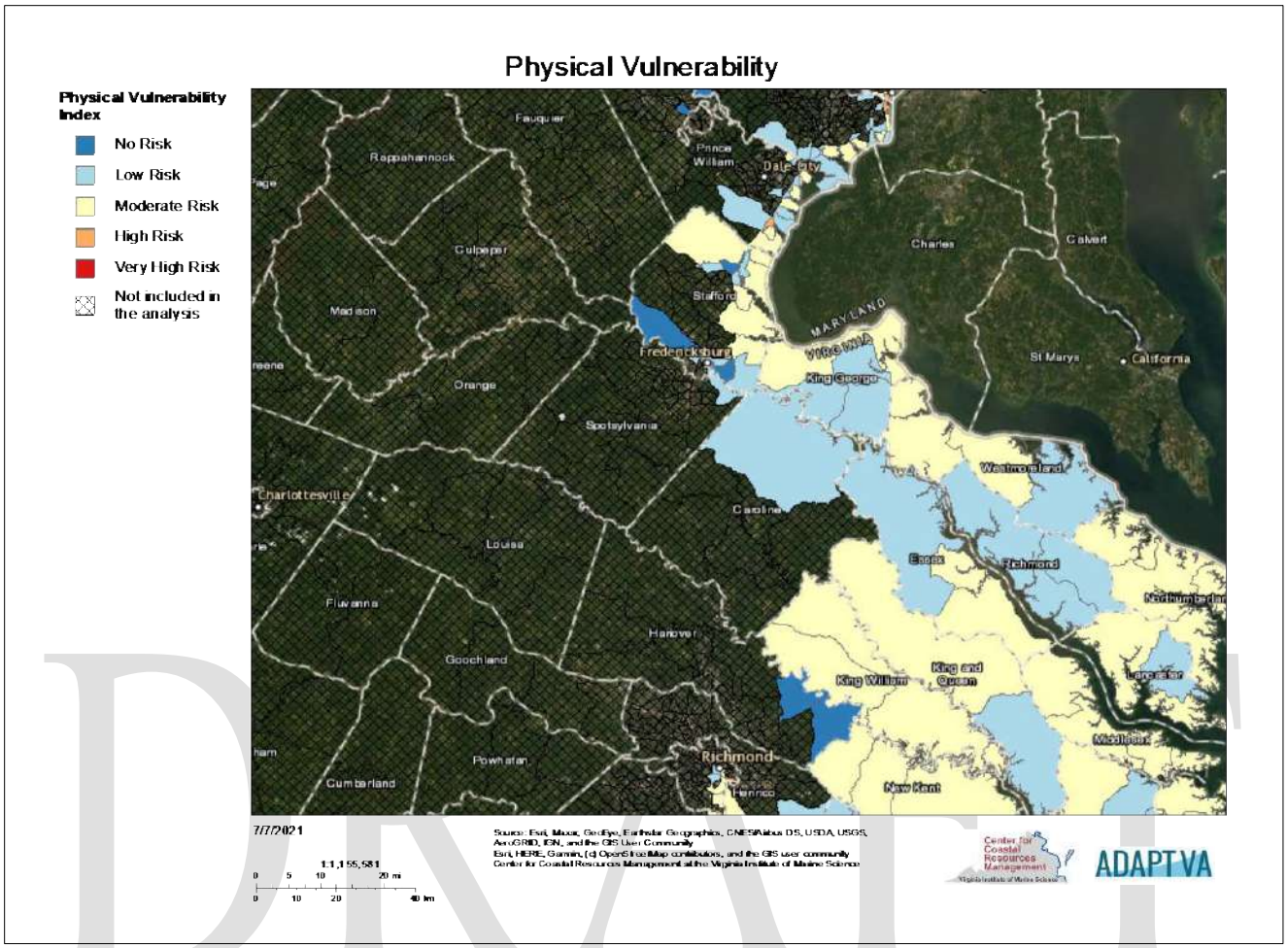


Figure 20. Physical Vulnerability Index
Source: AdaptVA Interactive Map http://cmap2.vims.edu/AdaptVA/adaptVA_viewer.html

Federal, State, Regional, and Local Disaster Preparedness

A capability assessment was conducted in the regional hazard mitigation plan to provide each jurisdiction with a better understanding of its own preparedness levels and its capability to mitigate against natural hazards. Listed below are the federal, state, local and jurisdictional resources for capability building.

Federal Capabilities:

- Federal Emergency Agency (FEMA): The Stafford Act
- The National Flood Insurance Program (NFIP)
- Federal Highway Administration (FHWA): Emergency Transportation Operations (ETO)
- Federal Highway Administration: Federal-aid Highway Emergency Relief Program
- U.S. Department of Energy (DOE): Disaster Recovery and Building Reconstruction Program
- U.S. Fish and Wildlife Service (USFWS): The Coastal Barrier Resources Act
- NOAA: Coastal Zone Management Act
- EPA Chesapeake Bay TMDLs

State Capabilities:

- VA Department of Emergency Management
  - Commonwealth of VA Emergency Operations Plan
  - Virginia Emergency Alert Systems Stations
  - Statewide Communications Interoperability Plan
- Virginia Department of Conservation and Recreation
  - VA Flood Damage Reduction Act
  - VA Dam Safety Act
  - Shoreline Erosion Advisory Service
- VA DEQ
  - Virginia Stormwater Management Act and Regulations
  - Chesapeake Bay Regulations
- VA Department of Forestry
- VA Marine Resources Commission
- Department of Housing and Community Development

Regional Capability:

- GWRC
- Fredericksburg Area Metropolitan Planning Organization
- GWRideConnect
- Fredericksburg Regional Alliance
- The Rappahannock River Basin Commission
- Climate, Environment, and Readiness Plan (CLEAR Plan)

The City of Fredericksburg utilizes a cable access channel, Reverse 911, and Fredericksburg Alert (email and text message capability) to notify residents of information that may include emergency preparedness.

Caroline County utilizes SMS and email notification system, Twitter, and the County's website to notify residents of emergency and non-emergency information. The Town of Bowling Green also utilizes a cable access channel to notify residents of information that may include emergency preparedness.

King George County has access to public access television channel for posting emergency and other community information. Emergency notifications are provided to citizens and businesses through KGALERT, CityWatch (Reverse 911) local radio station announcements, and Twitter postings.

Spotsylvania County utilizes a Mass Notification System (Spotsy Alert) to notify residents of important information. Spotsy Alert provides notifications ranging from emergencies to public events. These notifications come in the form of text message, phone call, and emails. Users can select the methods of notification that meets their needs. The County does have access to override all cable channels for EAS activation. Additionally, the Department of Fire, Rescue, and Emergency Management website has links to multiple websites providing information on emergency preparedness.

Stafford County utilizes a cable access channel, Reverse 911, and Stafford Alert to notify residents of important information. The County does have access to override all cable channels for EAS activation.

Critical Facilities

Critical Facilities should be given special attention when planning or preparing for a disaster because of their vital importance to maintaining citizen life, health, and safety during and directly after a disaster event. The critical facilities of the region are listed below by City and County.

The critical facilities in all counties of this region include:

- Emergency Operation Center (EOC);
- Emergency Communications Center (ECC)/911;
- Law Enforcement Offices
- Emergency Medical Services (EMS);
- Power;
- Communications;
- Water;
- Wastewater Treatment Plants (WWTP);
- Shelters and
- Administrative Buildings/Courthouses.

Table 8: Caroline County Critical Facilities

Facility Name	Location	Facility Type
Dept Fire & Rescue Admin. Emergency Operations Center	Caroline County	Fire-Rescue Admin/EOC
Upper Caroline Fire Dept 1	Woodford	Fire Dept
Frog Level VFD.2	Hanover	Fire Dept
Ladysmith VFD.2	Ladysmith	Fire Dept
Sparta VFD.2	Caroline County	Fire Dept
Port Royal VFD.2	Port Royal	Fire Dept
Frog Level VRS	Ruther Glen	Rescue Squad
Ladysmith VRS	Ladysmith	Rescue Squad
Rappahannock Elec. Field Ofc.	Caroline County	Power Co. Local Office
St. Johns Sub-station	Ruther Glen	Electrical Sub Station
Communications Transmit Tower	Varies	Communications
Communications Receive Tower	Varies	Communications
WWUZ CH 2451		Communications
Cell & Microwave Towers	Varies	Communications
Caroline Co. STP	Ruther Glen	Waste Water
Ladysmith Primary2	Ruther Glen	School / Shelter
Blowing Green Primary2	Milford	School / Shelter
Bowling Green Elem	Caroline County	School / Shelter
Lady Smith Elem2	Ruther Glen	School / Shelter
Caroline Middle2	Milford	School / Shelter
Caroline High School	Milford	School / Shelter
Caroline County Courthouse	Bowling Green	Administration Building
CSX/Amtrak Railway	Varies	Transportation
Plantation Gas Pipeline	Varies	Gas
Columbia Gas Pipeline	Varies	Gas
School Board Office	Caroline County	School Board
Pneumansend Regional Jail	Caroline County	Jail
Lake Caroline Dam	Ruther Glen	Office
Lake Land or Dam	Ruther Glen	Office
State Police	Bowling Green	Police Departments
Caroline Sheriff Admin.	Bowling Green	Police Departments
Bowling Green Police Dept	Bowling Green	Police Departments
Bowling Green Fire Dept	Bowling Green	Fire Dept
911 Center	Bowling Green	911 Center
Bowling Green Rescue Squad 1	Bowling Green	Rescue Squad
Water Main Controls/Ground Storage Well	Bowling Green	Water

Fort AP Hill	Bowling Green	Wastewater
Wastewater Treatment Plant	Bowling Green	Wastewater
Sewer Pump Station	Bowling Green	Sewer
Sewer Pump Station	Bowling Green	Sewer
Town Hall	Bowling Green	Administration Building
Dialysis Center	Bowling Green	Medical
Nursing Home	Bowling Green	Medical
Port Royal V.F.D. 1	Port Royal	Fire Dept
Town Water Storage Tank	Port Royal	Water
Town Hall	Port Royal	Administration

Table 9: Fredericksburg Critical Facilities

Facility Name	City	Facility Type
Emergency Operation Center @ Police Headquarters – Backup Location @ Fredericksburg Fire Dept. Station 2	Fredericksburg	EOC
Executive Plaza Office Building	Fredericksburg	City Government and Fire Department Administration
Fredericksburg Police Headquarters; E-911 Center	Fredericksburg	Police Department E-911 Center
Fredericksburg Sheriff; General District Court; Circuit Court	Fredericksburg	Police Department; Courts
Fredericksburg Fire Station 2	Fredericksburg	Fire Department
Fredericksburg Rescue Squad	Fredericksburg	Fire Department
Fredericksburg Fire Station 1	Fredericksburg	Fire Department
Juvenile and Domestic Relations Court	Fredericksburg	Court
Verizon	Fredericksburg	Communications
Courtland Water Pumping Station	Fredericksburg	Water Pumping Station
Powhatan Water Pumping Station	Fredericksburg	Water Pumping Station
Lafayette Blvd Pumping Station	Fredericksburg	Water Pumping Station
Motts Run Reservoir Water Treatment Plant	Fredericksburg	Water Treatment Plant
Normandy Village Sewage Pump Station	Fredericksburg	Sewage Pump Station
Bragg Hill Sewage Pump Station	Fredericksburg	Sewage Pump Station
Rt's 2 and 17 Area Sewage Pump Station	Fredericksburg	Sewage Pump Station
Snowden Sewage Pump Station	Fredericksburg	Sewage Pump Station
Caroline Street Sewage Pumping Station	Fredericksburg	Sewage Pumping Station
Fall Hill Sewage Pumping Station	Fredericksburg	Sewage Pumping Station
City of Fredericksburg Wastewater Treatment	Fredericksburg	Wastewater Treatment Plant
Hugh Mercer Elementary School	Fredericksburg	School / Shelter
James Monroe High School	Fredericksburg	School / Shelter
Walker-Grant Middle	Fredericksburg	School / Shelter
Lafayette Upper Elementary School	Fredericksburg	School / Shelter
City Hall	Fredericksburg	Administration
Mary Washington Hospital	Fredericksburg	Hospital
National Guard Amory	Fredericksburg	Military
FBI Field Office (local)	Fredericksburg	Federal Government
University of Mary Washington	Fredericksburg	University

Table 10: King George County Critical Facilities

Facility Name	Location	Facility Type
King George Sheriff's Office	King George	ECC
King George Fire & Rescue Company 1	King George	EOC / Fire Department
King George Fire & Rescue Company 2	King George	Fire Department
King George Fire & Rescue Company 3	King George	Fire Department
King George Fire & Rescue Station 2	King George	Rescue Station
Dahlgren WWTP	King George	Waste Treatment
Fairview Beach WWTP	King George	Waste Treatment
Hopyard Farm WWTP	King George	Waste Treatment
Oakland Park WWTP	King George	Waste Treatment
Purkins Corner WWTP	King George	Waste Treatment
Presidential Lakes WWTP	King George	Waste Treatment
King George High School	King George	School / Shelter

King George Middle School	King George	School / Shelter
King George Elementary School	King George	School / Shelter
Potomac Elementary School	King George	School / Shelter
King George Citizen Center	King George	School / Shelter
Sealston Elementary	King George	School / Shelter
Administration Center	King George	School / Shelter
King George Courthouse Complex	King George	Administration
Service Authority Office	King George	Administration
King George Animal Shelter	King George	Administration
King George Sheriff's Office	King George	Administration / Sheriff's Office
King George Library	King George	Administration
King George County School Bus Garage	King George	School Administration
Harry Nice Memorial Bridge	King George	Bridge
Rappahannock River Bridge	King George	Bridge
Williams Creek Bridge	King George	Bridge
Muddy Creek Bridge	King George	Bridge
Sgt. Nicholas C. Mason Memorial Bridge	King George	Bridge

Table 11: Spotsylvania County Critical Facilities

Facility Name	City	Facility Type
Brokenburg Fire & Rescue 2	Spotsylvania	Fire / EMS
Partlow Fire Company 3	Spotsylvania	Fire
5-Mile Fork Fire Company 5 & Rescue	Spotsylvania	Fire / EMS
Salem Church Road Fire Company & Rescue Station 6	Spotsylvania	Fire / EMS
Wilderness Fire Company & Rescue station 7	Spotsylvania	Fire / EMS
Thornburg Fire Company & Rescue Station 8	Spotsylvania	Fire / EMS
Belmont Fire Company & Rescue Station 9	Spotsylvania	Fire / EMS
Fire Company & Rescue Station 1	Spotsylvania	Fire / EMS
Fire Company & Rescue Station 4	Fredericksburg	Fire / EMS
Salem Fields Fire Company & Rescue Station 10	Fredericksburg	Fire / EMS
Fire Company & Rescue Station 11	Fredericksburg	Fire / EMS
Ni River Water Treatment Plan	Spotsylvania	Potable Treatment
Motts Run Water Treatment Plan	Fredericksburg	Potable Treatment
FMC Wastewater Treatment Plant	Fredericksburg	Water Treatment
Massaponax Wastewater Treatment Plant	Fredericksburg	Water Treatment
Stoneybrook Wastewater Treatment Plant	Fredericksburg	Water Treatment
Thornburg Wastewater Treatment Plant	Woodford	Water Treatment
County Courthouse	Spotsylvania	Administration
Holbert Building	Spotsylvania	Local Government
Marshall Center	Spotsylvania	Local Government
Merchant Square Bldg.	Spotsylvania	Local Government
Animal Control Office	Fredericksburg	Local Government
Joint Fleet Maintenance Facility	Spotsylvania	Local Government
Utilities Administration Office	Fredericksburg	Local Government
Voter Registration	Spotsylvania	Local Government
911/EOC/Sheriff/Fire Administration	Spotsylvania	Public Safety Bldg/911/EOC
School Transportation Office	Spotsylvania	School / Support Facility
Battlefield Elementary	Fredericksburg	School / Shelter
Battlefield Middle	Fredericksburg	School / Shelter
Berkley Elementary	Spotsylvania	School / Shelter
Brock Road Elementary	Spotsylvania	School / Shelter
Career and Technical Center High	Spotsylvania	School / Shelter
Cedar Forest Elementary	Fredericksburg	School / Shelter
Chancellor Elementary	Fredericksburg	School / Shelter
Chancellor High	Fredericksburg	School / Shelter
Chancellor Middle	Fredericksburg	School / Shelter
Courthouse Road Elementary	Spotsylvania	School / Shelter
Courtland Elementary	Spotsylvania	School / Shelter
Courtland High	Spotsylvania	School / Shelter
Freedom Middle	Fredericksburg	School / Shelter
Harrison Road Elementary	Fredericksburg	School / Shelter

