The Policy Climate for Climate Change in Virginia: Overview of Adaptation Policy, Planning and Implementation Landscape

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Abstract: Eastern Virginia is experiencing the highest measured rates of relative sea level rise on the U.S. Atlantic coast. At the same time, Virginia's coastal zone has a strong water-dependent economy, with port facilities, coastal transportation, shipbuilding and repair, and ocean-based tourism contributing billions of dollars annually to the state's economy. Sustaining this economic activity will require adapting to changes wrought by sea level rise. The adaptation policy landscape in Virginia is evolving rapidly, as illustrated through an examination of local, state, and federal concerns; local and state adaptation actions; and key milestones that have shaped perceptions and attitudes in Virginia. However, Virginia faces an implementation gap, between overarching plans and guidance acknowledging climate change concerns, and the concrete ordinances, codes, and other measures to address those concerns. The pathways forward are multi-faceted with opportunities for action, leadership, and collaboration from the local, regional, state, and federal level.

I. Introduction

As other papers in this special issue attest, eastern Virginia is experiencing the highest measured rates of relative sea level rise on the Atlantic Coast, causing many Tidewater localities to see more frequent and more extensive flooding events. Measured rates of sea level rise have averaged 3.6 to 7.0 mm per year (1.18 to 2.30 feet per century) in Virginia's lower Chesapeake Bay region. Increases in this measured rate have been projected in recent scientific publications.[2]

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[2] *See* John D. Boon, *Evidence of Sea Level Acceleration at U.S. and Canadian Tide Stations, Atlantic Coast, North America*, 28 J. COASTAL RESEARCH 1437, 1437 (2012), *available at* http://www.jcronline.org/doi/pdf/10.2112/JCOASTRES-D-12-00102.1; Tal Ezer and William Bryce Corlett, *Is Sea Level Rise Accelerating in the Chesapeake Bay? A Demonstration of a Novel New Approach for Analyzing Sea Level Data*, 39 GEOPHYSICAL RESEARCH LETTERS L19605 (2012), *available at* http://onlinelibrary.wiley.com/doi/10.1029/2012GL053435/full.

With more than 60% of the Commonwealth's population living in the twenty-nine counties and seventeen cities that comprise "Tidewater Virginia,"[3] sea level rise is arguably the most critical component of climate change affecting Virginia today. Virginia's coastal zone has a strong water-dependent economy, with port facilities, coastal transportation, shipbuilding and repair, and ocean-based tourism contributing billions of dollars annually to the state's economy. (Fig. 1). Sustaining this economic activity will require adapting to changes wrought by sea level rise.

Local governments in Tidewater Virginia have generally acknowledged sea level rise in planning documents, such as long-range comprehensive plans, floodplain management plans, and hazard mitigation plans,[4] but tangible adaptation actions are uncommon, *ad hoc*, and at a small scale. This paper reviews the evolving adaptation policy landscape in Virginia, through an examination of local, state, and federal concerns, local and state adaptation actions, and key milestones that have shaped perceptions and attitudes in Virginia. It ends with a brief discussion of Virginia's pathways forward.

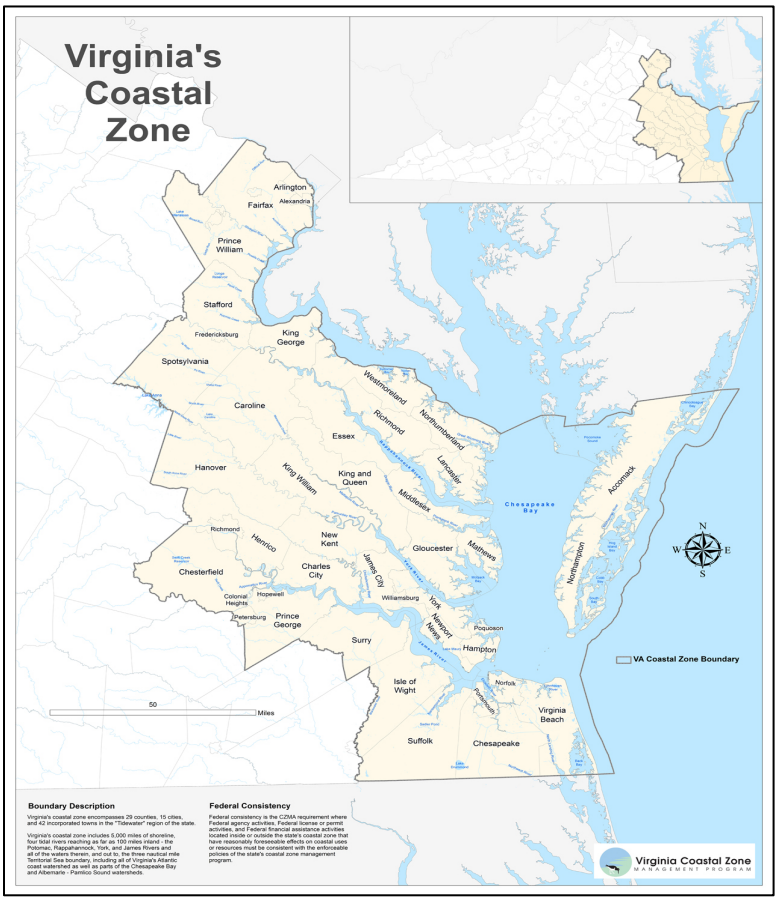

Fig. 1. Virginia's coastal zone. Graphic courtesy of Virginia Department of Environmental Protection.

