October 2018

BUILDING COASTAL RESILIENCE IN VIRGINIA

Data Needs Assessment & Funding Resources Review

Lead Author: Mary-Carson Stiff
Director of Policy, Wetlands Watch

Contributing Author: Ross Weaver
Assistant Director, Wetlands Watch

WETLANDS WATCH

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Sea Level Rise

DOCUMENT CONTENTS

This project seeks to identify data needs for building resilience and highlight funding resources currently utilized and those available for resilience projects in coastal Virginia. This document contains two sections:

(1) Data needs assessment

(2) Funding resources review

Wetlands Watch interviewed stakeholders engaged in resilience work in coastal Virginia and the content of those interviews inform the list of information needs and the funding resources identified in this document. Data needs listed include a parenthetical reference indicating which stakeholders reported the need – see the list of interviewed stakeholders on page 30. Many resilience data needs, such as first floor elevations, were obvious to those interviewed and not expressly referenced in the interview; therefore, the parenthetical may not be an exhaustive list of stakeholders interested in the data need. Funding resources utilized by, or available to, stakeholders are organized in tables, beginning on page 18. Originally, this project intended to simply note what funding resources stakeholders employ for resilience, however, several interviews revealed a need for the reference collection of funding resources available with detailed information such as match requirements, maximum grant award size, etc. organized in one place and ideally updated over time. Although such an extensive resource is outside the scope of this grant award, we attempted a framework for this reference document that could serve as a template for a future project.

The interplay between data needs and funding resources demonstrates the importance of data sharing across stakeholders. Every project proposal requires a level of baseline data, which is then used to leverage an ask for funding to acquire additional data. Without the initial investment to obtain the baseline data, projects to advance current work are nonexistent. This presents a difficult cycle that starts and ends with funding. The importance of utilizing existing data and leveraging data received by others is critical.

ACKNOWLEDGMENTS

Wetlands Watch thanks the Virginia Coastal Zone Management Program for funding this work. This project, Task 92.04, was funded by the Virginia Coastal Zone Management Program at the Department of Environmental Quality through Grant FY17 #NA17NOS4190152 of the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, under the Coastal Zone Management Act of 1972, as amended. The views expressed herein are those of the authors and do not necessarily reflect the views of the U.S. Department of Commerce, NOAA, or any of its subagencies.

Thank you to the list of interviewed CRS stakeholders included on page 30. Special thanks to Wetlands Watch staff, Ross Weaver, Skip Stiles, and Shereen Hughes and Wetlands Watch Intern, Jennifer Seay.

ABOUT WETLANDS WATCH

Wetlands Watch, an environmental non-profit located in Norfolk, Virginia, operates statewide to conserve and protect wetlands through education and advocacy. Sea level rise is the biggest threat to our tidal wetlands; we work with local governments to encourage nature based adaptation solutions to sea level rise adaptation.

Wetlands Watch, Inc. 2018

Please cite this document as: "Building Coastal Resilience in Virginia: Data Needs Assessment & Funding Resources Review," Stiff, M.C., Weaver, R., Wetlands Watch, 2018.

www.wetlandswatch.org

Cover Photo: Skip Stiles

For more information, please contact Mary-Carson Stiff at mc.stiff@wetlandswatch.org or 757-376-1364

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In an effort to broaden public engagement in sea level rise adaptation, Wetlands Watch developed an app to track flooding. The logo above is from the "Sea Level Rise" app, downloadable on all app stores.