Lee Hill Elementary	Fredericksburg	School / Shelter
Livingston Elementary	Spotsylvania	School / Shelter
Massaponax High	Fredericksburg	School / Shelter
Ni River Middle	Spotsylvania	School / Shelter
Parkside Elementary	Fredericksburg	School / Shelter
Post Oak Middle	Spotsylvania	School / Shelter
Riverbend High	Fredericksburg	School / Shelter
Riverview Elementary	Spotsylvania	School / Shelter
Robert E. Lee Elementary	Spotsylvania	School / Shelter
Salem Elementary	Fredericksburg	School / Shelter
Smith Station Elementary	Fredericksburg	School / Shelter
Spotswood Elementary	Fredericksburg	School / Shelter
Spotsylvania High	Spotsylvania	School / Shelter
Spotsylvania Middle	Spotsylvania	School / Shelter
Thronburg Middle	Spotsylvania	School / Shelter
Wilderness Elementary	Spotsylvania	School / Shelter

Table 12: Stafford County Critical Facilities

Facility Name	City	Facility type
Stafford Sheriff's Office	Stafford	Sheriff / EOC
Aquia Harbor Police	Stafford	Police Dept
Dept. of Fire Rescue and Safety	Stafford	Fire / Rescue
Stafford County Fire Marshall	Stafford	Fire Marshall
Stafford Volunteer Fire Assn	Stafford	Fire Dept Headquarters
Company 8 Rock Hill Volunteer Fire	Ruby	Fire
Company 1 Falmouth	Falmouth	Fire D
Company 3 Widewater Fire and Rescue	Stafford	Fire / Rescue
Company 4 Mountain View Fire	Stafford	Fire
Rescue 4 Mountain View EMS	Falmouth	EMS
Company 6 Hartwood Volunteer Fire & Rescue	Hartwood	Fire / Rescue
Rescue 7 White Oak EMS	Falmouth	Fire
Company 12 Berea Fire & Rescue	Stafford	Fire / Rescue
Company 9 Aquia Fire & Rescue	Stafford	Fire / Rescue
Company 7 White Oak Fire	Falmouth	Rescue
Rescue 8 Rock Hill EMS	Ruby	EMS
Company 2 / Rescue 1 Stafford Fire & Rescue	Stafford	Fire / EMS
Company 5 Brooke Fire & Rescue	Brooke	Fire / EMS
Company 14 North Stafford Fire	Stafford	Fire
Company 10 Potomac Hills Fire & Rescue	Stafford	Fire / Rescue
Smith Lake Water Treatment Facility	Stafford	Potable Water
Abel Lake WTP	Stafford	Potable Water
Aquia Wastewater Treatment Facility	Aquia	Wastewater
Little Falls Run Wastewater Treatment Facility	Stafford	Wastewater Treatment
Stafford County Schools Administration Center	Stafford	Administration
Anne E. Moncure Elementary	Stafford	School / Shelter
Garrisonville Elementary	Stafford	School / Shelter
Park Ridge Elementary	Stafford	School / Shelter
Ferry Farm Elementary	Stafford	School / Shelter
Widewater Elementary	Stafford	School / Shelter
Falmouth Elementary School	Stafford	School / Shelter
Conway Elementary	Fredericksburg	School / Shelter
Hampton Oaks Elementary	Stafford	School / Shelter
Stafford Elementary	Stafford	School / Shelter
Kate Walker Barret Elementary	Stafford	School / Shelter
Margaret Barret Elementary	Stafford	School / Shelter
Rockhill Elementary	Stafford	School / Shelter
Grafton Village Elementary	Fredericksburg	School / Shelter
Winding Creek Elementary	Stafford	School / Shelter
Rocky Run Elementary	Fredericksburg	School / Shelter
Anthony Burns Elementary	Stafford	School / Shelter
Hartwood Elementary	Stafford	School / Shelter

T. Benton Gayle Middle	Fredericksburg	School / Shelter
Stafford Middle	Stafford	School / Shelter
Shirley C. Heim Middle	Stafford	School / Shelter
Rodney E. Thompson Middle	Stafford	School / Shelter
H. H. Poole Middle	Stafford	School / Shelter
Edward Drew Middle	Falmouth	School / Shelter
Dixon-Smith Middle	Fredericksburg	School / Shelter
A.G. Wright Middle	Stafford	School / Shelter
North Stafford High	Stafford	School / Shelter
Mountain View High	Stafford	School / Shelter
Stafford High	Stafford	School / Shelter
Brooke Point High	Stafford	School / Shelter
Colonial Forge High	Stafford	School / Shelter

Critical Infrastructure

The City of Fredericksburg has several petroleum pipelines that run through the upriver watershed from which Fredericksburg obtains its water supply. All water supply reservoirs have been established on tributaries, but the following pipelines still cross the Rappahannock River upstream of the water intakes at Hunting Run, Motts Run, and Rocky Pen Run: The Colonial pipeline, Columbia Gas pipeline, Transcontinental Gas line, Commonwealth Gas pipeline, and an additional pipeline carrying fuel from Texas to New York running through the County.

Spotsylvania County, Livingston Elementary School is located nearby the Lake Anna North Anna Power Station, which in the event of an emergency requires evacuation procedures that follows the Spotsylvania County Schools Radiological Emergency Response Plan in coordination with Spotsylvania County Emergency Service. In the event of an evacuation, the public will be directed to the Evacuation Assembly Center.

Stafford County

Figure 21. Stafford County Infrastructure
Source: Stafford County Website

Rivers and Impaired Waterways

The Planning District region includes many local waterways: Potomac River, Rappahannock River, Mattaponi River, Numerous tributaries, Lake Anna and other lakes, Motts Run Reservoir and other reservoirs; more than 40 state, county, and city parks; many battlefields and historic sites; and miles of sidewalks, shared use paths, and bike trails along the waterways. GWRC needs clean waterways for outdoor fun (kayaking, fishing, and swimming), public health (drinking water, seafood, and physical health), and natural habitats for native plants, birds, and animals. GWRC has 113 impaired waterways as of 2020. The impaired waterways in each jurisdiction throughout the region are in the process of being identified (Appendix C).

Stafford County has 22 impaired waterways.

City of Fredericksburg has 3 impaired waterways.

Spotsylvania County has 35 impaired waterways.

King George County has 10 impaired waterways.

Caroline County has 43 impaired waterways.

TMDL implementation plans to restore water quality in the following watersheds include:

Mattaponi River Watershed – The majority of this watershed lie within Caroline and Spotsylvania Counties. The 2016 TMDL report documented that E. coli levels at 15 monitoring locations had exceeded the maximum assessment criterion of 235 colony forming units (cfu) per 100 milliliters (100 mL) for more than 10.5 percent of the samples collected within a six-year assessment period.

Upper York River Basin is partially located in Spotsylvania County, the BMPs listed below and estimated costs are based on all of the watersheds in the state of Virginia.

Agricultural Best Practices: The 2016 TMDL report identified that bacteria from pasture land is the largest source of bacteria in area streams. For the Mattaponi River watershed, streamside fencing to keep cattle out of streams, riparian buffer areas along streams, and improved pasture management are therefore top priorities. A comprehensive suite of agricultural best practices was identified and categorized as "Livestock Exclusion, Pasture and Cropland improvements, and Equine BMPs. Restricting cattle access to streams eliminates direct deposition of bacteria into area streams, creates a riparian buffer zone between the fence and stream, and reduces the quantity of bacteria that reaches the stream through stormwater runoff from pastures.

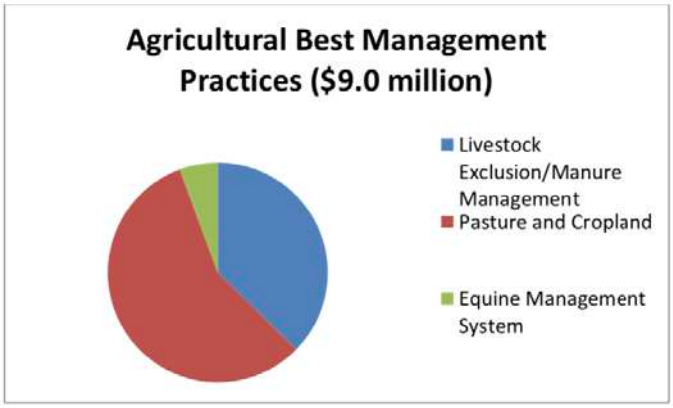


Figure 22. BMP for Agriculture in all of Virginia's Watersheds.
Source: DCR 2011 Technical Report

Residential Septic System Best Practices: Poorly maintained or failing septic systems can contribute significantly to bacteria contamination of surface waters. The TMDL plan was well informed on the number, age, and geographical distribution of septic systems across the watershed to support preparation of the GWRC WIP III. The TMDL plan recommends a combination of septic system maintenance, repair, and system replacement BMPs, along with a modest number of potential sewer system hookups in watersheds served by existing wastewater treatment facilities.

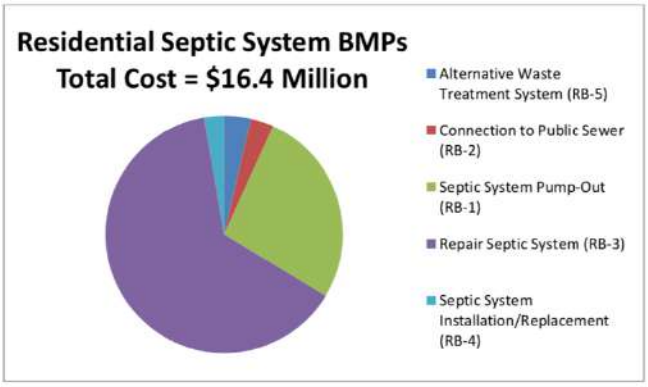


Figure 23. BMP for Septic in all Virginia's Watersheds.
Source: DCR 2011 Technical Report

Developed Land Best Practices: Stormwater from developed land also contributed to bacteria in streams, especially where pet wastes are not properly managed. Residential work group members supported inclusion of pet waste BMPs and an education and outreach program to address pet waste sources of bacteria. The cost of recommended stormwater and pet waste management BMPs for each of the identified impaired watersheds.

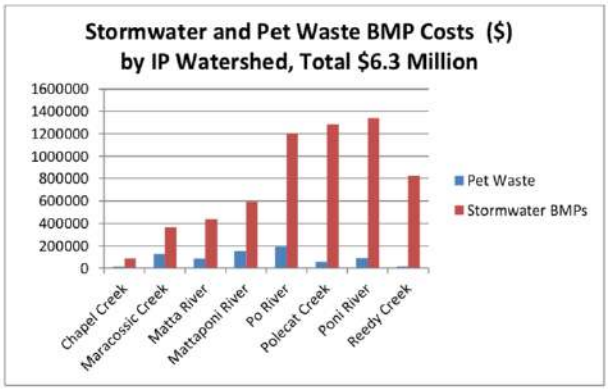


Figure 24. BMP for stormwater run-off in all Virginia's Watersheds.
Source: DCR 2011 Technical Report

Topography

Vulnerability to natural hazards such as sea level rise and flooding can be impacted by the topography of an area, in the George Washington Region vulnerability to natural hazards are increased for low lying coastal areas of Stafford and King George County.

Stafford County topography generally consists of rolling hills with most steep slopes occurring at the County's rivers, streams, and creeks. The elevation ranges from sea level to about 450 feet with higher elevations towards the western part of the County. The County's highest elevation is located at the norther tip of the County.

Caroline County topography varies within the County depending on location, consisting of gentle and moderate sloping with elevations ranging from 50 to 350 feet above sea level. Some areas with steep slopes (>15%) exist along streams or rivers.

King George County topography is flat with steep sloping, much of which is rugged. Elevations range from 0 feet to slightly over 200 feet above sea level. Slopes range from 0-10% in the plains and on ridge tops. Slopes on the ridge rides range between 6% and 45%. A majority of the rugged topography lies north of State Route 3 and west of U.S. 301.

Spotsylvania County topography is generally rolling hills and flat coastal plain, however there are areas where fairly steep slopes exist as a result of erosion of streams over time. Elevation ranges from a high of about 450 feet above sea level in the western section of the county to sea level in the northeastern area along the Rappahannock River. Roughly 9% of the county's soils are moderately sloped 15-25%, while an additional 3.7% of county's soils exceed 25% in slope.

City of Fredericksburg is characterized by moderate to steep slopes and elevations ranging between 280 feet above sea level at its highest reaches to less than 10 feet above sea level along the tidal portion of the Rappahannock River, the average elevation is approximately 59 feet above sea level.

Soil Erodibility

Erodible soil refers to the transportation of soil by wind or water. Some soils are more susceptible to erosion due to their composition as well as the slope and vegetative cover of the land. As development continues to occur in the George Washington Region, counties should consider the soil erosion as this will affect the siting suitability of dwellings, farming, or septic systems.

Stafford County soils classified as either highly erodible or potentially highly erodible is 75%.

Table 13: Stafford County Soil Erodibility

Erodibility	Acres	Percent
Not Highly Erodible Land	28,508	15.7%
Potentially Highly Erodible	73,049	40.2%
Highly Erodible Land	69,865	38.5%
Not Rated	10,259	5.6%

Caroline County land area is constituted by 21% highly erodible soils or 73,241 acres. The Chesapeake Bay Preservation Act also identifies these soils as a resource worthy of designation as a component of the Resource Management Area.

The City of Fredericksburg land area is constituted by almost 50% medium erodible soil, specifically stratified Coastal Plain Sediment-Ruston-Faceville.

King George County does not have data on soil erodibility readily available to the public.

Spotsylvania County is one of the most diverse soil communities in Virginia, with approximately 42 soil classifications mapped throughout the County by the U.S. Dept of Agriculture, Soil Conservation Services. Spotsylvania does not have data on soil erodibility readily available to the public.

Initial Needs for Regional Resilience

1. Defining what resilience means to GWRC.
2. Flood evacuation or snow evacuation plans for jurisdictions within the region
3. Obtain data and establish plan to address roadways that are prone to flooding within the GW region.
4. Environmental Justice: Identifying disproportionately at-risk (otherwise known as "front line") communities that need further assistance using environmental, social, and economic variables.
    a. Create a plan to identify and address the environmental justice populations of the GW Region.
5. Stafford County has a very thorough GIS database (Stafford GIS) and information readily available to the public, all other jurisdictions in the region should attempt to update the data in theirs accordingly to have consistent GIS mappers regionally. Being consistent with all of the entities across the community to promote a truly coordinate effort for regional resilience.
    a. Mapping dam inundation zones in all counties (Stafford County has already completed this) and mapping high-risk dams throughout the region, this will protect human life and property loss through better preparing the county and region as a whole in the event of a dam failure.
6. Filling in data gaps in soil erodibility as this will impact flooding and development considerations regionally.
    a. Fredericksburg, King George County, and Spotsylvania do not have data on soil erodibility readily available to the public
7. Identification and potential mapping of regional repetitive and severe repetitive loss structures.
8. Assessment of building codes being regularly updated and properly implemented.
9. GHG inventory for each locality and strategies to be net-zero by 2040
    a. City of Fredericksburg already has this data and commitment to net zero.
10. Shoring up public and private lands that are prone to recurrent flooding or will be at higher flood risk according to sea level rise and climate change models.