[3] "Tidewater Virginia", as defined in VA. CODE ANN. §28.2-100, "means the following counties: Accomack, Arlington, Caroline, Charles City, Chesterfield, Essex, Fairfax, Gloucester, Hanover, Henrico, Isle of Wight, James City, King and Queen, King George, King William, Lancaster, Mathews, Middlesex, New Kent, Northampton, Northumberland, Prince George, Prince William, Richmond, Spotsylvania, Stafford, Surry, Westmoreland, and York; and the Cities of Alexandria, Chesapeake, Colonial Heights, Fairfax, Falls Church, Fredericksburg, Hampton, Hopewell, Newport News, Norfolk, Petersburg, Poquoson, Portsmouth, Richmond, Suffolk, Virginia Beach, and Williamsburg."

[4] See examples listed in Table 2, pg. 25.

II. Commonwealth of Virginia—Local, State & Federal Governments with Climate Concerns

Although state and federal governments play a major role in facilitating adaptation planning, most coastal adaptation will be implemented at the local level. Local governments are the primary actors charged with making the critical, basic land-use and public investment decisions and with working with community stakeholder groups to implement adaptation measures on the ground.[5] There are many drivers of local government action.

The overwhelming majority of land along Virginia's shoreline is privately owned and decisions on its use lie with local governments and landowners. Localities also play an important role in the implementation of a range of federal and state programs, including transportation to community development and emergency management that will be critical in developing climate change adaptation strategies in Virginia, especially those addressing sea level rise.

The Commonwealth of Virginia is a Dillon Rule state, with provisions in the state constitution limiting local government authorities. Virginia courts have held, "municipal governments have only those powers which are expressly granted by the state legislature, those powers fairly or necessarily implied from expressly granted powers, and those powers which are essential and indispensable."[6]

Myriad state agencies administer laws, develop regulations, conduct enforcement actions, and develop policies addressing coastal zone resources, including:

- *Tidal and Non-tidal Wetlands*: Virginia Department of Environmental Quality (VADEQ), Virginia Marine Resources Commission (VMRC), along with local Wetlands Boards.
- *Fisheries*: VMRC and Virginia Department of Game and Inland Fisheries (VA DGIF)
- *Subaqueous Lands*: VMRC
- *Dunes and Beaches*: VMRC and local Wetlands Boards
- *Point Source Air Pollution*: VADEQ
- *Nonpoint Source Water Pollution*: Virginia Department of Conservation and Recreation (VADCR) and local governments
- *Shoreline Sanitation*: Virginia Department of Health (VADH)
- *Coastal Lands:* VADCR

However, the tidal zone in particular contains overlapping and at times ambiguous authority and jurisdiction. Figure 2 illustrates that complexity in Virginia's multi-jurisdictional coastal context.

[5] VIRGINIA BURKETT AND MARGARET DAVIDSON, EDS, COASTAL IMPACTS, ADAPTATION AND VULNERABILITY: A TECHNICAL INPUT TO THE 2012 NATIONAL CLIMATE ASSESSMENT, COOPERATIVE REPORT TO THE 2013 NATIONAL CLIMATE ASSESSMENT 104 (2012), *available at* www.coastalstates.org/wp-content/uploads/2011/03/Coastal-Impacts-Adaptation-Vulnerabilities-Oct-2012.pdf.

[6] Commonwealth v. County Board of Arlington County, 232 S.E.2d 30, 40 (1977).

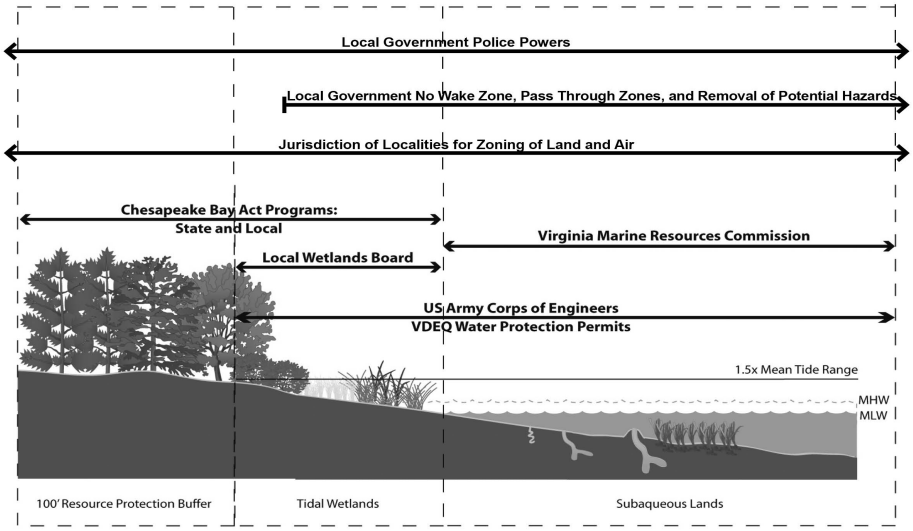

Fig. 2. Virginia legally defined shoreline resources and the relevant local, state, and federal authorities. Note that some authorities cross resource boundaries and most resources have a least two responsible regulatory authorities. Symbols courtesy of the Integration and Application Network (ian.umces.edu/symbols/). University of Maryland Center for Environmental Science.