TABLE OF CONTENTS

Data Needs Assessment

STRUCTURAL DATA.....1

MAPPING DATA.....2

FUTURE CONDITIONS: SEA LEVEL RISE & CLIMATE CHANGE DATA.....4

PLANNING & ASSESSMENTS DATA.....5

STORMWATER MANAGEMENT & WATER QUALITY DATA.....6

WATER & FLOODING RELATED DATA.....7

SHORELINE RESTORATION DATA.....8

GREEN INFRASTRUCTURE DATA.....8

GROUNDWATER, SOIL, & SALINATION DATA.....9

NATIONAL FLOOD INSURANCE PROGRAM & OTHER INSURANCE DATA.....10

MITIGATION ACTIONS DATA.....11

LEGAL & POLICY ANALYSIS DATA.....11

STATE AUTHORITY DATA.....12

SOCIAL VULNERABILITY DATA.....12

PUBLIC INFORMATION DATA.....13

ACCESSING EXISTING DATA.....14

Funding Resources Review

GENERAL COMMENTS ON RESILIENCE FUNDING 15

STATE & FEDERAL FUNDING SOURCES 17

PRIVATE FOUNDATION FUNDING SOURCES.....26

INTERVIEW PARTICIPANTS & RECOMMENDATION CONTRIBUTORS.....30

Structural Data

A. First Floor Elevations (FFE):

The most reported data need from nearly all interviewed stakeholders is first floor elevation data. First floor elevations would help stakeholders identify precise locations of risk, target outreach before and after flood events, direct first responders during events, stagger evacuation orders, differentiate between rain and surge flood risk, apply for assistance to implement mitigation projects, and much more. First floor elevation data helps the US Army Corps of Engineers perform economic analyses to determine effectiveness of proposed flood reduction projects. Currently, multiple efforts underway in the Hampton Roads region seek to estimate first floor elevation data at the neighborhood, locality, and regional scale. The USACE is generating estimates using building age and Federal Emergency Management Agency compliance, elevation certificates, windshield surveys through a phone app, and Google Street View in Portsmouth. The City of Virginia Beach is working with Dewberry and used elevation certificates in several neighborhoods and actual surveyed data to calibrate a mathematical tool to generate finished floor estimates. These estimates were used as input for their detailed HAZUS analysis. Old Dominion University has conducted field-based laser inclinometer mapping in Norfolk in conjunction with Google Street View and is preparing to use geostatistics and machine-learning to predict FFE elevations and estimate uncertainty in partnership with the City of Newport News, VA Department of Emergency Management, VIMS and the Commonwealth Center for Recurrent Flooding Resiliency (CCRFR). The Hampton Roads PDC is collecting elevation certificates across the region to create a GIS database accessible to the public, feeding data points to aid current and future first floor elevation estimation projects. Once all the estimation projects are completed and data shared and methodologies discussed, regional stakeholders will evaluate these varied approaches and determine which strategy is most economical and accurate. Once selected, discussions will begin on how the approach will be utilized to complete first floor elevation estimates for the region. One locality noted that using estimates for first floor elevations may be helpful for planning and research purposes, but creates a complication if the estimates do not match surveyor elevation certificate data. Estimates could be perceived as fact, opening the possibility to impact building resale or disputes on insurance claims. Surveyor-signed elevation certificates are the preferred data point to determine first floor elevations, but no communities have enough money or time to hire surveyors or conduct surveys for every at-risk structure in the community, therefore estimates are perceived as the next best thing.

B. Elevation Certificates:

Elevation certificates are the gold standard in reporting important structural information such as foundation type and first floor elevation. Many communities reported the need for elevation certificates in high risk zones, and most importantly, for older and most vulnerable structures in the community (Accomack, Chesapeake).

C. Foundation Types:

Data on the foundation types of buildings was often reported under the first-floor elevation and elevation certificate data request, however some stakeholders called it out

as a specific need to determine which projects are best for structural elevation, which may be most at risk from groundwater seepage, etc. (Northumberland, ODU, VCPC, HRPDC)

D. Building Condition:

Information about a structure's age (VCPC) or current condition (USACE) is important knowledge when considering mitigation actions for structures. If a structure is in terrible shape, elevation is not the smart economic decision, but rather acquisition becomes the preferred mitigation method. One regional planning entity noted data gaps in existing inventories and assessments of indoor plumbing needs in many rural communities (A-NPDC).