Potential Resilience Projects and/or Policies:

1. Create a Coastal Resiliency Advisory Committee that is representative of the communities being served to provide community engagement within the decision-making process.
2. Map dam vulnerability.
3. Identification of ecosystems/wetlands/floodplains that are suitable for permanent protection or acquisition.
4. Create map of Regional Critical Facilities and Infrastructure.
5. Targeted community outreach for predominately minority, low-income, or other vulnerable communities or communities that are not always included in the planning process.
6. Increased education on residential and private property green infrastructure projects.

Prioritizing Resilience Projects

The prioritization framework for regional resilience projects was based off an adapted version of the prioritization process and metrics utilized in the GWRC Green Way Plan. The goals of the prioritization process are to:

(1) Protect the built and natural environments from hazards
  (a) Life, Property, Livelihoods
(2) Establish Regional finance plan
(3) Incorporate state-wide goals and recommendations into project prioritization
(4) Establish a framework for future resilience projects

The table below outlines the prioritization indicators that were identified and subsequent factors of consideration within each indicator.

Prioritization Indicator	Factors of Considerations
Safety	• Evacuation Routes
Feasibility	• Available Funding • Shovel-Readiness • Right of Way/Public Property • Easements • Terrain Obstacles • Scale o Policy versus individual construction project versus education campaign

Prioritization Indicator	Factors of Considerations
Connectivity	• Drainage • Habitats/Contiguous Greenways • Lack of flood resistant infrastructure • Density

Public/Political Support	• Consistency with other regional goals and plans
	  o State TMDL
	  o State Resilience
	• Public Buy-in and Participation in regional resilience actions

Most Impacted Communities	• ALICE and Disabled Populations inclusion and accommodation within resilience projects
	• Environmental Justice Population
	  o Avg. Income
	  o Key Health Indicators (life expectancy, above average asthma, heart disease, etc.)
	  o Vulnerabilities to natural hazards

Life Cycle Costs	• Implementation/Construction costs versus the projected co-benefits • Nature Based Solutions

APPENDIX A – Relevant Data Bases

Database	Use/Purpose	Downloadable	Link:
Chesapeake Healthy Watersheds Assessment	1. Support the Chesapeake Bay Program and its jurisdiction partners 2. Detect "signals of change" in the state-identified healthy watersheds 3. Provide information useful to support strategies to protect and maintain watershed health 4. Provide an "early warning" to identify factors that could cause future degradation 5. Allow for communication and management action	Yes	Map Viewer: https://gis.chesapeakebay.net/healthywatersheds/assessment/ Data Portal: https://data-chesbay.opendata.arcgis.com/
Virginia Natural Heritage Data Explorer	ConserveVirginia: 1. Agriculture & Forestry Category 2. Natural Habitat & Ecosystem Diversity Category 3. Floodplains & Flooding Resilience Category 4. Cultural & Historic Preservation Category 5. Scenic Preservation Category 6. Protected Landscapes Resilience Category 7. Water Quality Improvement Category	Yes	*Map Viewer:* https://vanhde.org/content/map *Data Download:* https://www.dcr.virginia.gov/natural-heritage/cldownload
Virginia Coastal Geospatial and Educational Mapping System (GEMS)	1. Impaired waterways (303D) 2. Threatened and endangered water species 3. Coastal wildlife concerns, conservation planning, sea level rise impacts	Yes	http://www.coastalgems.org/ Data Download: *Source varies. Provided in information section for each layer within the map viewer.*
CCFR Recurrent Flooding Risk	Provides Coastal Virginia Sea Level Rise and Flooding Predictions for 2040, 2060, and 2080. Includes: Flooded Streets, Impacted Structures, Areas Impacted by Moderate Flood Events, and Areas Permanently Flooded by Sea Level Rise	Web Only	https://www.arcgis.com/home/webmap/viewer.html?webmap=36e758f7e2b544a980962faef1faaeb4&extent=-79.355,36.0917,-71.2415,39.4684

Database	Use/Purpose	Downloadable	Link:
Virginia Environmental Data Mapper	Provides water quality assessments, brownfields, renewable energy, etc. layers	Yes	*Link:* https://geohub-vadeq.hub.arcgis.com/ *Download:* https://geohub-vadeq.hub.arcgis.com/pages/f2d02039086b4a5c845152faa2f372e4
Virginia Fish and Wildlife Information Service	Provides a list of fish and wildlife for jurisdictions within Virginia. Provides in-depth information regarding specific species, habitat, distribution, etc. Can be useful ***to identify threatened and endangered species*** for CPDC jurisdictions.	Yes, data tables available by locality	https://services.dwr.virginia.gov/fwis/?Menu=Home
Wildlife Environmental Review Map Service	*GIS shapefiles and Comprehensive datasets for conservation planning and assessing potential impacts to wildlife and recreational resources.*	***Yes, currently subscriber only***	https://dwr.virginia.gov/gis/werms/
Virginia Wildlife Action Plan	Provides information on habitat conservation, local action plan summary for the CPDC region, and prioritization species	PDF	*Link to report:* http://bewildvirginia.org/wildlife-action-plan/
Virginia threatened and Endangered Species	Provides a comprehensive list of threatened and endangered species in VA	PDF	https://www.dgif.virginia.gov/wp-content/uploads/virginia-threatened-endangered-species.pdf
Virginia native and naturalized species,	Comprehensive list of Virginia Native and Naturalized species	PDF	https://www.dgif.virginia.gov/wp-content/uploads/virginia-native-naturalized-species.pdf

Database	Use/Purpose	Downloadable	Link:
Virginia Cultural Resources Information System	*VCRIS is the Department of Historic Resources' statewide electronic cultural resources GIS and database. It provides interactive views of information in the DHR Archives related to properties, historic districts, and archaeological sites, and presents evaluative information about the historic significance of resources.* *Note: More comprehensive datasets are available with a VCRIS License*	Online Viewer	https://www.dhr.virginia.gov/v-cris/
Historic Registers, Virginia DHR	Listings of properties listed under the Virginia Landmarks Registers, and the National Register of Historic Places	N/A	https://www.dhr.virginia.gov/historic-registers/
DCR's Natural Heritage Website	Provides information on Natural Areas Preserves, Rare Species and Natural Communities, Native Plants, Invasive Plants, Caves/Karst, as well as site selection for Pollinator Smart Solar Sites	Varies depending on resource	https://www.dcr.virginia.gov/natural-heritage/natural-area-preserves/
Virginia Natural Landscape Assessment (VaNLA)	A geospatial landscape analysis tool that can be used for identifying, prioritizing, and linking natural lands in Virginia. Provides data on Conserve Virginia priorities, agriculture, cultural resources, and other categories.	Varies by data type.	https://www.dcr.virginia.gov/natural-heritage/vaconvisvnla
DCR's Land Conservation Data Explorer Geographic Information System	Provides a geospatial data on VA's conservation lands.	Yes, shapefiles and metadata are available for download.	https://www.dcr.virginia.gov/natural-heritage/clinfo
VDOT's Scenic Byways Map	Provides maps of VDOT listed scenic byways throughout the State	Maps available for download	http://www.vdot.virginia.gov/programs/prog-byways.asp
Virginia Estuarine and Coastal Observing System	Shows the results of water quality and meteorological data monitoring from the Chesapeake Bay and associated tributaries within Virginia.	Yes	http://vecos.vims.edu/Default.aspx

Database	Use/Purpose	Downloadable	Link:
Chesapeake Bay Monitoring Cooperative – Chesapeake Data Explorer	A tool for storing and sharing data collected by a network of water quality. Contains data from multiple resources and monitoring sites throughout the CPDC region. Uses a GIS based map for displaying locations.	Yes	https://cmc.vims.edu/#/home
Chesapeake Bay Environmental Forecast System (CBEFS)	Uses a computer model to forecast the environmental conditions throughout Chesapeake Bay every day, including salinity and water temperature, along with dissolved oxygen and acidification. Low dissolved oxygen and changing acidification can have harmful impacts on the Chesapeake Bay ecosystem.	N/a web view updated daily	https://www.vims.edu/research/topics/dead_zones/forecasts/cbay/index.php
Adapt VA	Provides forecasting models regarding water levels, temperature, and precipitation. Also includes case studies for resilience planning for climate change, and data resources	Yes	http://adaptva.org/index.html
Sea Level Rise, NOAA	1. Visualize potential impacts from sea level rise through maps and photos 2. Learn about data and methods through documentation 3. Share maps and links via email and social media	Yes	https://coast.noaa.gov/digitalcoast/tools/slr.html
Coastal Flood Exposure Mapper, NOAA	Online visualization tool that supports localities in assessing their coastal hazard risks and vulnerabilities. Maps can be saved, downloaded, or shared to support in communication of flood exposure and potential impacts.	Yes	https://coast.noaa.gov/digitalcoast/tools/flood-exposure.html
Wetland Condition Assessment Tool (WetCAT)	A spatially-specific, interactive, only tool that provides water quality and habitat condition assessment for mapped non-tidal wetlands in Virginia.	Online Viewer with Map Printing function.	https://www.vims.edu/ccrm/wetlands_mgmt/wetcat/index.php
EnviroAtlas, EPA	EnviroAtlas provides geospatial data, easy-to-use tools, and other resources related to ecosystem services, their chemical and non-chemical stressors, and human health.	Yes	https://www.epa.gov/enviroatlas

Database	Use/Purpose	Downloadable	Link:
Chesapeake Bay and the Outer Coasts of Maryland and Virginia 2016 ESI FISH Polygons, Lines	This data set contains sensitive biological resource data for marine, estuarine, anadromous, and freshwater fish species in Chesapeake Bay and the Outer Coasts of Maryland and Virginia. Vector polygons in this data set represent fish distribution, concentration areas, spawning areas, nursery areas, and migration runs. Species specific abundance, seasonality, status, life history, and source information are stored in relational data tables (described below) designed to be used in conjunction with this spatial data layer. This data set comprises a portion of the ESI data for Chesapeake Bay and the Outer Coasts of Maryland and Virginia. ESI data characterize the marine and coastal environments and wildlife by their sensitivity to spilled oil. The ESI data include information for three main components: shoreline habitats, sensitive biological resources, and human-use resources. See also the FISHL data layer, part of the larger Chesapeake Bay and the Outer Coasts of Maryland and Virginia ESI database, for additional fish information.	Yes	https://www.fisheries.noaa.gov/inport/item/55093
Virginia Vulnerability Viewer	Online mapping tool providing social and environmental vulnerability throughout Virginia	Online viewer	https://cmap2.vims.edu/SocialVulnerability/SocioVul_SS.html
EJSCREEN: Environmental Justice Screening and Mapping Tool	EJSCREEN is an environmental justice mapping and screening tool that provides EPA with a nationally consistent dataset and approach for combining environmental and demographic indicators. EJSCREEN users choose a geographic area; the tool then provides demographic and environmental information for that area. All of the EJSCREEN indicators are publicly available data. EJSCREEN simply provides a way to display this information and includes a method for combining environmental and demographic indicators into EJ indexes.	Yes	*Link:* https://www.epa.gov/ejscreen *Limited English Proficiency Link:* https://www.lep.gov. *Data Download:* https://www.epa.gov/ejscreen/download-ejscreen-data
VTrans Vulnerability Assessment	Provides a screening level assessment of the vulnerability of Virginia's transportation system public roadways and VDOT-maintained structures, covered in the National Bridge Inventory (NBI), to projected sea level rise, storm surge, and inland/riverine flooding scenarios.	No	https://www.vtrans.org/long-term-planning/vulnerability

APPENDIX B – Goals and Objectives of Previous Regional Plans

ID Number	Year	Project Description	Lead/ Support Agency	Funding Source	Target Completion Date	Interim Measure of Success	Priority – (High, Medium, Low)
GWR-1	2017	Establish uniform GIS standards for capabilities and data throughout the GWRC region.	GWRC	Local	On-going	Continued transmission of GIS datasets to central ftp site	Medium
GWR-2	2017	Continue to improve regional inter-operable emergency communications and planning by coordinating and sharing GIS and other data.	GWRC	FEMA Unified Hazard Mitigation Assistance Funding	On-going	Develop information sharing plan to focus on sharing GIS datasets, MOUs, and IT procurement documents	Medium
GWR-3	2017	Refine and make available to the jurisdictions, the current regional critical facilities database maintained by the GWRC. Ensure common definition of critical facilities among the region and map each location using GIS.	GWRC	FEMA Unified Hazard Mitigation Assistance Funding	2017	Define critical facilities	Low
GWR-4	2017	Improve signage along major interstates and thoroughfares with interactive signs to provide hazard warnings, weather information, road closings, etc. Suggested locations include I-95 and Routes 1, 3, 17, 301, and 610.	GWRC/FAMPO	FAMPO Unified Planning Work Program	On-going	Incorporate in LRTP as program recommendation	Low
GWR-5	2017	Investigate emergency lane/shoulder improvements for Emergency Services access on all primary roads.	GWRC/FAMPO	FAMPO Unified Planning Work Program	On-going	Recommendations in special corridor studies	Low

ID Number	Year	Project Description	Lead/ Support Agency	Funding Source	Target Completion Date	Interim Measure of Success	Priority – (High, Medium, Low)
GWR-6	2017	Identify and publicize local evacuation routes throughout the region.	GWRC/FAMPO	FAMPO Unified Planning Work Program	On-going	Incorporate in LRTP as program recommendation	High
GWR-7	2017	Identify traffic plan/alternative routes due to closures on primary routes such as 1, 3, 17, 301, and 610.	GWRC/FAMPO	FAMPO Unified Planning Work Program	On-going	Recommendations in special corridor studies	Low
GWR-8	2017	Evaluate the vulnerability of the region's critical facilities to hazards and make recommendations for improving resiliency; focusing on generator power to shelters.	GWRC	FEMA Unified Hazard Mitigation Assistance Funding	2019	Define critical facility	High
GWR-9	2017	Review regional compliance with the NFIP on an annual basis and make recommendations where appropriate.	GWRC	FEMA Unified Hazard Mitigation Assistance Funding	Annually	Determine review parameters	High
GWR-10	2017	Develop a regional preparedness guide focusing on natural hazards to disseminate to the public.	GWRC	FEMA Unified Hazard Mitigation Assistance Funding	2018	Identify funding source and determine hazards to be included in guide	Low

GWRC Hazard Mitigation Plan Goals

The development of strategies included a thorough review of all-natural hazards and identified far-reaching policies and projects intended not only to reduce the future impacts of hazards, but also to assist counties and municipalities achieve compatible economic, environmental, and social goals.

1. Prevention of Future Risk
2. Protection of the Built Environment
3. Natural Resource Protection
4. Hazard Modification Through Construction
5. Emergency Services
6. Public Education and Awareness

The Regional Goals include:

1. Identify and implement projects that will eliminate long-term risk, directly reduce impacts from hazards, and maintain continuity of critical societal functions.
2. Incorporate mitigation concepts and objectives into existing and future policies, plans, regulations, and laws in the Commonwealth.
3. Improve the quality of the data and analysis used in hazard identification and risk assessment processes in state, local, and university hazard mitigation plans.
4. Through training, education, and outreach promote awareness of hazards, their risk, and potential mitigation actions in order to increase resiliency.

In addition to the adoption of the Hazard Mitigation Plan, the GWRC communities will attempt to:

- Pursue the implementation of the high-priority, low/no-cost recommended actions
- Keep the concept of mitigation in the forefront of community decision-making by identifying and stressing the recommendations of the Hazard Mitigation Plan when other community goals, plans, and activities are discussed and decided upon
- Maintain a constant monitoring of multi-objective, cost-share opportunities to assist the participating communities in implementing the recommended actions of this plan for which no current funding or support is available.

The GWRC region will remain committed to the National Flood Insurance Program, they will continue to enforce floodplain regulations and undertake other actions to remain in compliance with the program.