Further, Virginia's coastal zone has a substantial federal facility presence. (Fig. 3). The sixteen municipalities of the Hampton Roads region within the Virginia coastal zone contain the second largest concentration of military capacity and activities in the U.S. Over 40% of the region's economic activity comes from the combined military and other federal activities.[7]

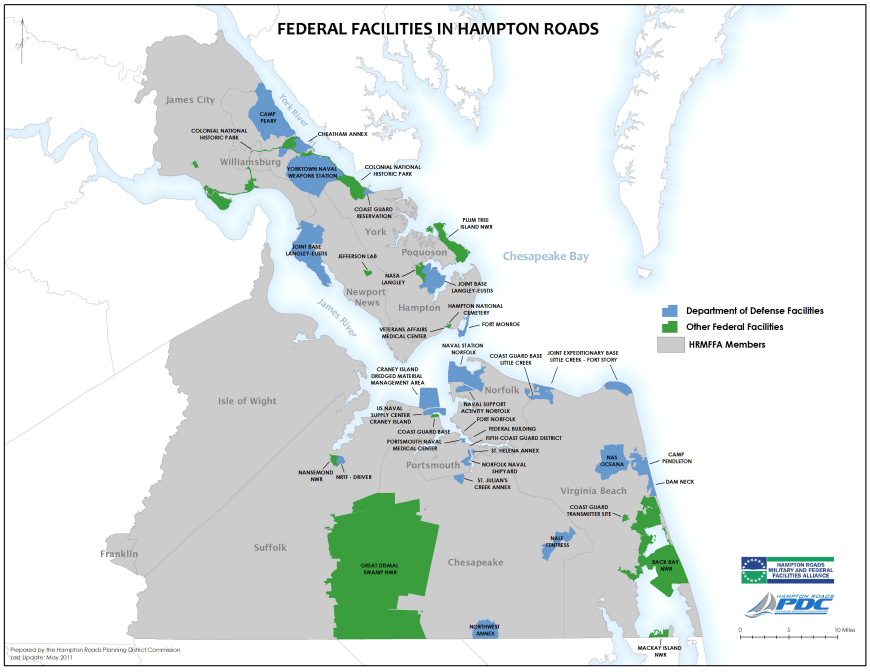

Fig. 3. Military Facilities in Hampton Roads. Image courtesy of the Hampton Roads Military and Federal Facilities Alliance.

[7] HAMPTON ROADS MILITARY AND FEDERAL FACILITIES ALLIANCE, REFERENCE GUIDE 3 (March 2009), *available at* http://www.hrmffa.org/images/stories/alliance_only/Documentation/2009_Reference_Guide.pdf.

Thus, there is a complex local, state, and federal government mosaic of jurisdiction and authority over various elements of climate adaptation planning and policy implementation. The Virginia Coastal Zone Management (VACZM) program, discussed further below, provides an overarching coordinating mechanism for the state agencies through an Executive Order which is renewed under each new Governor.[8]

III. Virginia's Adaptation Planning and Policy Action

Adaptation planning has arisen in Virginia from the increased flooding experienced by coastal zone localities. Localities along Virginia's tidal shoreline have seen higher storm surges, higher "spring" and astronomic tides, compromised transportation segments, and inundation to public and private properties among other impacts. Starting in 2008, Tidewater localities began to include sea level rise in local long-range land use planning documents, floodplain and hazard mitigation planning documents, and the like. These and other planning efforts are accelerating and some of those initiatives and examples are reviewed below.

A. Federal Incentives for Local Action

Many federal programs require local and regional governmental planning prior to participating in these programs, especially if they involve the distribution of federal funds. These federally mandated planning processes offer an opportunity for innovative communities to explore sea level rise impacts, even with limitations of local powers under the Dillon Rule.

In order for a locality in Virginia to be eligible for programs under the Federal Emergency Management Agency (FEMA), a community must undertake hazard mitigation planning.[9] The community must also have a floodplain management program and appropriate building ordinances in high-risk flood zones in order to qualify for the National Flood Insurance Program (NFIP).[10] The Virginia Department of Conservation and Recreation is the lead state agency on floodplain management planning.[11]

These prerequisites to participating in FEMA programs present opportunities for local governments to plan for inundation and sea level rise impacts. Federal regulations allow localities to exceed minimum federal standards, enabling location-specific sea level rise adaptation strategies. Discounts in National Flood Insurance Program (NFIP) rates can be obtained by going beyond minimum federal and state requirements and some communities (e.g., Gloucester County, Chesapeake) are using committees of citizens to help plan those additional steps. Many hazard mitigation plans in Virginia include sea level rise discussions, and other localities are including sea level rise in their floodplain management plans (see Table 2 for examples).

The U.S. Department of Transportation requires states[12] and regions[13] to complete long range transportation plans prior to receiving federal transportation funding and these plans require extensive

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[8] Office of the Governor, Commonwealth of Virginia, Continuation of the Virginia Coastal Zone Management Program, Executive Order No. 18 (2010), *available at* http://www.governor.virginia.gov/PolicyOffice/ExecutiveOrders/pdf/EO_18.pdf.

[9] 44 C.F.R. § 201.3(d).

[10] *See* 44 C.F.R. Chapter 1, Subchapter B.

[11] VA. CODE ANN. § 10.1-602.

[12] 23 C.F.R. § 450.206.