E. Real Estate Information:

Stakeholders reported cross-locality real estate information would be helpful to build resilience (VIMS, HRPDC). Real estate trend data that shows property values across time would help inform academic research as well as locality planning (VIMS) and shows the market impacts of increased flooding and sea level rise (Wetlands Watch, MPPDC). Geocoded data about structural vacancies is available through the US Post Office, but is largely unknown and underutilized. It would be helpful to prioritize planning and understand neighborhood character (ODU).

Mapping Data

Built Environment

A. Transportation Network:

Better coordination with VA Department of Transportation (VDOT) was a commonly reported comment, but one stakeholder reported the need to identify VDOT right of ways and digitize paper maps showing right of way locations in rural communities (A-NPDC).

B. Land Use:

Data to determine the percentage of impervious cover in a community or regional area would be helpful, and higher resolution data, like that used in the North Carolina models, would be an improvement (ODU).

C. Parcel data:

Ownership information is necessary for outreach & mitigation priorities (DCR). There is a need for a uniform parcel database, that is updated annually. North Carolina has a uniform parcel information service maintained by the state that could serve as a useful model (ODU).

D. Building Footprints:

One stakeholder reported improved building footprints that include setback distance would be helpful. Current building footprint data is not consistent - some footprints are accurately sited and others are represented as crude boxes, meaning footprints cannot be used to calculate square footage (VIMS).

Stormwater Infrastructure

A. Ditches Inventory:

Stakeholders reported the need to identify right of ways when proposing redesigns to accommodate stormwater and tidal flooding. All regions need a comprehensive ditch map (A-NPDC). The Virginia Institute of Marine Science Center for Coastal Resources Management is working on a project to determine a methodology.

B. Comprehensive Stormwater Inventory:

A comprehensive inventory of stormwater systems that includes culverts, ditches, and more is needed (Norfolk).

Natural Infrastructure

A. Hydrology/Geomorphology:

Mapping data on watershed and sub-watershed boundaries would be helpful (Portsmouth). Topographic data can be improved with Light Detection and Ranging (LiDAR) sensing.

B. Green Infrastructure:

A map showing the locations of green infrastructure projects would help provide examples of projects, while also offering the opportunity to model the effectiveness of the projects (VCPC).

C. Tree Canopy:

Higher resolution sensing improves the accuracy of an assessed tree canopy (Wetlands Watch).

D. Wetlands/Marshes:

A dataset is needed that identifies tidal wetlands projected to drown due to sea level rise (NVRC, ERP, Wetlands Watch). This information could be used to prioritize locations for restoration.

E. Shoreline Inventory:

LiDAR that includes a frequently updated shoreline inventory and data on bank and buffer conditions would be helpful (HRPDC).

Flooding Vulnerability

A. Pollution Hotspots:

Identifying remediation sites located in the floodplain can help communities receive Brownfield grants (Norfolk).

B. Localized Flooding:

Hot spots & pocket flooding areas need to be identified, as FEMA Flood Insurance Rate Maps (FIRMs) do not identify all at-risk areas (DCR, Wetlands Watch, Chesapeake).

C. Storm Surge Projections:

The VA Department of Emergency Management projects storm surge at various storm levels, but this data may need to be updated following the release of more accurate LiDAR data (Accomack).

D. Precipitation:

Many stakeholders reported the need for current and future rainfall modeling (Portsmouth, ODU, Wetlands Watch).

E. Real-Time Data:

Many communities and stakeholders reported the need for real-time data on the depth of flooding, which can be achieved through flood sensors. The Hampton Roads Planning District Commission is working on a regional project – read more under the *Water & Flooding Related Data* section.

Future Conditions: Sea Level Rise & Climate Change

A. Subsidence:

The margin of error in mapping subsidence is currently very large, but a higher resolution (building level, acres, or less) should be available in the next couple years, which will be extremely helpful. Regional work through the US Geological Survey and the existence of new satellite data will help lessen the margin of error (ODU).