Priority 1-Low 5-High	**Project Phase**	**Locality**	**Location**	**Strategy / Project Name**	**Project Idea Source**	**Brief Description**	**Potential Funding Source**
2	Conceptual	Caroline County	Bowling Green	Floodplain improvements	GWRC Hazard Mitigation Plan	Develop and support a program for mitigation of priority flood-prone structures through promotion of acquisition/ demolition, elevation, flood proofing, minor localized flood control projects, mitigation reconstruction. The county does not have capacity to carry this out.	FEMA / VDEM
2	Conceptual	Caroline County	Caroline County	Floodplain improvements	GWRC Hazard Mitigation Plan	Develop and support a program for mitigation of priority flood-prone structures through promotion of acquisition/ demolition, elevation, flood proofing, minor localized flood control projects, mitigation reconstruction. The county does not have capacity to carry this out	FEMA / VDEM
2	Conceptual	Caroline County	Port Royal	Floodplain improvements	GWRC Hazard Mitigation Plan	Develop and support a program for mitigation of priority flood-prone structures through promotion of acquisition/ demolition, elevation, flood proofing, minor localized flood control projects, mitigation reconstruction. The county does not have capacity to carry this out	FEMA / VDEM
2	Conceptual	City of Fredericksburg	City of Fredericksburg	Floodplain improvements	GWRC Hazard Mitigation Plan	Develop and support a program for mitigation of priority flood-prone structures through promotion of acquisition/ demolition, elevation, flood proofing, minor localized flood control projects, mitigation reconstruction. The county does not have capacity to carry this out	FEMA / VDEM
2	Conceptual	King George County	King George County	Floodplain improvements	GWRC Hazard Mitigation Plan	Develop and support a program for mitigation of priority flood-prone structures through promotion of acquisition/ demolition, elevation, flood proofing, minor localized flood control projects, mitigation reconstruction. The county does not have capacity to carry this out	FEMA / VDEM
2	Conceptual	Spotsylvania County	Spotsylvania County	Floodplain improvements	GWRC Hazard Mitigation Plan	Develop and support a program for mitigation of priority flood-prone structures through promotion of acquisition/ demolition, elevation, flood proofing, minor localized flood control projects, mitigation reconstruction. The county does not have capacity to carry this out	FEMA / VDEM

Environmental Services Strategic Plan (2020)

GWRC worked with regional stakeholders to develop a multi-year strategic plan for coastal zone management that aligns with the goals and focus areas of the Virginia Coastal Zone Management Program (CZM) and responds to needs of the local jurisdictions of Planning District 16.

The conceptual development and prioritization of projects equipped GWRC with a list of projects ranging from planning activities to "shovel-ready" designs. These are not limited to shoreline or stormwater management projects. The plans goals, objectives, and strategies are focused in 10 areas, one of which being resilience.

Strategic Plan Approach

NOAA's Office for Coastal Management recommends assessing the target population, preforming a self-evaluation, and developing a niche as the first steps in the strategic planning process. Stakeholder identification and assessment focused on member locality staff, decision makers, and other interested stakeholders in the region. The following stakeholders are identified below.

State Government Stakeholders:
DEQ, VDOF, DCR, DWR, VDOT, VDEM, VDH, DHCD, DSS

Local Government Stakeholders:
Caroline County, City of Fredericksburg, King George County, Spotsylvania County, Stafford County

Other Interested Stakeholders:
U.S. Army Fort A.P. Hill, Naval District Washington, Marine Corps Base Quantico, University of Mary Washington, Germanna Community College, Friends of the Rappahannock, York and Small Coastal Basin Roundtable, Rappahannock River Basin Commission, Soil and Water Conservation Districts, Virginia Cooperative Extension, VA Institute of Marine Science, Climate Environment and Readiness, Northern Virginia Conservation trust, Friends of Dahlgren Railroad Heritage Trail, Resilience Adaptation Feasibility Tool, and Private companies.

The Environmental Services Strategic Plan includes a list of projects with sources of funding and timelines for completion as well as identifies areas of potential collaboration between regional stakeholders.

The full plan can be found at: https://gwregion.org/environment/environmental-services-strategic-plan

GWRC Green Infrastructure Plan

In 2009 GIS was utilized to quantify the amount of impervious surface and tree canopy, and the trends affecting a change in the relative amount of these dominant land cover patterns. Using this data GWRC worked to encourage and support active local conservation efforts and the adoption of BMPs to reduce stormwater run-off and associated sedimentation and pollution of regional stream and water bodies, producing maps of the Region's designated impaired waterways, regional eco-cores and corridors, potential regional greenway routes, and assessments of the ecosystem service value of the regions tree canopy.

Findings

1) The active development of the Region over the 13-year period from 1996 through 2009 contributed to a loss of 4.17% of its tree canopy, while gaining 2.80% of urban bare area, 8.68% of open space, and 43.46% of impervious surface area. The Region is still blessed with an enviable amount of tree canopy land cover, relative to other rapidly urbanizing or established urban metro areas.
2) The cumulative changes to the Region's land cover and associated losses to the Region's tree canopy resulted in the loss of the tree canopy's ability to naturally manage 222.98 million cubic feet of stormwater, valued at $1.06 billion using the average cost assumption of $4.75 per cubic foot for man-made stormwater retention facilities. The Region's "green infrastructure" also lost the ability to remove approximately 2.89 million lbs. of air pollutants annually, valued at $7.74 million per year, 1.24 million lbs. of carbon stored in trees' wood, and 9,616 lbs. of annual carbon sequestration.
3) Local governments in the region do not, generally speaking, have reliable data on the amount of impervious surface area within their jurisdiction to estimate stormwater runoff by sub-watershed or to use to identify priority areas for urban retrofit programs or to target reforestation efforts.
4) Active coordination between local government urban stormwater management programs and rural-oriented Soil and Water Conservation District programs is vital to achieve balanced reductions in non-point source pollution. The SWCDs will be challenged in addressing agricultural run-off issues and facilitating the development of nutrient management plans for each agricultural operation.
5) Between the urban MS4 program requirements and the Chesapeake Bay Preservation Act regulations requiring a cataloging of installed BMPs in each CBPA community, both urban and rural; all localities in the region should have a good grasp of the distribution of these facilities throughout their jurisdiction. However, the over-lapping and (at-times) seemingly contradictory stormwater regulations under various federal and state programs challenge local governments to cost-effectively manage development and associated stormwater-related water quality impacts.
6) Many of the planning tools authorized under the Code of Virginia have been utilized by local governments in PD 16 to manage growth and development and promote, directly or indirectly, the enhancement of the Region's green infrastructure.
7) Green infrastructure planning practice in the Region heretofore has focused somewhat more on advancing the stormwater management practices (as part of local governments' response to federal and state environmental mandates). However, such notable efforts as the acquisition of Crow's Nest – Part 2, the adoption of a Spotsylvania County Trailways Plan and local designation of urban development areas

demonstrates local movement toward the identification, prioritization and conservation of rural forests, working farms and other open spaces for their recognized ecological asset value.

8) Local governments have supported exploration (through Rappahannock River Basin Commission and other initiatives) of innovative approaches to "green infrastructure" planning, such as the development of a regional nutrient credit trading program and other market-based approaches to removing pollutants from the air and water sources that pollute the Chesapeake Bay and its tributaries.
9) There is no established locally-based, conservation-oriented land trust in Planning District 16 that can hold conservation easements. Consequently, local conservation easement negotiations must involve such out-of-region interest as the Northern Virginia Conservation Trust, the Virginia Outdoors Foundation and other entities.
10) Local governments are interested, if designated an ozone non-attainment area, in being added to the Code of Virginia (§ 15.2-961.1) that allows referenced local governments authority to adopt a local ordinance to include in site plan review provisions for the preservation or replacement of trees on the development site.

GWRC Green Infrastructure Plan- Recommendations

1) Adopt quantitative regional goals to achieve reforestation and land conservation outcomes, including:
   a) Increasing regional tree canopy by 5 percent (approximately 51.5 sq. miles), thereby restoring a little more than the amount of tree canopy lost in the Region in the 1996-2009 era, with priority given to infilling gaps in riparian buffers, and other areas that complement water quality protection programs implemented and expanded to respond to Chesapeake Bay watershed implementation planning goals.
   b) Encouraging public and private landowners to increase land acreage in the Region under conservation easement by 14,300 acres, representing the Region's pro-rata share of Governor McDonnell's 400,000-acre statewide conservation easement goal for his 4-year plan.
2) Continued collaboration of GWRC's ad-hoc watershed implementation plan committee with full local government technical staff participation and broad involvement of community-wide stakeholders from all sectors to develop a comprehensive, cost-effective regional responses to Chesapeake Bay Watershed Implementation Plan Phase 2 process and expansion of the installed inventory of BMPs.
3) Should a grant opportunity materialize, local governments should work through GWRC to create a 1-meter (or better) classified land cover data layer that could better define the Region's green and grey infrastructure and support comprehensive land use planning, green infrastructure planning and watershed implementation and stormwater management planning.
4) GWRC Boars endorsement of the Regional Green Infrastructure Plan and direction to staff to communicate the Plan document to local governments and other stakeholders in the Region as an advisory tool to help public and private actors incorporate green infrastructure planning into public and private comprehensive planning and land development processes.

Good Jobs Here Report

Goal 1. Create A Strong and Unique Regional Community Identity

	Objectives and Strategies	Responsible Party/Agency	Timeframe
1-1	Develop our regional identity		
	1-1a. Gather studies and other resources to understand identities of local communities in our region	GWRC / FRA	Short
	1-1b. Analyze and conglomerate identities of local communities	GWRC / FRA	Short
	1-1c. Investigate our region's role in the larger identities of Virginia, the Mid-Atlantic region, and the east coast considering the state capital, national capital, highway system, waterways, and other features	GWRC / FRA	Short
	1-1d. Develop a description of our regional identity	GWRC / FRA	Short
1-2	Promote our regional identity		
	1-2a. Create branding and marketing materials to advertise our identity	GWRC / FRA	Short
	1-2b. Distribute and advertise our identity	GWRC / FRA	Short
	1-2c. Collaborate within and across the region to promote adoption and use of our identity	GWRC / FRA	Short
1-3	Live up to the regional identity		
	1-3a. Develop regional metrics for success and a tracking and reporting system	GWRC / FRA	Short
	1-3b. Create regional task forces to address specific regional identity issues	GWRC	Medium
	1-3c. Develop a regional revenue sharing strategy	GWRC	Medium

Goal 2. Support Existing and Future Businesses

	Objectives and Strategies	Responsible Party/Agency	Timeframe
2-1	Revise regulations to lower barriers to major employers and small businesses		
	2-1a. Create an advocacy review group and provide guidance on legislative issues	FRCC	Short
	2-1b. Streamline local ordinances	GWRC / CKSSF	Medium
	2-1c. Lighten restrictions on zoning	GWRC / CKSSF	Medium
	2-1d. Simplify the process for starting a new business	GWRC / CKSSF	Medium
2-2	Retain and attract employers		
	2-2a. Develop a regional strategy for SWAM businesses (small, women-owned, and minority)	FRCC	Short

	2-2b. Recruit large employers	FRCC	Medium
	2-2c. Attract out-commuters and non-residents to work in region and increase workforce.	FRCC	Medium
	2-2d. Redevelop current commercial business parks	FRCC / CKSSF	Long
	2-2e. Promote a network among business owners and industry representatives in the region to create a vibrant economy	GWRC / FRCC	Short
	2-2f. Promote collaborations and partnerships among businesses, non-profits, and educational organizations in the region to spur innovation	GWRC / FRCC	Short
	2-2g. Create co-working space and other amenities for non-traditional companies/jobs	GWRC / FRCC	Short

Goal 3. Increase Vocational Education and Skilled Trade Capacity

	Objectives and Strategies	Responsible Party/Agency	Timeframe
3-1	Identify technical trade skills gap		
	3-1a. Poll regional employers on technical trade skill needs	GWRC / FRA	Short
	3-1b. Evaluate the industry for technical trade skill needs of potential new businesses	FRA / FRCC	Short
	3-1c. Evaluate availability of vocational education on those trade skills	FRA	Short
3-2	Build capacity in adult workforce		
	3-3a. Develop vocational education on trade skills in demand	GCC	Medium
	3-3b. Advertise vocational education opportunities to increase enrollment	FRA / FRCC	Medium
	3-3c. Identify those with an aptitude for trade skills and connect them to vocational education	RUW / GI	Medium
	3-3d. Promote collaborations and partnerships among businesses, non-profits, and educational organizations in the region related to skilled trades	GWRC / FRCC	Short
3-3	Build capacity in future workforce		
	3-3a. Restructure high school education programs to provide more training for regional jobs. For example, provide a pilot program for healthcare fields (more than nursing)	PSS	Short
	3-3b. Refocus high school education on career options, job availability, and impacts on lifestyle	PSS	Medium
	3-3c. Promote collaborations and partnerships in the region to provide career exploration opportunities, like field trips, apprenticeships, internships, and training opportunities.	PSS / GCC / FRCC	Short

Goal 4. Support A Good Quality of Life for Our Workforce

	Objectives and Strategies	Responsible Party/Agency	Timeframe
4-1	Support success of individuals		
	4-1a. Provide education and services spanning the life continuum (housing, food security, job security, financial literacy, etc.)	FRA / RUW / GI	Short
	4-1b. Identify ALICE citizens. Create innovative solutions to meet ALICE needs	FRA / RUW / GI	Short
	4-1c. Identify and meet the needs of pre-ALICE people (people not yet employed)	FRA / RUW / GI	Short
4-2	Improve community services		
	4-2a. Create an employer's council to address barriers to employment around affordable housing, family care (child and adult), background issues, and transportation.	FRA / FRCC	Short
	4-2b. Create a childcare initiative among local business to help fund and subsidize for employees	FRA / FRCC	Short
	4-2c. Develop a regional resilience plan addressing social, economic, and environmental aspects	GWRC / FRA	Short
	4-2d. Set diversity and inclusion targets for boards and commissions	GWRC / FRA	Short
	4-2e. Encourage public engagement by addressing physical, financial, and social accessibility challenges	CKSSF	Short
	4-2f. Promote collaborations and partnerships in the region among public and private social services providers to better meet the needs of our citizens.	FRA / RUW / GI	Short
4-3	Improve community infrastructure		
	4-3a. Evaluate and address the need for affordable housing	FRA / CKSSF / FABA	Medium
	4-3b. Improve and expand regional transit and non-motorized transportation options	FAMPO	Medium
	4-3c. Expand access to broadband		Medium
	4-3d. Promote mixed-use development practices and redevelopment of current corridors	FRA / CKSSF / FABA	Long

APPENDIX C – Impaired Waterways (DEQ Environmental Data Mapper 2020).