[13] *Id.* § 450.306.

public notice and participation opportunities. In shoreline communities, inundation of transportation segments with sea level rise/storm surges is a long-range risk that could be included in these plans. The current Virginia long-range transportation plan has a section discussing climate change impacts including sea level rise, although there are no recommendations for acting on those projected impacts. The regional Hampton Roads regional long-range transportation plan also included a discussion on sea level rise. On September 24, 2012, the Federal Highway Administration announced federal cost-sharing would be available for, "activities to plan, design, and construct highways to adapt to current and future climate change and extreme weather events."[14]

The U.S. Department of Commerce requires a regional Comprehensive Economic Development Strategy (CEDS) prior to being eligible for many Commerce funding programs.[15] These regional plans are another opportunity for further climate change planning. The Hampton Roads, Virginia CEDS (Vision Hampton Roads) mentions climate change/sea level rise as one of the economic challenges facing the region. For example, an identified subcommittee action is to "Develop a long-range adaptation strategy for the impacts of climate change and sea level rise on Hampton Roads in order for Hampton Roads to be a region of excellence for environmental distinction."[16]

In addition to incentive programs, federal guidance can provide standards and opportunities for regions and localities in their sea level rise planning efforts. The U.S. Army Corps of Engineers (USACE) issued an engineering guidance in 2011, entitled "Sea-Level Change Considerations for Civil Works Programs" (Circular No. 1165-2-212), in which they proposed a formula for sea level rise adaptation to be used on any construction project within their civil works division.[17] This guidance is the first federal government policy that anticipates sea level rise and will have an impact in Virginia, given its large military and federal presence along the tidal shoreline and the use of this guidance by the USACE in their projects throughout the Hampton Roads region.

The Coastal Zone Management Act (CZMA) was established in 1972 and is administered by the National Oceanographic and Atmospheric Administration. The CZMA authorizes state coastal zone programs, such as Virginia's, and requires the preparation of a management program for the coastal zone.[18] This program enables assessments of the natural resources in that zone. The CZMA language specifically mentions sea level rise as an element of concern – "(l) Because global warming may result in a substantial sea level rise with serious adverse effects in the coastal zone, coastal states must anticipate and plan for such an occurrence."[19]

B. State Action

In 2008, a state government review of climate change impacts in Virginia was conducted by the Governor's Commission on Climate Change.[20] Then-governor Tim Kaine established the Commission with Executive Order No. 59, issued in December 2007. The Commission was a direct result of the

[14] U.S. Department of Transportation, Federal Highway Administration, Memorandum: Eligibility of Activities to Adapt to Climate Change and Extreme Weather Events Under the Federal-Aid and Federal Lands Highway Program (Sept. 24, 2012), *available at* http://www.fhwa.dot.gov/federalaid/120924.cfm

[15] 42 U.S.C. § 3162.

[16] HAMPTON ROADS PARTNERSHIP, VISION HAMPTON ROADS ANNUAL REPORT 32 (2011), *available at* http://hrp.org/Site/docs/Publications/VisionHamptonRoads_AnnualCEDSreport_30Sep11.pdf.

[17] Circular No. 1165-2-212 is available at http://planning.usace.army.mil/toolbox/library/ECs/EC11652212Nov2011.pdf.

[18] *See* 16 U.S.C. § 1455.

[19] 16 U.S.C. § 1451(l).

[20] A record of the Governor's Commission on Climate Change's meetings and deliberations is maintained by Wetlands Watch at http://www.sealevelrisevirginia.net/main_CCC_files/.

Virginia Energy Plan issued that same year, which established the need for a 25% reduction in greenhouse gas emissions in Virginia, laid out energy conservation and renewable energy options to partially meet those goals, and recommended a Climate Change Commission to find ways to meet the rest of the greenhouse gas reduction goals. The Commission was composed of 39 members/stakeholders from a range of sectors and was chaired by then-Secretary of Natural Resources, L. Preston Bryant, Jr. The Commission was one of 29 state climate change commissions nationwide that met during the period from 2007 – 2009.

The climate change adaptation and sequestration workgroup was chaired by then-Delegate Joe Bouchard and made a number of recommendations for actions to be taken by Virginia in order to adapt to those irreversible climate change impacts that were known. The Commission agreed by consensus that over the coming 100 years, Virginia would see sea level rise between 2.3 and 5.2 feet, would experience a warming of 3.1°C (5.6°F), and that precipitation would increase by 11%, all regardless of any action taken to reduce greenhouse gas emissions.[21]

Few of the adaptation options recommended by the Commission have been acted upon. Implemented actions include: policy actions for mapping (recommendation 14N), policies emphasizing the use of living shorelines for erosion control (14A), including sea level rise in local government long-range plans (14C), and use of shoreline management plans that include sea level rise (14U).

Beginning in 2013, pursuant to Va. Code § 15.2-2223.2, localities in Tidewater Virginia will need to include coastal resource management guidance in their comprehensive plans. This guidance will be developed in part by the Virginia Institute of Marine Science (VIMS) and "shall identify preferred options for shoreline management and taking into consideration the resource condition, priority planning, and forecasting of the condition of the Commonwealth's shoreline with respect to projected sea-level rise."[22] This new requirement aims to provide more detail and depth to the evaluation of inundation and sea level rise impacts in tidal localities in Virginia. This program implements recommendations 14D and 14U of the Governor's Commission on Climate Change. To date, all of the implemented policies have been enacted on a local level, none of the state-level policy recommendations have been implemented, and there has been minimal high-level state agency action on the issue of sea level rise adaptation since the 2008 Climate Change Commission report.