B. Sea Level Rise Scenarios & Standardization:

Consistent regional or state sea level rise scenarios will help with cost benefit analysis & ensure consistency (DCR, Norfolk, WW, VIMS). Science seems to project planning at a much more extreme level than many scenarios adopted in Virginia, which may be a concern (ODU). Other standardization, like a state-set of flood return frequencies helps promote consistency (VIMS). There is also a need for regional or state standards for agency actions that will help localities (Hampton). The Hampton Roads PDC recently adopted a set of sea level rise scenarios for recommended regional planning use.

C. Regulation:

We should require that communities regulate to the future floodplain (VA Beach). Federal planning standards should include future conditions (Norfolk).

D. Precipitation:

An official standardized set of scenarios for rainfall is needed. Although a rainfall dataset exists, it is not compiled, not accessible, nor useful, and is not forecast. You can find station specific return frequency, but rainfall varies based on whether you are interested in intensity or frequency of events (VIMS, Wetlands Watch). We also need rainfall

data related to future climate conditions – this information impacts design standards, stormwater management, road building, infrastructure, etc. (Chesapeake). Consider requiring rainfall inclusion in the modeling for federal programs - there is no required rainfall inclusion in the modeling because the inclusion of that data is not in the guidance for the program execution (Norfolk).

E. Climate Change Generally:

Localized temperature data and information about urbanized heat islands is needed (Portsmouth). There is significant attention to sea level rise, but climate change generally is left behind, which is a major oversight – atmospheric climate change projections are multi-regional at best. The Eastern Shore uses National Aeronautics and Space Administration Wallops data, but needs regional or better data on temperature, precipitation, wind, and drought (A-NPDC). One stakeholder is interested in data related to the health impacts of climate change (kidney, pulmonary, heart, etc.) (NVRC).

F. LiDAR:

Updated LiDAR data is a commonly reported data need (Portsmouth, HRPDC, NNPDC), with specific 6-inch LiDAR or better needs reported by some (DCR). Organizing better LiDAR data in one place would be helpful – those using the data from VA Geospatial Services (VGIN) note it needs improvements because it has accuracy errors, requiring users to fix layers manually (ODU).

G. Resilience Projects:

A GIS database of resilience project examples would be helpful to showcase work already done as case studies for implementation elsewhere (CPDC).

H. Road Management:

Guidance for how to manage roads long-term with the knowledge that many roads will be partially submerged in the face of sea level rise (A-NPDC).

Planning & Assessments Data

A. Risk Assessments:

Many stakeholders reported the need for comprehensive risk assessments that extend beyond the flood maps, focus on City owned and critical infrastructure, as well as important assets, and include a public communication requirement to the public (Portsmouth, Dewberry, VCPC, MPPDC, VA Beach). This basic hazard risk assessment data is reportedly critical to apply for funding to implement projects and plans to mitigate the risks facing a community or to design shovel ready projects to implement when funding is available post-disaster (Dewberry). We need to conduct a statewide risk assessment of what is located in the floodplain of today and what is in the future floodplain, attaching value, population, and damage estimates that include future liability/obligation of the National Flood Insurance Program versus locality and individual financial burdens (ODU).

B. Lack of Action:

Although some state level research on this topic has been conducted, a stakeholder reported the need for localized data on the cumulative impacts of the cost of doing nothing to prepare for sea level rise and increased flooding (MPPDC).

C. Adaptation Planning:

Regional adaptation plans are needed to determine how to make less vulnerable areas more appealing for smart development and to provide guidance on what realistic development looks like in the most vulnerable areas (A-NPDC).

D. Regional Partnership:

The identification of flood projects or capital improvement projects located on locality boundaries, or projects that may have impacts across jurisdictional borders, would be helpful (VA Beach).

E. Blue Spots Model:

Maps of road accessibility in the face of flooding and sea level rise would help identify where strategic investments could be made to allow access and functionality during stress events (Norfolk).

F. Flooding Extent Model:

A model that shows actual flooding events based on tidal or precipitation flooding (with documentation) is critical to calibrate predictive flood models (VA Beach).