Stafford County

Assessment ID	Water Name	Watershed Waterway is located in	Impairment	Source
VAN-E10R_ALC01A00	Alcotti Run	Rappahannock River Basin	Escherichia coli (E. coli)	Grazing in Riparian or Shoreline Zones, Impacts from Land Application of Wastes, Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Livestock (Grazing or Feeding Operations), Sewage Discharges in Unsewered Areas, Runoff from Forest/Grassland/Parkland.
VAN-A28R_AUS02A06	Austin Run	Potomac and Shenandoah River Basins	Escherichia coli (E. coli)	Grazing in Riparian or Shoreline Zones, Sanitary Sewer Overflows (Collection System Failures), Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Livestock (Grazing or Feeding Operations), Urban Runoff/Storm Sewers, Runoff from Forest/Grassland/Parkland
VAN-A28R_AUS01A04	Austin Run	Potomac and Shenandoah River Basins	Escherichia coli (E. coli)	Grazing in Riparian or Shoreline Zones, Sanitary Sewer Overflows (Collection System Failures), Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Livestock (Grazing or Feeding Operations), Urban Runoff/Storm Sewers, Runoff from Forest/Grassland/
VAN-A29R_XLB01A08	Unnamed tributary to Long Branch	Potomac and Shenandoah River Basins	Benthic Macroinvertebrates Bioassessments	Source Unknown
VAN-A29R_POM02A06	Potomac Creek	Potomac and Shenandoah River Basins	Escherichia coli (E. coli)	Grazing in Riparian or Shoreline Zones, Sanitary Sewer Overflows (Collection System Failures), Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Livestock (Grazing or Feeding Operations), Urban Runoff/Storm Sewers, Runoff from Forest/Grassland/Parkland

VAN-A29R_ACC01A00	Accokeek Creek	Potomac and Shenandoah River Basins	Escherichia coli (E. coli)	Grazing in Riparian or Shoreline Zones, Sanitary Sewer Overflows (Collection System Failures), Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Livestock (Grazing or Feeding Operations), Urban Runoff/Storm Sewers, Runoff from Forest/Grassland/Parkland
VAN-A27R_AUA01A00	Aquia Creek	Potomac and Shenandoah River Basins	Escherichia coli (E. coli)	Source Unknown
VAN-E20R_FAL01A04	Falls Run	Rappahannock River Basin	Benthic Macroinvertebrates Bioassessments	Source Unknown
VAN-A29R_POR01A06	Potomac Run	Potomac and Shenandoah River Basins	Benthic Macroinvertebrates Bioassessments, Escherichia coli (E. coli)	Grazing in Riparian or Shoreline Zones, Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Source Unknown, Livestock (Grazing or Feeding Operations), Urban Runoff/Storm Sewers, Runoff from Forest/Grassland/Parkland
VAN-A29R_POM01A00	Potomac Creek	Potomac and Shenandoah River Basins	Escherichia coli (E. coli)	Grazing in Riparian or Shoreline Zones, Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Source Unknown, Livestock (Grazing or Feeding Operations), Urban Runoff/Storm Sewers, Runoff from Forest/Grassland/Parkland
VAN-E19R_HOR01A04	Horsepen Run	Rappahannock River Basin	Escherichia coli (E. coli)	Source Unknown
VAN-E20R_CLB01A00	Claiborne Run	Rappahannock River Basin	Escherichia coli (E. coli), PCBs in Fish Tissue	On-site Treatment Systems (Septic Systems and Similar Decentralized Systems), Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Source Unknown, Livestock (Grazing or Feeding Operations), Urban Runoff/Storm Sewers
VAN-A27R_XLN01A10	Unnamed tributary to Aquia Creek	Potomac and Shenandoah River Basins	Dissolved Oxygen	Source Unknown

VAN-E20R_RPP01A10	Rappahannock River	Rappahannock River Basin	Escherichia coli (E. coli), PCBs in Fish Tissue	On-site Treatment Systems (Septic Systems and Similar Decentralized Systems), Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Source Unknown, Livestock (Grazing or Feeding Operations), Urban Runoff/Storm Sewers
VAN-A27R_AUA02A02	Aquia Creek	Potomac and Shenandoah River Basins	Escherichia coli (E. coli)	Source Unknown
VAN-A26R_XLF01A10	Unnamed tributary to Potomac River	Potomac and Shenandoah River Basins	Escherichia coli (E. coli), pH	Grazing in Riparian or Shoreline Zones, Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Source Unknown, Livestock (Grazing or Feeding Operations), Urban Runoff/Storm Sewers, Runoff from Forest/Grassland/Parkland
VAN-E20R_LIA01A04	Little Falls Run	Rappahannock River Basin	Benthic Macroinvertebrates Bioassessments, Escherichia coli (E. coli)	On-site Treatment Systems (Septic Systems and Similar Decentralized Systems), Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Source Unknown, Livestock (Grazing or Feeding Operations), Urban Runoff/Storm Sewers
VAN-A26R_SOB01A12	South Branch Chopawamsic Creek	Potomac and Shenandoah River Basins	Escherichia coli (E. coli)	Source Unknown
VAN-E10R_DPR01A00	Deep Run	Rappahannock River Basin	Escherichia coli (E. coli)	Grazing in Riparian or Shoreline Zones, Impacts from Land Application of Wastes, Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Livestock (Grazing or Feeding Operations), Sewage Discharges in Unsewered Areas, Runoff from Forest/Grassland/Parkland.
VAN-E21R_WHT01A06	White Oak Run	Rappahannock River Basin	Benthic Macroinvertebrates Bioassessments, Escherichia coli (E. coli), pH	On-site Treatment Systems (Septic Systems and Similar Decentralized Systems), Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Source Unknown, Livestock (Grazing or Feeding Operations), Natural Conditions - Water Quality Standards Use Attainment

VAN-A26R_NOR01A02	North Branch Chopawamsic Creek	Potomac and Shenandoah River Basins	Escherichia coli (E. coli)	Sanitary Sewer Overflows (Collection System Failures), Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Livestock (Grazing or Feeding Operations), Urban Runoff/Storm Sewers, Runoff from Forest/Grassland/Parkland
VAN-E21R_MUY01B20	Muddy Creek	Rappahannock River Basin	Escherichia coli (E. coli)	On-site Treatment Systems (Septic Systems and Similar Decentralized Systems), Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Livestock (Grazing or Feeding Operations), Urban Runoff/Storm Sewers
VAN-E21R_MUY01A00	Muddy Creek	Rappahannock River Basin	Escherichia coli (E. coli)	On-site Treatment Systems (Septic Systems and Similar Decentralized Systems), Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Livestock (Grazing or Feeding Operations), Urban Runoff/Storm Sewers

City of Fredericksburg

Assessment ID	Water Name	Watershed Waterway is located in	Impairment	Source
VAN-E20R_XIA01A12	Unnamed tributary to Hazel Run	Rappahannock River Basin	Escherichia coli (E. coli)	On-site Treatment Systems (Septic Systems and Similar Decentralized Systems), Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Livestock (Grazing or Feeding Operations), Urban Runoff/Storm Sewers
VAN-E20R_XHN01A10	Unnamed tributary to Hazel Run	Rappahannock River Basin	Escherichia coli (E. coli)	On-site Treatment Systems (Septic Systems and Similar Decentralized Systems), Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Livestock (Grazing or Feeding Operations), Urban Runoff/Storm Sewers
VAN-E20R_HAL01A00	Hazel Run	Rappahannock River Basin	Benthic Macroinvertebrates Bioassessments, Escherichia coli (E. coli), PCBs in Fish Tissue	On-site Treatment Systems (Septic Systems and Similar Decentralized Systems), Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Source Unknown, Livestock (Grazing or Feeding Operations), Urban Runoff/Storm Sewers

King George County

Assessment ID	Water Name	Watershed Waterway is located in	Impairment	Source
VAN-A30R_PEP01A10	Pepper Mill Creek	Potomac and Shenandoah River Basins	Dissolved Oxygen, pH	Natural Conditions - Water Quality Standards Use Attainability Analyses Needed
VAP-A31R_PIN01A00	Pine Hill Creek Watershed	Potomac and Shenandoah River Basins	Escherichia coli (E. coli)	Non-point Source
VAN-E21R_LAM01A08	Lambs Creek	Rappahannock River Basin	Escherichia coli (E. coli)	On-site Treatment Systems (Septic Systems and Similar Decentralized Systems), Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Livestock (Grazing or Feeding Operations), Urban Runoff/Storm Sewers
VAN-A29R_DBR01A10	Dirt Bridge Run	Potomac and Shenandoah River Basins	Escherichia coli (E. coli)	Source Unknown
VAN-E21R_GIN01A08	Gingoteague Creek	Rappahannock River Basin	Benthic Macroinvertebrates Bioassessments, Escherichia coli (E. coli)	Source Unknown
VAN-E21R_JET01A10	Jetts Creek	Rappahannock River Basin	Escherichia coli (E. coli)	On-site Treatment Systems (Septic Systems and Similar Decentralized Systems), Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Livestock (Grazing or Feeding Operations)
VAN-E21R_MUY01A00	Muddy Creek	Rappahannock River Basin	Escherichia coli (E. coli)	On-site Treatment Systems (Septic Systems and Similar Decentralized Systems), Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Livestock (Grazing or Feeding Operations), Urban Runoff/Storm Sewers
VAP-A31R_MAO01A98	Mattox Creek	Potomac and Shenandoah River Basins	Escherichia coli (E. coli)	Municipal Point Source Discharges, Non-Point Source
VAN-A30R_GAM01A04	Gambo Creek	Potomac and Shenandoah River Basins	Dissolved Oxygen, pH	Natural Conditions - Water Quality Standards Use Attainability Analyses Needed

VAN-E21R_MUY01B20	Muddy Creek	Rappahannock River Basin	Escherichia coli (E. coli)	On-site Treatment Systems (Septic Systems and Similar Decentralized Systems), Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Livestock (Grazing or Feeding Operations), Urban Runoff/Storm Sewers

Caroline County

Assessment ID	Water Name	Watershed Waterway is located in	Impairment	Source
VAN-F17R_MPN02A20	Mattaponi River	York River Basin	Escherichia coli (E. coli)	Grazing in Riparian or Shoreline Zones, Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Livestock (Grazing or Feeding Operations), Sewage Discharges in Unsewered Areas, Runoff from Forest/Grassland/Parkland
VAN-F17R_MPN01A02	Mattaponi River	York River Basin	Escherichia coli (E. coli)	Grazing in Riparian or Shoreline Zones, Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Livestock (Grazing or Feeding Operations), Sewage Discharges in Unsewered Areas, Runoff from Forest/Grassland/Parkland
VAN-F22R_MAR04A08	Maracossic Creek	York River Basin	Escherichia coli (E. coli), pH	Grazing in Riparian or Shoreline Zones, Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Livestock (Grazing or Feeding Operations), Natural Conditions - Water Quality Standards Use Attainability Analyses Needed, Sewage Discharges in Unsewered
VAN-F17R_MPN02B02	Mattaponi River	York River Basin	Escherichia coli (E. coli)	Grazing in Riparian or Shoreline Zones, Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Livestock (Grazing or Feeding Operations), Sewage Discharges in Unsewered Areas, Runoff from Forest/Grassland/Parkland
VAN-F20R_PCT01A00	Polecat Creek	York River Basin	Benthic Macroinvertebrates Bioassessments	Source Unknown
VAN-F20R_PCT01B06	Polecat Creek	York River Basin	Dissolved Oxygen	Natural Conditions - Water Quality Standards Use Attainability Analyses Needed

VAN-F19R_HBS01A00	Hobby Swamp	York River Basin	Escherichia coli (E. coli), pH	Grazing in Riparian or Shoreline Zones, Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Livestock (Grazing or Feeding Operations), Natural Conditions - Water Quality Standards Use Attainability Analyses Needed, Sewage Discharges in Unsewered
VAN-F22R_MAR03A08	Maracossic Creek	York River Basin	Escherichia coli (E. coli)	Grazing in Riparian or Shoreline Zones, Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Livestock (Grazing or Feeding Operations), Sewage Discharges in Unsewered Areas, Runoff from Forest/Grassland/Parkland
VAN-F17R_MPN03A02	Mattaponi River	York River Basin	Escherichia coli (E. coli)	Grazing in Riparian or Shoreline Zones, Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Livestock (Grazing or Feeding Operations), Sewage Discharges in Unsewered Areas, Runoff from Forest/Grassland/Parkland
VAN-F22R_DOC01A08	Doctors Creek	York River Basin	Escherichia coli (E. coli), pH	Grazing in Riparian or Shoreline Zones, Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Livestock (Grazing or Feeding Operations), Natural Conditions - Water Quality Standards Use Attainability Analyses Needed, Sewage Discharges in Unsewered
VAN-F21R_RDY02B10	Reedy Creek	York River Basin	Escherichia coli (E. coli), Mercury in Fish Tissue	Grazing in Riparian or Shoreline Zones, Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Source Unknown, Livestock (Grazing or Feeding Operations), Sewage Discharges in Unsewered Areas, Runoff from Forest/Grassland/Parkland
VAN-F21R_MPN02A02	Mattaponi River	York River Basin	Escherichia coli (E. coli)	Source Unknown
VAN-F21R_RDY01A10	Reedy Creek	York River Basin	Mercury in Fish Tissue	Source Unknown
VAN-F21R_RDY02A10	Reedy Creek	York River Basin	Benthic Macroinvertebrates Bioassessments, Escherichia coli (E. coli), Mercury in Fish Tissue	Grazing in Riparian or Shoreline Zones, Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Source Unknown, Livestock (Grazing or Feeding Operations), Sewage Discharges in Unsewered Areas, Runoff from Forest/Grassland/Parkland
VAN-F19R_MOT01A04	Motto River	York River Basin	Escherichia coli (E. coli)	Grazing in Riparian or Shoreline Zones, Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Livestock (Grazing or Feeding Operations), Sewage Discharges in Unsewered Areas, Runoff from Forest/Grassland/Parkland

VAN-F20R_PCT02A02	Polecat Creek	York River Basin	Escherichia coli (E. coli)	Grazing in Riparian or Shoreline Zones, Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Livestock (Grazing or Feeding Operations), Sewage Discharges in Unsewered Areas, Runoff from Forest/Grassland/Parkland
VAN-F17R_PNI01A10	Poni River	York River Basin	Escherichia coli (E. coli)	Discharges from Municipal Separate Storm Sewer Systems (MS4), Grazing in Riparian or Shoreline Zones, Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Livestock (Grazing or Feeding Operations), Sewage Discharges in Unsewered Areas, Runoff from
VAN-F19R_STH03A08	South River	York River Basin	Escherichia coli (E. coli)	Grazing in Riparian or Shoreline Zones, Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Livestock (Grazing or Feeding Operations), Sewage Discharges in Unsewered Areas, Runoff from Forest/Grassland/Parkland
VAN-F22R_BEV02A08	Beverly Run	York River Basin	pH	Natural Conditions - Water Quality Standards Use Attainability Analyses Needed
VAN-E21R_MIC02A06	Mill Creek	Rappahannock River Basin	Benthic Macroinvertebrates Bioassessments	Source Unknown
VAP-F09R_XIM01A10	North Anna, UT	York River Basin	pH	Natural Conditions - Water Quality Standards Use Attainability Analyses Needed
VAN-F18R_MTA01A00	Matta River	York River Basin	Escherichia coli (E. coli)	Grazing in Riparian or Shoreline Zones, Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Livestock (Grazing or Feeding Operations), Sewage Discharges in Unsewered Areas, Runoff from Forest/Grassland/Parkland
VAN-F17R_XJV01A18	Unnamed Tributary to Poni River	York River Basin	Escherichia coli (E. coli), pH	Discharges from Municipal Separate Storm Sewer Systems (MS4), Grazing in Riparian or Shoreline Zones, Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Livestock (Grazing or Feeding Operations), Natural Conditions - Water Quality Standards Use
VAN-F21R_BOT01A20	Boot Swamp	York River Basin	Escherichia coli (E. coli)	Source Unknown
VAP-F09R_NAR01A00	North Anna River	York River Basin	Escherichia coli (E. coli)	Municipal Point Source Discharges, Non-Point Source
VAN-F22R_BEV01B00	Beverly Run	York River Basin	Escherichia coli (E. coli)	Grazing in Riparian or Shoreline Zones, Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Livestock (Grazing or Feeding Operations), Sewage Discharges in Unsewered Areas, Runoff from Forest/Grassland/Parkland

VAN-F17R_XJV02A16	Unnamed Tributary to Poni River	York River Basin	pH	Natural Conditions - Water Quality Standards Use Attainability Analyses Needed
VAN-E21R_MIC01A08	Mill Creek	Rappahannock River Basin	Escherichia coli (E. coli)	On-site Treatment Systems (Septic Systems and Similar Decentralized Systems), Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Livestock (Grazing or Feeding Operations)
VAN-E21R_WAE02A04	Ware Creek	Rappahannock River Basin	Benthic Macroinvertebrates Bioassessments, pH	Source Unknown, Natural Conditions - Water Quality Standards Use Attainability Analyses Needed
VAN-F21R_HER02A04	Herring Creek	York River Basin	Benthic Macroinvertebrates Bioassessments	Source Unknown
VAN-F22R_MAR01A02	Maracossic Creek	York River Basin	Escherichia coli (E. coli)	Grazing in Riparian or Shoreline Zones, Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Livestock (Grazing or Feeding Operations), Sewage Discharges in Unsewered Areas, Runoff from Forest/Grassland/Parkland
VAP-F09R_MLL01A12	Mill Creek	York River Basin	Escherichia coli (E. coli), pH	Municipal Point Source Discharges, Non-Point Source, Natural Conditions - Water Quality Standards Use Attainability Analyses Needed
VAN-E21R_GLL01A08	Goldenvale Creek	Rappahannock River Basin	Escherichia coli (E. coli), pH	On-site Treatment Systems (Septic Systems and Similar Decentralized Systems), Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Livestock (Grazing or Feeding Operations), Natural Conditions - Water Quality Standards Use Attainability Analyses
VAN-F16R_POR01A10	Po River	York River Basin	Escherichia coli (E. coli)	Discharges from Municipal Separate Storm Sewer Systems (MS4), Grazing in Riparian or Shoreline Zones, Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Livestock (Grazing or Feeding Operations), Sewage Discharges in Unsewered Areas, Runoff
VAP-F09R_NAR02A00	North Anna RIver	York River Basin	Escherichia coli (E. coli)	Municipal Point Source Discharges, Non-Point Source
VAN-F15R_NIR01A00	Ni River	York River Basin	Benthic Macroinvertebrates Bioassessments, Escherichia coli (E. coli)	Discharges from Municipal Separate Storm Sewer Systems (MS4), Grazing in Riparian or Shoreline Zones, Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Source Unknown, Livestock (Grazing or Feeding Operations), Sewage Discharges in Unsewered Area