In 2011, the Virginia General Assembly requested that the Virginia Institute of Marine Science conduct a study of the strategies for adaptation to recurrent flooding in the Tidewater and Eastern Shore regions of Virginia.[23] While the study compiled and reviewed an extensive amount of existing data and findings, it concluded that:

- Recurrent flooding is a significant issue and one that is predicted to become worse over a 20- to 50-year planning horizon;
- Risks from recurrent flooding are not same throughout the Tidewater region;
- Data are lacking for comprehensive and fine resolution analysis of risks;
- It is possible for Virginia to develop an effective response but it takes 20-30 years to effectively plan and implement adaptation strategies; and

[21] GOVERNOR'S COMMISSION ON CLIMATE CHANGE, FINAL REPORT: A CLIMATE CHANGE ACTION PLAN 5 (2008), *available at* http://www.sealevelrisevirginia.net/docs/homepage/CCC_Final_Report-Final_12152008.pdf. The SUMMARY OF NATURAL RESOURCES/SHORELINE ADAPTATION STRATEGY RECOMMENDATIONS OF THE VIRGINIA COMMISSION ON CLIMATE CHANGE (2009) is available on the Wetlands Watch website at http://wetlandswatch.org/Portals/3/WW%20documents/Adap_Strat_adopted_VCCC_062109.pdf

[22] VA CODE ANN. § 28.2-1100.9.

[23] MOLLY MITCHELL ET AL., RECURRENT FLOODING STUDY FOR TIDEWATER VIRGINIA, VIRGINIA SENATE DOCUMENT NO. 3 (2013), *available at* http://ccrm.vims.edu/recurrent_flooding/Recurrent_Flooding_Study_web.pdf.

- The optimal adaptation strategy will be a flexible plan that matches adaptation options to each coastal locality and links implementation to the evolving risks.[24]

The study recommended that state and local governments in Tidewater Virginia:

- Immediately begin comprehensive and coordinated planning efforts;
- Initiate identification, collection and analysis of data needed to support planning;
- Assess local government legal authority to address current and projected flooding risks, and enact authorizing legislation; and
- Develop a comprehensive state strategy, including prioritization of action and analysis of appropriateness, feasibility, and cost/benefit of strategy implementation.[25]

Further, the study noted that state leadership is needed to better access relevant federal resources, transcend local boundaries, standardize assessment methods for prioritization efforts, and enable local community action.

C. Regional Action

Much of the regional planning for sea level rise has occurred within the regional planning district commissions (PDCs; of which there are 8 in Tidewater Virginia). PDCs are enabled to "encourage and facilitate local government cooperation and state-local cooperation in addressing on a regional basis problems of greater than local significance…"[26] Local governments voluntarily join PDCs, pay membership fees, and receive technical assistance and program services on an array of local land use, economic development, natural resources, transportation, and other infrastructure issues. The PDCs are composed of appointed elected officials and citizens, and local government staff. PDCs are funded by local government contributions, state appropriations, and grants. PDCs actively supports localities, but have no authority to enact adaptation strategies.

Since 2008, VA CZM has supported efforts by several coastal PDCs to help plan for climate change adaptation, particularly work to characterize, assess, and map the risk and community vulnerability from sea level rise and storm surges. VA CZM has supported the following coastal PDC projects over a three-year period (2009-2011), generally between $40,000-$70,000 per project annually. (Table 1).

[24] *Id.* at vi – vii.
[25] *Id.* at vii – viii.
[26] VA. CODE ANN. § 15.2-4207(A).

Table 1. PDC projects related to climate change adaption.

PDC	Project	Topic
Hampton Roads	*Climate Change in Hampton Roads: Impacts and Stakeholder Involvement*	• Collection and analysis of available data on vulnerability and impact analysis. • Local government staff meetings on impacts. • Development of a regional framework for responding to climate change, including guidelines and recommendations.
	Storm Surge Vulnerability and Public Outreach	• Estimating potential impacts from gathered data, including current exposure and vulnerability to storm surges from hurricanes.
	Sea Level Rise in Hampton Roads, Virginia	• Development and demonstration of a GIS-based tool to estimate exposure to future sea level rises, across sectors (e.g., population, built environment, natural environment, economy).
Middle Peninsula	*An Assessment of Potential Anthropogenic and Ecological Impacts of Climate Change*	• Collection, assessment, and analysis of available information on climate impacts on the Middle Peninsula, including human communities and institutional impacts, threats to estuarine environments and coastal wetlands, and impact on marine fisheries.
	Facilitation of Presentations and Discussions of Climate Change Issues with Local Elected Officials and Public	• Prioritization of anthropogenic and environmental impacts for adaptation and education/outreach responses through engagement with local officials and general public.
	Ecological and Anthropogenic Impacts	• Development of a planning technical assistance kit containing locally applicable scientific data, vulnerability assessment tool, case studies, and sample ordinances.
Northern Virginia	*Sustainable Shoreline Community Management I*	• Inventorying existing data resources and policies, identifying data gaps, and assessing current local shoreline management regulations.
	Sustainable Shoreline Community Management II	• Refining sea level rise and storm surge vulnerability map. • Survey of waterfront property owners. • Development of adaptation strategy recommendations.
	Preparing Shorelines for Sea Level Rise	• In collaboration with Northern Virginia Hazard Mitigation Planning process, strategies developed to prepare for sea level rise and storm surge inundation impacts.