G. Comprehensive & Overlapping Models:

Access to overlapping models for the most in-depth analysis, such as a digital terrain model that includes a rainfall model, overlaid with the existing stormwater system, would be extremely helpful to assess impacts. When modeling flood impacts, all forms of flooding should be considered (riverine risks, dam inundation, stormwater, tidal flooding, storm surge, etc.) (DCR). This can help identify the effects of mitigation practices at a watershed or sub-watershed scale, highlighting unintended consequences in immediate and surrounding areas (Wetlands Watch).

Stormwater Management & Water Quality Data

A. Stormwater Infrastructure:

Information about the tidal impacts on locality stormwater infrastructure would be helpful. Current infrastructure knowledge includes errors; accurate data about pipe location, capacity, condition, invert elevations, outfalls, etc., will help generate accurate maps of stormwater systems (Norfolk, HRPDC). Additional information such as "bluespot" modeling, is needed to help indicate locations in a stormwater system where capacity is not met (ODU).

B. Best Management Practices (BMP):

Several stakeholders stated the need for verification data and/or modeling that indicates

whether BMPs and low impact development practices are as effective as the stormwater management handbooks report (Portsmouth, Wetlands Watch, VA Beach).

C. Design Storms:

Research to determine whether current design storm standards are still accurate in the state or region would be helpful (Norfolk).

D. Water Quality:

One locality noted that while the stream monitoring network provided by the VA Department of Environmental Quality is helpful as it provides static points, continuous modeling would provide more accurate water quality measurements (VA Beach).

E. Watershed Management:

One community reported it would be helpful to adopt consistent policy for water management across neighboring jurisdictions that share the same watershed (Hampton).

F. Septic Systems:

Information about the consequences of septic system failures on human health and the potential impacts to the aquaculture industry would be helpful (A-NPDC) (a VIMS project is scheduled for the Northern Neck). Additional data on where septic systems are located regionally would be extremely helpful for water quality research (ODU).

Water & Flooding Related Data

A. Flood Sensors:

Flood sensors inform localities where flooding occurs during what types of events, which is critical to accurately plan for the impacts of increased flooding and sea level rise. There is significant activity around the use of flood sensors in Hampton Roads, which will hopefully inform practices elsewhere in the state. Similar to the first floor elevation estimates, use of flood sensors ranges across various stakeholders in the region, however, the Hampton Roads PDC will serve as the leader of this regional effort. The HRPDC will work with a team of regional specialists and facilitate the placement of different types of sensors installed through different methods to determine how a regional network of sensors can develop in the future.

B. Tide Gauges:

Stakeholders need more localized tide gauges to help build the foundation of tail water conditions (Norfolk), help installers base the siting of restoration projects off more accurate tidal ranges rather than deferring to a distant gauge (Norfolk), gain more knowledge of inland flooding (Northumberland), and more. Tide gauges should also include subsidence rates – the Eastern Shore is using subsidence data from 1974, which is extremely dated (A-NPDC).

C. Inshore Bathymetry Data:

It is useful to know areas with shallows where the water could get piled up with wind

blowing a specific way. Realtors frequently ask how deep the water is for access questions (Northumberland).

D. Economic Benefits:

Information about how a water or flooding based economy would function in coastal Virginia would help communities start monetizing the impacts of the problems facing the region (MPPDC). Similarly, information about how working waterfronts and water access infrastructure can adapt to sea level rise and economic stressors is needed (A-NPDC).

Shoreline Restoration Data

A. Restoration / Stabilization & SLR:

Many stakeholders reported the need for data on the effectiveness of various shoreline restoration and stabilization techniques to adapt to sea level rise, which includes wetlands losses and rebound rates, the effectiveness of wetlands grasses and oyster reefs to withstand levels of inundation, and information about the multiple benefits of nature-based protection measures (NWTF, CBF, Wetlands Watch). Monitoring and modeling of shoreline stabilization techniques and wave attenuation by breakwaters is needed (VIMS, Wetlands Watch). Similarly, a cost benefit analysis that shows when different methods of shoreline restoration projects no longer make financial sense because of the lifespan of the project and timing of projected sea level rise inundation (ERP) would be helpful. Finally, guidance on how to prioritize conservation and restoration efforts in the face of climate change and sea level rise is needed (A-NPDC). An assessment of the future conditions of barrier islands and the marsh systems behind them in the face of sea level rise is needed (A-NPDC). An assessment of how islands to the south will be impacted by NASA Wallops Flight Facility's planned series of offshore breakwaters is needed (A-NPDC).