VAN-E21R_MTC01A08	Mount Creek	Rappahannock River Basin	Escherichia coli (E. coli), pH	On-site Treatment Systems (Septic Systems and Similar Decentralized Systems), Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Livestock (Grazing or Feeding Operations), Natural Conditions - Water Quality Standards Use Attainability Analyses
VAP-F09R_XHS01A08	XHS – North Anna River, UT	York River Basin	Benthic Macroinvertebrates Bioassessments	Industrial Point Source Discharge, Source Unknown
VAN-E21R_PBC01A10	Portobago Creek	Rappahannock River Basin	Escherichia coli (E. coli), pH	On-site Treatment Systems (Septic Systems and Similar Decentralized Systems), Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Livestock (Grazing or Feeding Operations), Natural Conditions - Water Quality Standards Use Attainability Analyses
VAN-E21R_WAE01A08	Ware Creek	Rappahannock River Basin	Escherichia coli (E. coli)	On-site Treatment Systems (Septic Systems and Similar Decentralized Systems), Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Livestock (Grazing or Feeding Operations), Urban Runoff/Storm Sewers
VAP-F11R_LTL01A98	Little River	York River Basin	Escherichia coli (E. coli)	Municipal Point Source Discharges, Non-Point Source
VAP-F04R_SAR03A98	South Anna River	York River Basin	Escherichia coli (E. coli)	Municipal Point Source Discharges, Non-Point Source
VAP-F12R_PMK01B08	Pamunkey River	York River Basin	Escherichia coli (E. coli)	Municipal Point Source Discharges, Non-Point Source

Spotsylvania County

Assessment ID	Water Name	Watershed Waterway is located in	Impairment	Source
VAN-F16R_POR01C06	Po River	York River Basin	Escherichia coli (E. coli)	Discharges from Municipal Separate Storm Sewer Systems (MS4), Grazing in Riparian or Shoreline Zones, Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Livestock (Grazing or Feeding Operations), Sewage Discharges in Unsewered Areas, Runoff from Forest/Grassland/Parkland
VAN-F16R_GDY01A10	Glady Run	York River Basin	Escherichia coli (E. coli)	Grazing in Riparian or Shoreline Zones, Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Livestock (Grazing or Feeding Operations), Sewage Discharges in Unsewered Areas, Runoff from Forest/Grassland/Parkland
VAN-F16R_POR01B02	Po River	York River Basin	Escherichia coli (E. coli)	Discharges from Municipal Separate Storm Sewer Systems (MS4), Grazing in Riparian or Shoreline Zones, Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Livestock (Grazing or Feeding Operations), Sewage Discharges in Unsewered Areas, Runoff from Forest/Grassland/Parkland
VAN-F18R_BLF01A20	Bluff Run	York River Basin	Dissolved Oxygen	Natural Conditions - Water Quality Standards Use Attainability Analyses Needed
VAN-F18R_TAR01A00	Ta River	York River Basin	Escherichia coli (E. coli)	Grazing in Riparian or Shoreline Zones, Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Livestock (Grazing or Feeding Operations), Sewage Discharges in Unsewered Areas, Runoff from Forest/Grassland/Parkland
VAN-F09R_XIA01A06	Unnamed tributary to Northeast Creek	York River Basin	Escherichia coli (E. coli)	Grazing in Riparian or Shoreline Zones, Impacts from Land Application of Wastes, Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Livestock (Grazing or Feeding Operations), Sewage Discharges in Unsewered Areas, Runoff from Forest/Grassland/Parkland
VAN-F18R_MAT02A18	Mat River	York River Basin	Escherichia coli (E. coli)	Grazing in Riparian or Shoreline Zones, Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Livestock (Grazing or Feeding Operations), Sewage Discharges in Unsewered Areas, Runoff from Forest/Grassland/Parkland

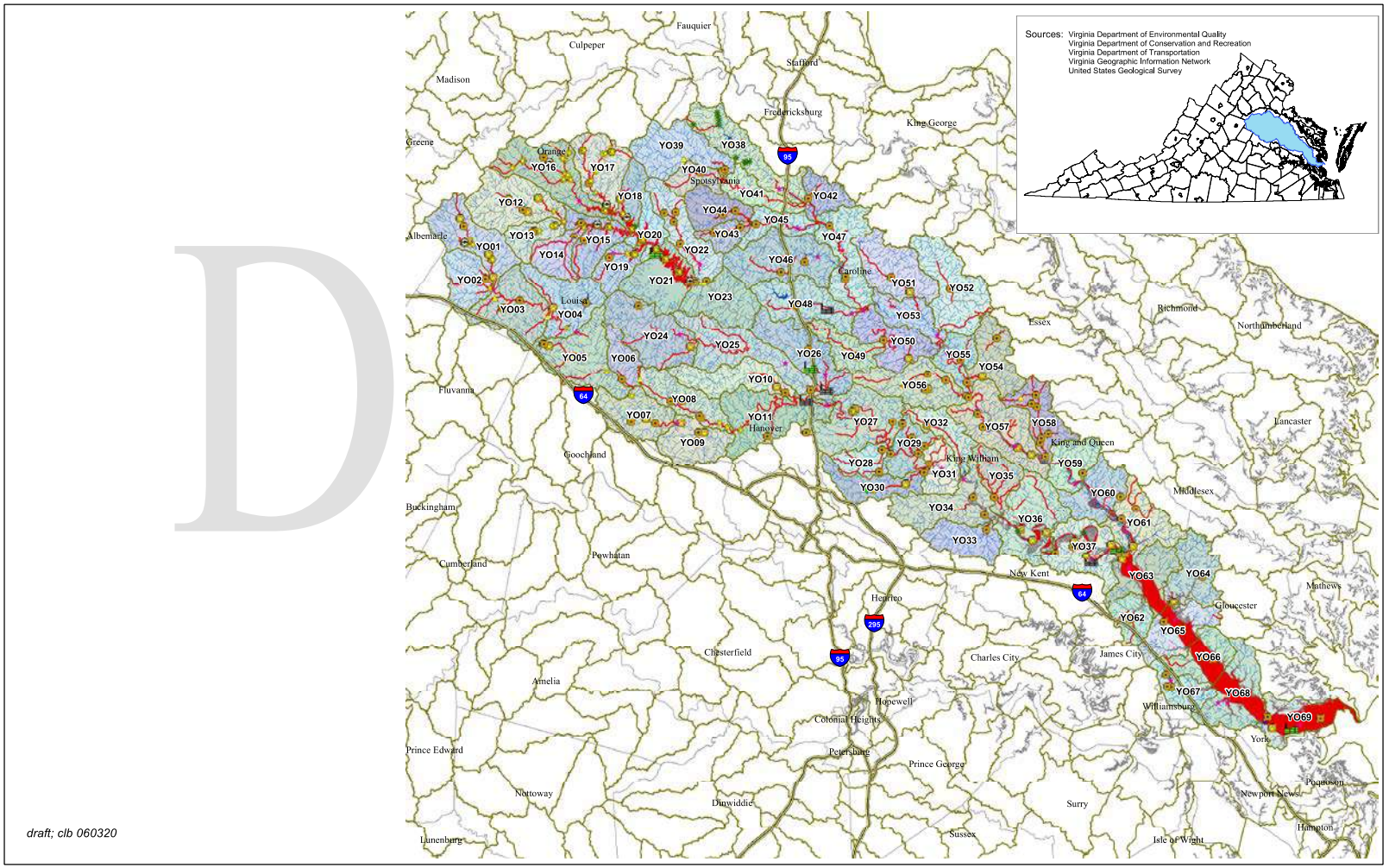
VAN-F18R_MAT01A12	Mat River	York River Basin	Escherichia coli (E. coli)	Grazing in Riparian or Shoreline Zones, Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Livestock (Grazing or Feeding Operations), Sewage Discharges in Unsewered Areas, Runoff from Forest/Grassland/Parkland
VAN-F15R_BRK01A06	Brock Run	York River Basin	Escherichia coli (E. coli)	Grazing in Riparian or Shoreline Zones, Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Livestock (Grazing or Feeding Operations), Sewage Discharges in Unsewered Areas, Runoff from Forest/Grassland/Parkland
VAN-F09R_MUS01A06	Music Branch	York River Basin	Escherichia coli (E. coli)	Grazing in Riparian or Shoreline Zones, Impacts from Land Application of Wastes, Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Livestock (Grazing or Feeding Operations), Sewage Discharges in Unsewered Areas, Runoff from Forest/Grassland/Parkland
VAN-F18R_MTA02A04	Matta River	York River Basin	Benthic Macroinvertebrates Bioassessments, Escherichia coli (E. coli)	Grazing in Riparian or Shoreline Zones, Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Source Unknown, Livestock (Grazing or Feeding Operations), Sewage Discharges in Unsewered Areas, Runoff from Forest/Grassland/Parkland
VAN-F09R_NST04A08	Northeast Creek	York River Basin	Escherichia coli (E. coli)	Grazing in Riparian or Shoreline Zones, Impacts from Land Application of Wastes, Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Livestock (Grazing or Feeding Operations), Sewage Discharges in Unsewered Areas, Runoff from Forest/Grassland/Parkland
VAN-F15R_BRK01B12	Brock Run	York River Basin	pH	Source Unknown
VAN-E20R_MAP04A02	Massaponax Creek	Rappahannock River Basin	Escherichia coli (E. coli)	On-site Treatment Systems (Septic Systems and Similar Decentralized Systems), Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Livestock (Grazing or Feeding Operations), Urban Runoff/Storm Sewers
VAN-F09R_NST03A08	Northeast Creek	York River Basin	Escherichia coli (E. coli)	Grazing in Riparian or Shoreline Zones, Impacts from Land Application of Wastes, Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Livestock (Grazing or Feeding Operations), Sewage Discharges in Unsewered Areas, Runoff from Forest/Grassland/Parkland

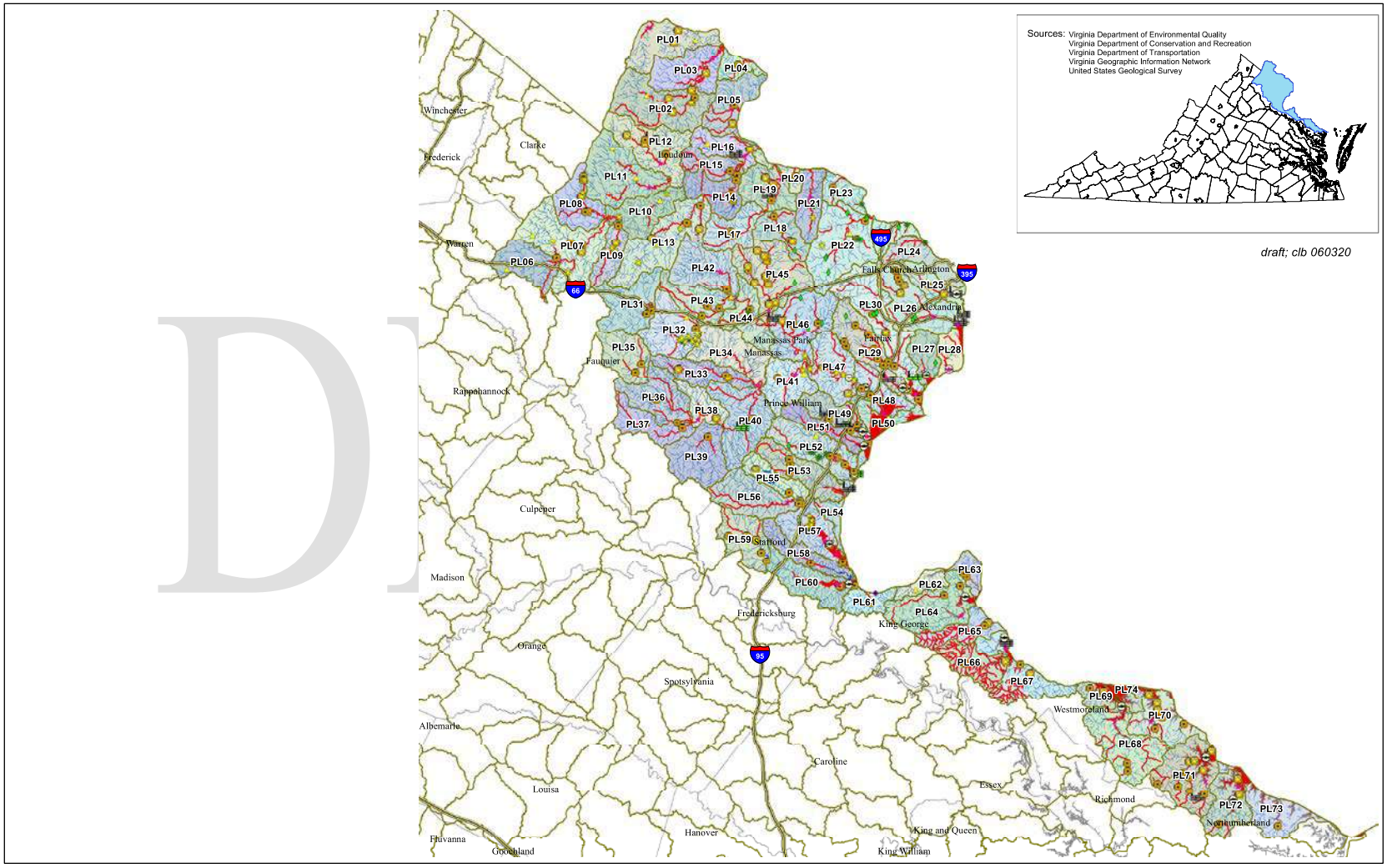
VAN-F16R_POR01A10	Po River	York River Basin	Escherichia coli (E. coli)	Discharges from Municipal Separate Storm Sewer Systems (MS4), Grazing in Riparian or Shoreline Zones, Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Livestock (Grazing or Feeding Operations), Sewage Discharges in Unsewered Areas, Runoff from Forest/Grassland/Parkland
VAN-E20R_MAP03A02	Massaponax Creek	Rappahannock River Basin	Escherichia coli (E. coli)	On-site Treatment Systems (Septic Systems and Similar Decentralized Systems), Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Livestock (Grazing or Feeding Operations), Urban Runoff/Storm Sewers
VAN-E20R_XFE01A02	Unnamed tributary to Massaponax Creek	Rappahannock River Basin	pH	Source Unknown
VAN-F15R_NIR01A00	Ni River	York River Basin	Benthic Macroinvertebrates Bioassessments, Escherichia coli (E. coli)	Discharges from Municipal Separate Storm Sewer Systems (MS4), Grazing in Riparian or Shoreline Zones, Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Source Unknown, Livestock (Grazing or Feeding Operations), Sewage Discharges in Unsewered Area
VAN-E19R_MIN02A14	Mine Run	Rappahannock River Basin	Escherichia coli (E. coli)	Source Unknown
VAN-F18R_MTA01A00	Matta River	York River Basin	Escherichia coli (E. coli)	Grazing in Riparian or Shoreline Zones, Impacts from Land Application of Wastes, Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Livestock (Grazing or Feeding Operations), Sewage Discharges in Unsewered Areas, Runoff from Forest/Grassland/Parkland
VAN-F09R_NST02A98	Northeast Creek	York River Basin	Escherichia coli (E. coli)	Grazing in Riparian or Shoreline Zones, Impacts from Land Application of Wastes, Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Livestock (Grazing or Feeding Operations), Sewage Discharges in Unsewered Areas, Runoff from Forest/Grassland/Parkland
VAN-F07R_PLT01A00	Plentiful Creek	York River Basin	Escherichia coli (E. coli)	Grazing in Riparian or Shoreline Zones, Impacts from Land Application of Wastes, Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Livestock (Grazing or Feeding Operations), Sewage Discharges in Unsewered Areas, Runoff from Forest/Grassland/Parkland