While other PDC and local government assessments of impacts from sea level rise and inundation exist, the VA CZM-funded projects represent a comprehensive example of the vulnerability assessments underway in the mid- to late- 2000s that established the foundation of awareness among local government officials. The PDC actions also demonstrate the regional scale of the climate change impact in Virginia's coastal zone.

Although less regionally defined, there have been some community conversations throughout southern Tidewater Virginia. In 2011 and 2012, the Virginia Sea Grant Program funded four community conversations on sea level rise. The first set of conversations was held in Virginia Beach, with four

sessions conducted over a two-day period, involving 128 citizens who discussed impacts from increased flooding that they had observed. A second focus group meeting was held in Virginia Beach in 2012 to determine citizen reaction to proposed adaptation measures. A community conversation on sea level rise was held on the Eastern Shore in 2012 and drew 200 people. A fourth meeting was funded on Virginia's Middle Peninsula, in a focus group format, to explore impacts and acceptable adaptation options there.

In 2012, Old Dominion University, Hampton Roads PDC, and Virginia Sea Grant launched a series of Forum meetings among local planners, stormwater managers, emergency management officials, and other facility managers from predominantly local, but also state and federal facilities. The Forum will extend at least into early 2014 and seeks to facilitate information sharing and networking among on-the-ground staff responsible for facility adaptation activities in the Hampton Roads region, and funding secured from the National Sea Grant Office in the National Oceanic and Atmospheric Administration will also support public meetings in 2013 and 2014.[27] Thus local dialogue among citizens, facility managers and other stakeholders across the region is beginning to occur.

D. Local Action

Every Virginia locality is required to develop a long-range land use plan which is to be reviewed and revised on a five-year cycle:

> The comprehensive plan shall be made with the purpose of guiding and accomplishing a coordinated, adjusted and harmonious development of the territory which will, in accordance with present and probable future needs and resources, best promote the health, safety, morals, order, convenience, prosperity and general welfare of the inhabitants, including the elderly and persons with disabilities.[28]

These plans usually have a 20-year planning horizon and the "probable future needs" clause above would allow consideration of long-range flooding and sea level rise adaptation planning.

In "Tidewater" localities, comprehensive plans and zoning authorities are also required under the Chesapeake Bay Protection Act to include water quality protection measures, including zones protected from disturbance along the shoreline.[29] These additional natural resource planning requirements provide opportunities to discuss and plan for tidal flooding and sea level rise. Consequently, general inundation and sea level rise concerns are reflected in every long-range land use plan developed and approved by a Tidewater locality since 2008, although these plans have not included specific development policies. Table 2 below provides a sample of local references to sea level rise in comprehensive, hazard mitigation, and floodplain management plans.

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[27] *See* Old Dominion University, Climate Change and Sea Level Rise, http://www.odu.edu//research/initiatives/ccslri (last visited Apr. 15, 2013), and Virginia Sea Grant, *Adaptation and Flooding Forum Promotes Sharing Among Hampton Roads Communities*, Dec. 6, 2012, http://vaseagrant.vims.edu/2012/12/06/adaptation-and-flooding-forum-promotes-sharing-among-hampton-roads-communities/ (last visited Apr. 15, 2013).

[28] VA. CODE ANN. § 15.2-2223(A).

[29] *Id.* § 10.1-2100.

Table 2. Sample of Climate Adaptation Steps by Municipalities in Hampton Roads Region.

Municipalities	Hazard Mitigation Plans[30]	Comprehensive Plans	Floodplain Management Plans
Gloucester	Middle Peninsula Natural HMP (pg. 241)		A Coastal Floodplain Management Plan for Gloucester County, Virginia (pg. 9)[31]
Hampton	Peninsula HMP (pg. 51)	Hampton Comprehensive Waterways Management Plan (pg. 2)[32]	
Isle of Wight	Southside Hampton Roads HMP (pg. A:16)	Comprehensive Plan, Isle of Wight County, Virginia (pg. 2-23)[33]	
James City	Peninsula HMP (pg. 51)	James City County 2009 Comprehensive Plan (pg. 63)[34]	
Newport News	Peninsula HMP		
Norfolk	Southside Hampton Roads HMP (pg. A:25)		
Poquoson	City of Poquoson, Virginia Multi-Hazard Mitigation Plan (pg. 31)	City of Poquoson Comprehensive Plan 2008-2028 (pg. 5-3)[35]	Flood Insurance Study[36]
Portsmouth	Southside Hampton Roads HMP (pg. A:43)		City of Portsmouth 2010 FMP (pg. 26)[37]
Suffolk	Southside Hampton Roads HMP	Comprehensive Plan for 2026, City of Suffolk, Virginia (pg. 5-2)[38]	
Surry	Richmond-Crater Multi-Regional HMP (pg. 5-132)		
Virginia Beach	Southside Hampton Roads HMP (pg. A:65)	City of Virginia Beach, Comprehensive Plan Policy Document (pg. 7-3)[39]	
Williamsburg	Peninsula HMP (pg. 51)		
York	Peninsula HMP (pg. 118)	Charting the Course to 2025 - The County of York Comprehensive Plan (pg. G-1)[40]	