VAN-E18R_WIL01A08	Wilderness Run	Rappahannock River Basin	Escherichia coli (E. coli)	On-site Treatment Systems (Septic Systems and Similar Decentralized Systems), Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Livestock (Grazing or Feeding Operations)
VAN-E20R_MAP02B12	Massaponax Creek	Rappahannock River Basin	Escherichia coli (E. coli)	On-site Treatment Systems (Septic Systems and Similar Decentralized Systems), Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Livestock (Grazing or Feeding Operations), Urban Runoff/Storm Sewers
VAN-E20R_XHN01A10	Unnamed Tributary to Hazel Run	Rappahannock River Basin	Escherichia coli (E. coli)	On-site Treatment Systems (Septic Systems and Similar Decentralized Systems), Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Livestock (Grazing or Feeding Operations), Urban Runoff/Storm Sewers
VAN-E20R_DEP03A12	Deep Run	Rappahannock River Basin	pH	Natural Conditions - Water Quality Standards Use Attainability Analyses Needed
VAN-E20R_HAL01A00	Hazel Run	Rappahannock River Basin	Benthic Macroinvertebrates Bioassessments, Escherichia coli (E. coli), PCBs in Fish Tissue	On-site Treatment Systems (Septic Systems and Similar Decentralized Systems), Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Source Unknown, Livestock (Grazing or Feeding Operations), Urban Runoff/Storm Sewers
VAN-F19R_STH03A08	South River	York River Basin	Escherichia coli (E. coli)	Grazing in Riparian or Shoreline Zones, Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Livestock (Grazing or Feeding Operations), Sewage Discharges in Unsewered Areas, Runoff from Forest/Grassland/Parkland
VAN-E18R_RAP03A02	Rapidan River	Rappahannock River Basin	Escherichia coli (E. coli), Mercury in Fish Tissue	On-site Treatment Systems (Septic Systems and Similar Decentralized Systems), Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Source Unknown, Livestock (Grazing or Feeding Operations)
VAN-E20R_DEP02A18	Deep Run	Rappahannock River Basin	Escherichia coli (E. coli)	On-site Treatment Systems (Septic Systems and Similar Decentralized Systems), Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Livestock (Grazing or Feeding Operations), Urban Runoff/Storm Sewers
VAN-E18R_RAP01A02	Rapidan River	Rappahannock River Basin	Mercury in Fish Tissue	Source Unknown
VAN-E18R_RAP02A02	Rapidan River	Rappahannock River Basin	Mercury in Fish Tissue	Source Unknown

VAN-E18R_RAP04A04	Rapidan River	Rappahannock River Basin	Mercury in Fish Tissue	Source Unknown
VAN-E20R_MAP02A02	Massaponax Creek	Rappahannock River Basin	Escherichia coli (E. coli)	On-site Treatment Systems (Septic Systems and Similar Decentralized Systems), Wastes from Pets, Waterfowl, Wildlife Other than Waterfowl, Livestock (Grazing or Feeding Operations), Urban Runoff/Storm Sewers

APPENDIX D – Maps of Regional Watersheds/Impaired Waterways




Sources: Virginia Department of Environmental Quality
Virginia Department of Conservation and Recreation
Virginia Department of Transportation
Virginia Geographic Information Network
United States Geological Survey
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Goochland
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Stafford
Fredericksburg
King George
Caroline
King and Queen
King William
Essex
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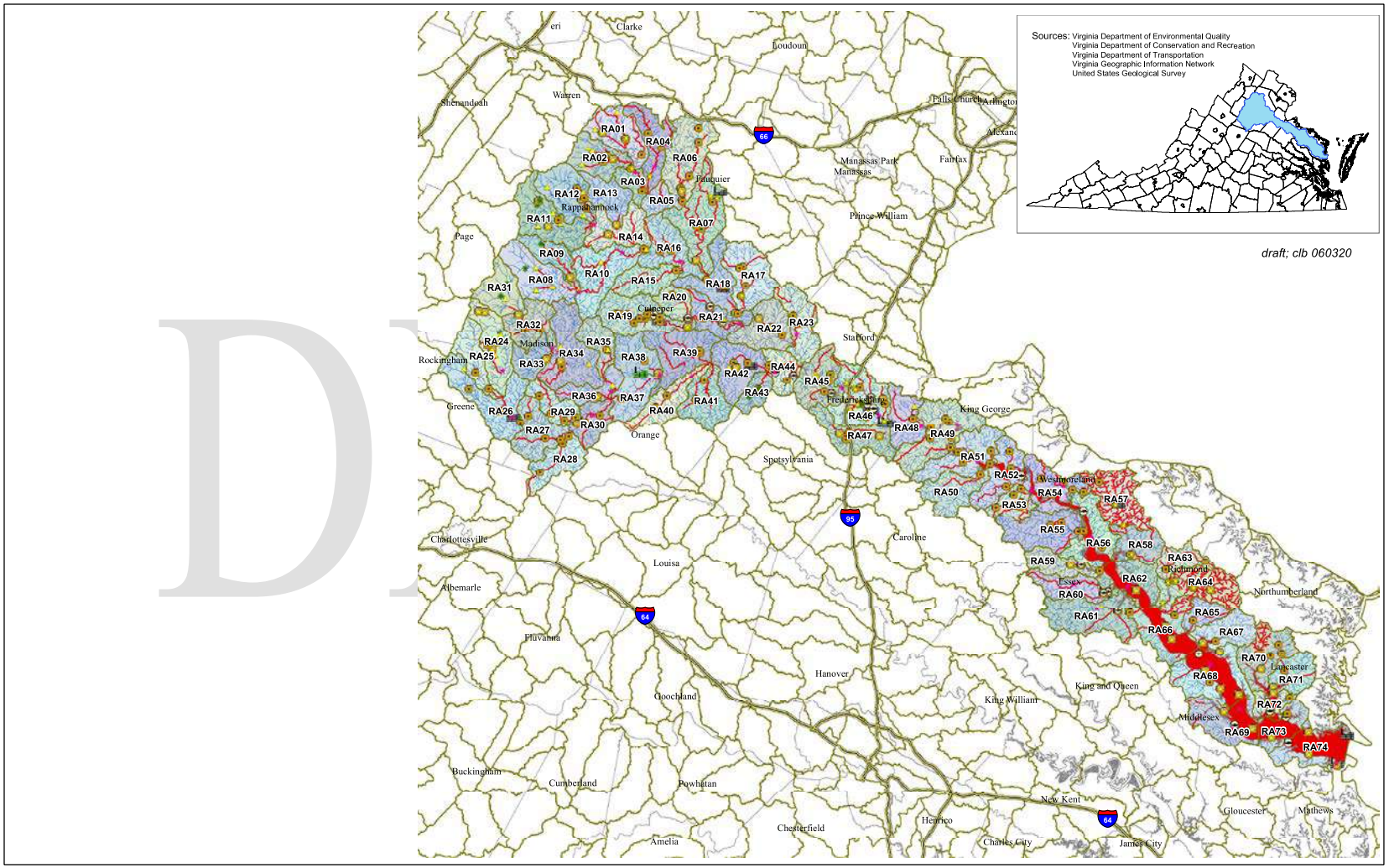
Sources: Virginia Department of Environmental Quality
Virginia Department of Conservation and Recreation
Virginia Department of Transportation
Virginia Geographic Information Network
United States Geological Survey
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Warren
Shenandoah
Fauquier
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Prince William
Manassas Park
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Rockingham
Greene
Orange
Spotsylvania
Fredericksburg
King George
Westmoreland
Northumberland
Essex
Richmond
Lancaster
King and Queen
King William
Middlesex
Caroline
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Albemarle
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APPENDIX E – GWRC Priority Species of Greatest Conservation Need

Taxa	Common Name	Habitat
Amphibian	Carpenter Frog	Freshwater wetlands with sphagnum moss
Amphibian	Greater Siren	Tolerates a variety of warm aquatic habitats with abundant vegetation
Amphibian	Lesser Siren	Tolerates a variety of warm aquatic habitats with abundant vegetation
Bird	Bank Swallow	Habitat includes open and partly open situations, frequently near flowing water. Nests are in steep sand, dirt, or gravel banks, in burrows dug near the top of the bank, along the edge of inland water, or along the coast, or in gravel pits, road embankments, etc.
Bird	Belted Kingfisher	Primarily along water, both freshwater and marine, including lakes, streams, wooded creeks and rivers, seacoasts, bays, estuaries, and mangroves. Perches in trees, on over hanging branches, posts and utility wires
Bird	Black and White Warbler	Habitat generalist with broad habitat tolerances
Bird	Brown Thrasher	Thickets and bushy areas in deciduous forest clearings and forest edge, shrubby areas and gardens; in migration and winter also in scrub.
Bird	Chimney Swift	Inhabits rural and urban environments having both an abundance of flying arthropods and suitable roosting/nesting sites
Bird	Easter Kingbird	Forest edge, open situations with scattered trees and shrubs, cultivated lands with bushes and fencerows, and parks; in winter more closely associated with forest clearings and borders.
Bird	Eastern Meadowlark	Grasslands, savanna, open fields, pastures, cultivated lands, sometimes marshes
Bird	Eastern Towhee	Inhabits forest and swamp edges, regenerating clear-cuts, open-canopied forests, particularly those with a well-developed understory, reclaimed strip mines, mid-late successional fields, riparian thickets, overgrown fencerows, shrub/small-tree thickets, and other brushy habitats.
Bird	Eastern Whip-Poor-Will	Forest and open woodland, from lowland moist and deciduous forest to montane forest and pine-oak association
Bird	Eastern Woo-Peewee	Inhabits a wide variety of wooded upland and lowland habitats including deciduous, coniferous, or mixed forests

Bird	Field Sparrow	Old fields, brushy hillsides, overgrown pastures, thorn scrub, deciduous forest edge, sparse second growth, fencerows
Bird	Grasshopper Sparrow	Grassland obligate
Bird	Grey Catbird	Thickets, dense brushy and shrubby areas, undergrowth of forest edge, hedgerows, and gardens, dense second growth
Bird	Green Heron	Swamps, mangroves, marshes, and margins of ponds, rivers, lakes, and lagoons
Bird	Kentucky Warbler	Humid deciduous forest, dense second growth, swamps
Bird	Northern Flicker	Open forest, both deciduous and coniferous, open woodland, open situations with scattered trees and snags, riparian woodland, pine-oak association, parks.
Bird	Wood Thrush	Deciduous or mixed forests with a dense tree canopy and a fairly well- developed deciduous understory, especially where moist
Bird	Yellow-Billed Cuckoo	Open woodland (especially where undergrowth is thick), parks, deciduous riparian woodland
Bird	Yellow-Breasted Chat	Second growth, shrubby old pastures, thickets, bushy areas, scrub, woodland undergrowth, and fence rows, including low wet places near streams, pond edges, or swamps; thickets with few tall trees; early successional stages of forest regeneration; commonly in sites close to human habitation.
Fish	American Brook Lamprey	Requires clear flowing water but can tolerate a range of temperatures and substrates
Fish	American Shad	Large unfragmented migratory rivers for spawning
Fish	Bridle Shiner	Slow clear water with aquatic vegetation
Fish	Least Brook Lamprey	Warm small streams with slow flows and sand/ silt substrates
Fish	Mud Sunfish	Swamps, ponds, and slow-moving water
FW Mollusk	Alewife Floater	Alewife obligate - coastal streams and lakes with sand or gravel substrates
FW Mollusk	Dwarf Wedgemussel	Clean warm streams and rivers with low to moderate current and unstilted substrates
Reptile	Rainbow Snake	Riparian forest - eel obligate

APPENDIX F: Summary of Conservation Strategies and Actions for the GW Region

Conservation Strategies	Conservation Action	Threats Addressed	Economic/Human Benefits	Priority Areas
Maintain and restore wetland habitats	2. Work with appropriate permitting process to ensure adequate mitigation and restoration procedures are in place; 3. Implement living shoreline where feasible; 4. Establish or enhance vegetated buffer areas inland of existing wetlands; 5. Utilize relevant data (e.g. Virginia Department of Conservation and Recreation's Wetlands catalog) to identify priority areas for conservation, acquisition, and restoration; 6. Control invasive species.	Water quality degradation, habitat/land use conversion, climate change, non-native and exotic species, predators	Flood control; filtration services, erosion and sediment control; supports recreational and commercial fisheries; ecotourism/wildlife watching and fishing/hunting opportunities	Watershed with priority wetlands and areas adjacent to priority watershed that allow inland migration of wetlands
Enhance, maintain, and restore aquatic riparian habitats	1. Establish riparian vegetative buffers along waterways; 2. Reforest erodible cropland and pastures; 3. Establish waste storage facilities (such as dairy lagoons or waste sheds) to better manage animal waste and prevent flow into the river; 4. Establish retention ponds, impoundments, or other features to manage and slow storm water runoff from cropland, pastures, forests, and barren lands; 5. Implement projects to slow urban storm water flowing into steams such as vegetative buffers, reducing impervious surface, rain gardens, and low impact development techniques; 6. Repair or replace failing septic systems and pit privies; 7. Work to prevent pet and kennel waste from entering waterways; 8. Identify additional impaired waters within planning region; 9. Restore aquatic connections; 10. Monitor and address invasive species impacts; and 11. Adopt land use practices or policies through zoning or other means to help improve the health of aquatic systems.	Sedimentation, contaminant loading, water chemistry alteration, stream nutrient dynamics alteration, land conversion/alteration, invasive species, water withdrawals, climate change	Address TMDL concerns by reducing amounts of sediment, nutrients, pesticides, and other pollutants that enter waterways; Sustain sport fisheries and recreation opportunities; contribute to clean water supply	Deep Run, Fairview Beach, Plentiful Creek
Maintain and restore forest	1. Protect land through acquisition, easement, incentives, or other mechanisms; 2. Implement vegetative buffers around extractive practices and	Land use change and conversion, invasive species,	Flood control; water quality; and ecotourism/wildlife viewing/other outdoor	Forest patches adjacent to already

habitat	development; 3. Work with state and federal agencies to ensure implementation of appropriate best management practices; 4. Maintain forest health to help ensure forest viability; and 5. Monitor and control invasive species.	climate change	recreation	protected parcels
Maintain and restore forest habitat	1. Restore native grasses, shrubs, and forbs; 2. Maintain existing open habitats with periodic disturbance (e.g., prescribed burning, mowing, disking, etc.); and 3. Conserve, via acquisition, easement, collaboration, or agreement, patches from 20 acres to 100 or more acres.	Land use changes, invasive species	Conservation of native pollinators; erosion control; sequestration of nutrients, pesticides, and other pollutants before they enter river systems	Areas supported SGCM that are not already protected

Source: Virginia Wildlife Action Plan

APPENDIX G: Considering the Whole Community

This Plan emphasizes the need to give all people in the GW Region an equal chance to participate in and benefit from resiliency efforts, especially those who will feel the brunt of natural hazards by virtue of where they live or other factors. A simple example of this might be reaching out to people who typically aren't contacted for planning efforts. Support should be provided for those who face barriers to participation, such as hearing difficulties or lack of access to transport. Support might include providing marginalized people with an empowering environment in which to speak, offering translation services, providing physical access accommodations, and providing education to remove information barriers.

Civil Rights Requirements

This section provides information on civil rights laws that apply to the George Washington Regional Commission, and contractors doing work on GWRC's behalf.