[30] All community hazard mitigation plans can be found on the Commonwealth of Virginia's Department of Emergency Management website at http://www.vaemergency.gov/em-community/plans/local-mit.
[31] www.gloucesterva.info/Portals/0/es/documents/FinalFloodplainManagementPlanAdoptedSeptember2009.pdf.
[32] For URLs to many engineering studies conducted for the City of Hampton, *see* http://www.hampton.gov/publicworks/engineering/historical_studies.html.
[33] http://www.co.isle-of-wight.va.us/planning-and-zoning/download/Comprehensive%20Plan/Isle%20of%20Wight%20County%20Comprehensive%20Plan.pdf.
[34] http://www.jamescitycountyva.gov/administration/comprehensive-plan.html.
[35] http://www.ci.poquoson.va.us/sites/default/files/CompPlan03.22.10_0.pdf.
[36] https://www.rampp-team.com/county_maps/virginia/poquoson/poquoson_city_va_pmr_fis_tables1_.pdf.
[37] http://www.portsmouthva.gov/planning/images/2010-Flood-Plan-Directions-Final-Draft.pdf.
[38] http://www.suffolkva.us/pcd/comprehensive-planning/2026-comprehensive-plan/volume-1/.
[39] www.vbgov.com/government/departments/planning/2009CompPlanProcess/Pages/default.aspx/compplandocs/Documents/CP_PolicyDocument_Web.pdf
[40] http://www.yorkcounty.gov/Default.aspx?tabid=1723.

Beyond Hampton Roads, yet still in the Virginia coastal zone, other communities have acknowledged sea level rise and adaptation needs in their general guidance and planning documents. For example, Accomack County on the eastern shore of Virginia contains general recommendations for development given sea level rise in their comprehensive plan.[41] Mathews County in the Northern Neck region along the western shore of the Chesapeake Bay has recommendations for future development and expresses concern about climate changes and its impact on septic systems in their comprehensive plan.[42]

IV. Additional Milestone Events in Virginia's Considerations of Climate Change

While not an exhaustive list of bellwether events that have influenced the place for climate change on the policy agenda in Virginia, a few milestones are noteworthy:

- In 2007, the city of Norfolk let a contract to study coastal flooding in the city. While the study request for proposals did not mention sea level rise, the resulting study has brought this issue central to the discussion of tidal flooding in Norfolk. This study has resulted in a comprehensive flooding strategy for the city of Norfolk, one that readily admits sea level rise has to be taken into account. The study, conducted by Fugro Atlantic, a Dutch environmental engineering firm, suggested immediate protection measures of most vulnerable and essential infrastructure—floodwalls, tide gates, elevated roads, and water pumping stations. The cost estimate was $300M.[43] Another consulting firm, Timmons Group, identified the inadequacy of Norfolk's stormwater system to handle more frequent major storms and recommended a $775M upgrade—Norfolk's annual stormwater budget is $6M.[44]

- The political leadership of Norfolk has been direct in confronting its inundation issues, with Norfolk's Mayor Paul Fraim stating that one of the options that must be considered is a managed "retreat"[45] from areas for which other adaptation options cannot be used.[46] Such statements from local elected officials have not been forthcoming from other communities in the Virginia coastal zone.

- In 2010, the city of Hampton, Virginia, engaged in a year-long comprehensive, citizen-led review of the city's waterways and their management. Tidal flooding and sea level rise were one focus of this effort. The final report, the "Hampton Comprehensive Waterways

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[41] *See generally*, ACCOMACK COUNTY, VIRGINIA, 2008 COMPREHENSIVE PLAN UPDATE (2008), *available at* http://www.co.accomack.va.us/Planning/2008_comprehensive_plan_update.html.

[42] *See* MATHEWS COUNTY, VIRGINIA, 2030 COMPREHENSIVE PLAN (2011), *available at* http://www.mathewscountyva.gov/home/showdocument?id=1433.

[43] Kevin Smith, Fugro Atlantic, City of Norfolk City-wide Coastal Flooding Study, Presentation to Storm Water Working Group, Feb. 29, 2012, *available at* http://www.norfolk.gov/DocumentCenter/View/3977. *See also*, Darryl Fears, *Built on sinking ground, Norfolk tries to hold back tide amid sea-level rise*, THE WASHINGTON POST, June 17, 2012, http://articles.washingtonpost.com/2012-06-17/national/35459771_1_sea-level-rise-sea-levels-hampton-roads.

[44] Fears, *supra* note 43.

[45] Meghan Hoyer, *Consultants Work on Flood Plan as Tides Rise and Norfolk Sinks*, PILOTONLINE.COM, Aug. 6 2010, http://hamptonroads.com/2010/08/consultants-work-flood-plan-tides-rise-and-norfolk-sinks.

[46] William Bragham, *Rising Tide in Norfolk Virginia*, Need-to-know on PBS, April 27, 2012, http://www.pbs.org/wnet/need-to-know/environment/rising-tide-in-norfolk-va/13739/ (last visited Mar. 12, 2013).

Management Plan," was issued in 2012 and provides a number of options for addressing tidal flooding in that city.[47] The study was noteworthy for its citizen engagement and the specific response recommendations.

- In 2012, the National Aeronautics and Space Administration (NASA) conducted a climate change impact review of its two facilities in Virginia, its research facility at Langley and its launch facility at Wallops Island, on the eastern shore. These planning efforts noted significant challenges to these two shoreline facilities due to sea level rise and other climate change impacts.[48] In general, the federal facilities in the Hampton Roads have been active in planning and studying adaptation issues (e.g., U.S. Army Engineer Research and Development Center study of the Norfolk Naval Station[49]), and some have conducted adaptation activities on their facilities (e.g., raising docks at the Norfolk Naval Station[50]). The Langley Air Force Base has sought $5.5M for flood protection measures.[51] However, the federal facilities have not coordinated a consistent federal message,[52] nor have they been facilitating region-wide discussions on adaptation strategies and approaches.

These examples are shaping the rapidly evolving context for climate adaptation in Virginia's coastal zone. Virginia's Tidewater region has accepted storm surge inundation and more frequent flooding from climate change, although it faces the implementation realities.

V. Virginia's Policy Climate for Climate Change—The Implementation Gap

Local governments in the coastal zone of Virginia are increasingly aware of and talking about sea level rise and the need to adapt to it. This is evident in local comprehensive, hazard mitigation, and floodplain management plans. However, a substantial implementation gap exists between guidance and overarching plans which acknowledge climate change issues and the specific ordinances, codes, and best management practices to address those issues. Progress has been limited by several factors.

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[47] HAMPTON ROADS CITY COUNCIL, HAMPTON COMPREHENSIVE WATERWAYS MANAGEMENT PLAN: FINAL REPORT (2012), *available at* http://www.hamptonva.gov/publicworks/engineering/waterways_management/waterways_management_plan.pdf.

[48] NASA Langley Research Center, Delivering for Today…, Preparing for Tomorrow, http://www.norfolk.gov/DocumentCenter/View/1767.

[49] K. A. Burks-Copes and E. J. Russo. (In press). Risk Quantification for Sustaining Coastal Military Installation Assets and Mission Capabilities, Final Technical Report. Prepared by the U.S. Army Engineer Research and Development Center (ERDC), Environmental Laboratory (EL), Vicksburg, MS for the Strategic Environmental Research and Development Program (SERDP) under project #RC-1701. *See also*, Old Dominion University, Quantifying Risks of Climate Change and Sea Level Rise to Naval Station Norfolk, http://www.odu.edu/research/initiatives/ccslri/calendar/2012/12/risks_of_climate_cha.

[50] Joe Bouchard, Friends don't let friends marry climate scientists, Virginia Sea Grant Policy Seminar Series (Nov. 17, 2010), *available at* http://vaseagrant.vims.edu/2010/11/12/vss-fall-2010/.

[51] David Macaulay, *Langley AFB wants $5.5 million in flood protection*, THE DAILY PRESS, Apr. 7, 2010, http://articles.dailypress.com/2010-04-07/news/dp-local_floodrisk_0407apr07_1_flood-protection-factory-point-langley-air-force-base.

[52] Skip Stiles, Op., *The Coastal Conundrum*, THE WASHINGTON POST, Dec. 14, 2012, http://articles.washingtonpost.com/2012-12-14/opinions/35847620_1_coastal-homes-coastal-communities-coastal-towns.

For example, there has been limited regional coordination and response. The 2013 recurrent flooding study for the Virginia General Assembly noted:

> In areas where the government takes little or no action to stem flooding issues, individuals will take actions to protect their properties. However, property owners have different incomes to work with and different levels of education about the effectiveness of flood adaptation strategies, leading to a coastline scattered with a variety of protection measures that have variable success. The failure of one protection measure may impact the success of adjacent structures (Jarungrattanapong and Manasboonphempool 2009); therefore, the lack of community scale planning is likely to contribute to community level failures. In Virginia, where flooding is a widespread problem, the cooperation of the federal, state and local governments in conjunction with the property owners will increase chances of successful adoption of adaptation strategies. [53]

At the state level, there has been limited engagement and, as a Dillon Rule state, the lack of state policy fails to empower localities to develop and implement adaptation plans. Similarly, the federal facilities have shown limited leadership-by-example that may facilitate regional coordination. Further, the costs of response, over a $1 billion in the City of Norfolk, can be daunting and potentially debilitating.

The initial steps needed to move forward on climate change adaptation were laid out by the Governor's Commission on Climate Change in 2008 and those actions remain a roadmap for launching state and local government action. A review of climate change impacts to state programs and activities and a review of state statutory and regulatory authority to deal with those impacts are actions items laid out in the Commission's report. These reviews may likely reveal areas of needed authority and empowerment necessary for localities to begin adaptation implementation.

The federal government has initiated planning on its facilities in Virginia and has an engineering guidance for U.S. Army Corps of Engineers civil works construction projects, and these initiatives may begin to drive adaptation implementation in Virginia's coastal zone. However, until localities are enabled to take action, the state will lag in implementing climate change adaptation measure. Nonetheless, while Virginia faces an implementation gap between overarching plans and guidance acknowledging climate change concerns and the concrete ordinances, codes, and other measures to address those concerns, the pathways forward are multi-faceted with opportunities for action, leadership, and collaboration from the local, regional, state, and federal level.

[53] MOLLY MITCHELL ET AL., RECURRENT FLOODING STUDY FOR TIDEWATER VIRGINIA, VIRGINIA SENATE DOCUMENT NO. 3 at 38 (2013), *available at* http://ccrm.vims.edu/recurrent_flooding/Recurrent_Flooding_Study_web.pdf, *citing* R. JARUNGRATTANAPONG AND AREEYA MANASBOONPHEMPOOL, ADAPTATION STRATEGIES TO ADDRESS COASTAL EROSION/FLOODING: A CASE STUDY OF THE COMMUNITIES IN BANG KHUN THIAN DISTRICT, BANGKOK, THAILAND (2009).