It is important to note that Title VI of the Civil Rights Act of 1964 provides protection from discrimination based on race, color, or national origin - exclusively. A Title VI audit might look into discrimination based on race, color, and national origin, but also whether low-income and minority populations (covered under environmental justice law) as well as those with limited English proficiency (covered under limited English Proficiency law) are being afforded equitable participation and benefits.

Title VI

In accordance with Title VI of the Civil Rights Act of 1964 "No person in the United States shall, on the ground of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving federal financial assistance." The Civil Rights Restoration Act of 1987 adds that federal nondiscrimination laws apply broadly to *all* programs and policies of recipients and sub-recipients of federal funds and private businesses to which federal assistance is extended, regardless of which program or policy is funded by federal dollars.

The George Washington Regional Commission and Local Governments can take the following actions to promote Title VI protections:

- Solicit and record demographic data on public participants, committee members, and staff to identify underrepresentation.
- Map minority and ethnic populations using U.S. Census data to learn about community composition and strategically plan proactive community outreach.
- Conduct an analysis to understand who will be most affected by climate hazards.
- Take a boots-on-the-ground approach to identify community needs at a micro-level.
- Provide translation services free of charge and proactively translate documents as appropriate.
- Strategically conduct outreach to engage minority populations and facilitate their participation in the decision-making process.
- Provide clear directions on how to file a discrimination complaint.

Environmental Justice (EJ)

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, was issued out of concern that low-income and minority populations in the U.S. were disproportionately burdened by the negative consequences of community development and did not always receive a proportionate amount of the benefits of community development. The executive order requires federal agencies to identify and address disproportionately high and adverse human health or environmental effects of federal programs, policies, and activities on low-income and minority populations.

The George Washington Regional Commission and Local Governments can take the following actions to promote Environmental Justice:

- Conduct target community outreach to encourage low-income and minority populations to participate in resiliency planning process – from early planning phases to implementation.
- Mapping and data collection to identify "front-line" communities that are geographically and socio-economically more vulnerable to the effect of coastal flooding and other natural hazards.
- Conduct community outreach at accessible locations within the community.
- Offering in-person and virtual participation opportunities in a comfortable setting for all ages and abilities which feature multiple ways to communicate with staff.
- Provide free language translation and interpretation services upon request and proactively translating documents as appropriate.

Analysis for Resiliency Plans and Programs

GWRC can measure the impact of resiliency related policy, programs, and initiatives by conducting an analysis of benefits and burdens to different communities. Such an analysis would evaluate how the cumulative impact of the Resilience Plan will benefit and/or burden minority and low-income populations. GWRC should investigate the localities' staff and technology capacity to conduct such analyses.

Benefits include but are not limited to the following:

- Increased economic resilience and creation of resiliency related jobs.
- Access to healthcare facilities, critical facilities, and emergency evacuation routes and services.
- Any measure or action that would help alleviate poverty.
- Any measure or action that would protect human health and property from natural hazards.
- Increased protection and adaptation to natural hazards.
- Access to a healthy and safe environment.

Adverse effects, which constitutes burdens, include one or more significant human health or environmental effects, including social and economic effects. These include but are not limited to:

- Bodily impairment, infirmity, illness, or death.

- Air, noise, and water pollution and soil contamination.
- Displacement of persons, business, farms, or community organizations.
- Destruction or disruption of a community's economic vitality.
- Destruction or disruption of man-made or natural infrastructure.
- Destruction or disruption of accessibility of critical facilities, and emergency evacuation routes and services.
- Isolation, exclusion or separation of individuals within a given community or from the broader community.
- Disproportional impacts of coastal flooding.

APPENDIX H: Community Engagement

Opportunities for Community Engagement

GWRC is currently in the resilience planning process, there are upcoming opportunities for community members and other stakeholders to participate.

- Charette: July 27th 2021, 1:00-3:00pm in person
- Public Meeting: July 27th 2021, 6:00-8:00pm

Procedures

The FAMPO Community Engagement and Equity Plan serves as a detailed guide for regional staff to conduct community outreach. These procedures with allow GWRC staff to reach, teach, and learn from community members and other resilience stakeholders, particularly those who are traditionally underrepresented in civic processes. These procedures will facilitate meaningful community involvement in the resiliency decision-making process.

Staff Guide for Conducting Community Engagement

Community Engagement Goals

1. To effectively reach, teach, and learn from community members and other resilience stakeholders, particularly those who are traditionally underrepresented in civic processes.
2. To communicate community and stakeholder input early in the decision-making process to planners, GWRC committee members, and policy-makers so that resiliency decisions are made with the community's needs and vision in mind.
3. Create and sustain knowledgeable and inclusive community leaders and networks, especially for traditionally underserved communities.
4. To communicate back to the community members how their input influenced the decision-making process or policies.

Make and Maintain a Formal Engagement Plan

Developing and maintaining a public participation plan provides formalized procedures, strategies, and desired outcomes. Regularly assessing the plans effectiveness ensure accountability and

The FAMPO Community Engagement and Equity Plan, provides a thorough outline of community engagement strategies, tools, evaluation criteria for effectiveness of tools, and indicators of success. Although this plan is transportation based, it should be adapted to inform community engagement throughout the GWRC resilience planning process.

Identify Community Members

GWRC must be familiar with the community it serves. Regional demographic information is included in the Regional Assets section. Maps should be made of environmental justice communities. It is also important to take a boots-on-the-ground approach to become more familiar with specific neighborhood conditions, and to speak to a wide range of people to learn about their unique resiliency challenges or considerations.

Resiliency decisions will also impact businesses, schools, government entities, community organizations, and all other stakeholders. Regular research and networking should be conducted to identify stakeholders and encourage them to participate in the resiliency planning process.

Follow up with the Community and other Stakeholders

When a group or individual communicates a concern or idea, takes a survey, submits a public comment, or otherwise participates in the planning process, staff must follow up in a timely manner. Staff need to convey how the stakeholder participation influenced the decision-making process. Communicating this information to participants encourages further community participation and also requires staff to take the time to consider whether public input is being conveyed to planners and decision-makers in an impactful and timely manner.

Community Engagement Strategies and Tools

The following strategies and tools to encourage and enable meaningful community participation in the decision-making and planning processes. These strategies and tools are designed to promote equitable participation by lowering participation barriers.

Tool	Outreach Purpose	Strategies	Considerations for Different Demographics
Social Media	To keep the community engaged and informed.	• Post regularly on social media platforms. • Use Facebook ads to announce public meetings, hearings, events, and surveys. • Engage in dialogue and share information.	• Very low following and interactions overall. • Different age groups use different social media platforms.
Websites	To provide the community with easy to understand comprehensive and timely information.	• Simplify complex concepts. • Periodically conduct a website audit to ensure information is easy to find and understand. • Use interactive features such as maps and videos.	• Ensure google translates and text enlargement buttons are available. • Ensure images have alternate text and the site is easy to navigate.

Surveys	To provide an opportunity for the community to easily share concerns and ideas before decisions are made.	• Use online and paper surveys. • Offer surveys in multiple languages, as appropriate.	• Always collect and analyze demographic information on participations. • Include participation clause on surveys that translation services are available free of charge.
In-Person Events	To meet people where they are. To provide information and facilitate conversation.	• Hold tabling events in public spaces and at community events or gatherings. • Host public workshops and open houses. • Provide interactive activities at in-person events to promote communication. • Participate in external meetings as a guest speaker. • Host community resilience events. • Educational seminars or talks. • Food Truck rodeos.	• Some individuals have barriers to reaching in-person events. • Those with limited English proficiency may struggle to communicate and participate. • Have printed information available in Spanish, as appropriate. • Have Google Translate and “I Speak Cards” ready to use. • Information must be tailored to the audience. • Meeting community members where they live and work.
Virtual Events	To provide a convenient method for the community to learn about coastal resilience, ask questions, and express concerns or ideas.	• Live stream Q and A sessions on social media. • 24/7 virtual classroom on website with videos and interactive features. • Host virtual round-tables, work-shops, and focus groups. • Attend external virtual meetings as a guest speaker. • Use interactive virtual meeting room features.	• Some individuals may not have access to the internet. Provide information on in-person events and other meaningful opportunities to participate. Provide information on ways to obtain low-cost internet devices • Some people struggle to navigate virtual platforms. Provide guides and easy to understand information on how to navigate virtual events. • Implement closed caption and other accessibility features.

Public Meetings and Hearings	To provide an opportunity for the community to directly address decision makers.	• Record meetings and post on social media outlets and website. • When possible, offer virtual attendance option for in-person meetings and hearings. • When possible, live stream in-person meetings. • Allow community members to submit comments in advance of the meeting to be read by the staff Offer text to comment feature, phone call, or email submissions.	• Some have visual, hearing, mobility, or language barriers. • Translation and interpretation services must be offered free of charge, upon request. • Hold meetings at times and locations that allow for participation of historically underrepresented populations, frontline communities, and all other stakeholders.
Advisory Committees	Allow interested members of the community to influence the decision-making process by serving on an advisory committee.	• Form a Citizens Coastal Resiliency Advisory Committee (CCRAC). • Raise awareness of the ability to serve on CCRAC with advertisements, social media, networking, and news articles. • Provide staff support and education to committee members. • Translation and interpretation services must be offered free of charge, upon request.	• Committee members demographics should be reflective of the George Washington Region population being served. • Committee members tend to be those who are politically connected and economically advantaged. • GWRC staff must proactively encourage individuals of underrepresented groups to serve on CRAC and educate localities about the importance of representation and diversity.

Appendix D: GWRC CZM/VCRMP Database Projects

County(s)	Project Name	Description	Purpose and Need	Total Cost
Stafford	Crow's Nest Peninsula and Estuary Conservation	This project focuses on NVCT's long-term goals of building out comprehensive estuarine land conservation in the vicinity of Crow's Nest peninsula in Stafford County, with a focus on lands surrounding the estuaries of Potomac Creek and Accokeek Creek. It involves ongoing and future targeted land conservation through easement and fee acquisitions that can allow for buffering of stream corridors, transition of habitats inland as sea levels rise, and avoidance of shoreline development in vulnerable areas. With adequate resources we would anticipate conserving up to an additional 8-10 high-priority properties over a five-year timeframe.	Tidal_Flooding, Storm_Surge_Flooding, Riverine_Flooding, Shoreline_Erosion	$ 6,500,000
Stafford	Quantico to Aquia Creek Coastal Land Protection	This project focuses on permanent protection of natural lands in Stafford County along the shorelines of the Potomac River and Aquia Creek on the Widewater peninsula south of Marine Corps Base Quantico. It involves ongoing and future targeted land conservation through easement and fee acquisitions that can allow for transition of habitats inland as sea levels rise, prevention of coastal erosion, protection of critical infrastructure (i.e., railroad), and avoidance of shoreline development in vulnerable areas. With adequate resources we would anticipate conserving up to an additional 4-8 high-priority properties over a five-year timeframe.	Tidal_Flooding, Storm_Surge_Flooding, Riverine_Flooding, Shoreline_Erosion	$ 5,000,000
Caroline, Spotsylvania	Plan for Bioretention Demonstration Sites	Bioretention Demonstration Sites at 6 Caroline County schools	Community Resilience, Ecosystem Resilience	NULL
All	GIS Development and Coordination	Establish uniform GIS standards for capabilities and data throughout the GWRC Region. Continue to improve regional inter-operable emergency communications and planning by coordinating and sharing GIS and other data. Encourage member localities to incorporate dam failure inundation mapping into local GIS systems to standardize and quantify the potential impacts of dam failure hazards	Community Resilience, Economic Resilience, Planning Capacity	$ 100,000
All	Coordinate with Developers and Realtors	Engage, educate, and incorporate developers and realtors on sustainable and resilient development.	Community Resilience, Risk Awareness, Adaptation Options	$ 100,000

All	Floodplain Improvement Program development	Floodplain improvements through the development of.a program for mitigation of priority flood-prone structures through the promotion of acquisition/demolition, elevation, flood proofing, minor localized flood control projects, mitigation reconstruction. In addition, create and prioritize an inventory of flood-prone structures.	Community Resilience, Planning Capacity	$	50,000
All	Rappahannock River Plan	Install living shorelines, acquire land for public access and stormwater management, remove and replace revetments, grading the bank if possible, and include vegetation buffers, and develop shoreline enhancement projects (include sand beach/dune and vegetated wetlands). In addition, Caroline County is interested in streambank restoration to prevent further land erosion and to develop habitat restoration.	Community Resilience, Ecosystem Resilience, Adaptation Options, Planning Capacity	$	50,000
All	Potomac River Plan	Acquire land for public access, green stormwater management, and l shoreline construction, includes Wayside Park shoreline stabilization expansion/buffering protection of the Crow's Nest Peninsula	Community Resilience, Ecosystem Resilience, Adaptation Options	$	5,000
All	Mattaponi River Plan	Mattaponi River Project for IP, Riparian Forest Buffer Restoration	Community Resilience, Ecosystem Resilience, Adaptation Options, Planning Capacity	$	50,000
All	Port Royal Main Street Plan	Improving Main Street drainage systems; currently planning and seeking funding for collaborative action to correct existing problems of pollution resulting from ditches along Route 301 (Main St.), which carry stormwater runoff and leachate from septic fields directly to the Rappahannock River.	Community Resilience, Risk Awareness, Adaptation Options	$	10,000
All	Septic System Management Program	Develop a septic system program management program for all localities within the GWRC Region.	Community Resilience, Ecosystem Resilience, Risk Awareness, Planning Capacity	$	20,000
All	Sewer and Water Connection Plan	Conducting studies and developing a plan for sewer and water connection	Community Resilience, Planning Capacity	$	25,000
All	Study of Pavement Removal Options on City Property	Study of Pavement Removal Options on City Property	Ecosystem Resilience, Adaptation Options, Planning Capacity	$	8,000
All	Assess resilience of drinking water supply and wastewater management systems	Assess resilience of drinking water supply and wastewater management systems	Community Resilience, Economic Resilience, Ecosystem Resilience, Risk Awareness	$	50,000
All	Creation of local resilience policy 'toolkit' for GWRC	Creation of local resilience policy 'toolkit'	Community Resilience, Economic Resilience, Risk Awareness,	$	15,000

			Adaptation Options, Planning Capacity, Funding Capacity	
All	Plan for Bioretention Demonstration Sites	Bioretention Demonstration Sites at Frederickburg schools	Community Resilience, Ecosystem Resilience	$ 20,000
All	Plan for Bioretention Demonstration Sites	Bioretention Demonstration Sites at 4 King George schools	Community Resilience, Ecosystem Resilience	NULL
All	Plan for Bioretention Demonstration Sites	Bioretention Demonstration Sites at several Spotsylvania County facilities	Community Resilience, Ecosystem Resilience	NULL
All	Investigate emergency lane/shoulder improvements In GWRC	Investigate emergency lane/shoulder improvements for Emergency Services access on all primary roads.	Community Resilience, Economic Resilience, Risk Awareness	$ 15,000
All	Identify and publicize local evacuation routes throughout the region.	Identify and publicize local evacuation routes throughout the George Washington Region	Community Resilience, Economic Resilience, Risk Awareness	$ 15,000
All	Natural Hazard Public Outreach for the George Washington Region	Develop a regional preparedness guide focusing on natural hazards to disseminate to the public.	Community Resilience	NULL
All	Create a Citizen Coastal Resiliency Advisory Committee (CCRAC)	Create a Citizen Coastal Resiliency Advisory Committee (CCRAC) that is representative of the communities being served to provide a lens of equity and community engagement within the resilience decision-making process.	Community Resilience, Economic Resilience, Risk Awareness, Adaptation Options, Planning Capacity	$ 20,000
All	Study to Identify GWRC's "Front-Line" Communities.	Using environmental, social, and economic variables to identify disproportionately at-risk (otherwise known as "front line"•) communities that need further assistance against coastal flooding and natural hazards.	Community Resilience, Economic Resilience, Ecosystem Resilience, Risk Awareness, Planning Capacity	NULL
All	GWRC Equity Training	Equity training for locality and regional staff members.	Planning Capacity	NULL
Stafford	Plan for Bioretention Demonstration Sites	Bioretention Demonstration Sites at Stafford County facilities	Community Resilience, Ecosystem Resilience	NULL