B. Targeting Restoration:

Data is needed that helps identify areas of targeted restoration, such as the location of living shorelines adjacent to armored shorelines (NWTF, CBF). VIMS's shoreline inventory has this information in GIS format, but some stakeholders reported it may not be as up to date and accurate as needed.

C. Wetlands Inventory:

A wetlands inventory that shows whether the state is achieving its goals of no net wetland losses would be helpful (ERP).

D. Daylighting Creeks:

Many urban communities are advised to consider Dutch water management strategies, such as daylighting creeks to accommodate increased flooding, however, communities need more data and best practices on how to daylight creeks effectively (Norfolk).

Green Infrastructure Data

A. Green Infrastructure (GI) Effectiveness:

Data on how effective green infrastructure techniques are to help meet water quality and quantity needs, such as a cost-benefit analyses of pervious vs. impervious technologies and soft v. hard engineering shoreline stabilization techniques, will help market the nature-based solutions to the public, City Council, and City Staff (Portsmouth).

B. GI Case Studies:

Information about which green infrastructure techniques work in communities with very localized risks is needed (Accomack). For example, permeable pavement does not work in areas with high water tables.

C. GI Wellness Benefits:

Data on the wellness benefits of green infrastructure is needed (ODU).

D. GI Database:

A database that is common to all localities showing where GI is located, type, metrics of reduction, etc. would be helpful (ODU).

Groundwater, Soil, & Salination Data

A. Soil Data:

More data and information on soils, such as soil permeability, erodibility, hydraulic conductivity, carrying capacity of columns, etc., helps with scenario or risk modeling (VIMS).

B. Saltwater Intrusion:

Data on the salinization of wells is needed (VIMS). Updated modeling for groundwater is needed to determine salination because the current modeling is based off data from the early 1990s. USGS has new data that shows saltwater intrusion hot spots in some areas, although it would be helpful to have data at the regional scale (A-NPDC). Shallow water bathometry data will help monitor the impacts of salt water intrusion. There are some models for waterways, but none that model conditions under the ground (VIMS).

C. Wellhead Protection:

Need best practices for regulations/policies to ensure wellheads are designed above the Base Flood Elevation (A-NPDC).

D. Groundwater System:

Data on the depth to the water table across the region is critical to build resilience (HRPDC). The Hampton Roads Sanitation District (HRSD) is working on collecting this data, but data beyond Hampton Roads would be helpful. Research data on paleochannels is also critical to understand the impact of the confining units of the confined aquifer on the Eastern Shore (A-NPDC).

E. SLR Impacts:

Information about the impacts of climate change and sea level rise on groundwater supply, surface inundation rates, surficial aquifer, and the water table is needed (A-NPDC). More specifically, information about how these sea level rise impacts will modify the agricultural industry would be helpful (A-NPDC).

National Flood Insurance Program & Other Insurance Data

A. Flood Insurance Coverage:

Spatially explicit flood insurance coverage is needed (VIMS). It would be helpful to know NFIP policies by year, to show growth or increase in policy numbers throughout time. It has been very difficult to get this information through FEMA (ODU, VIMS). Data on how many structures are located in the floodplain and how many structures carry flood insurance would be helpful (HRPDC). Localities need easier access to FEMA's flood data to download Letter of Map Amendment/Letter of Map Revision layers (VA Beach).

B. Flood Insurance Claims:

Spatially explicit flood insurance claims data is needed (VIMS, ODU), especially to identify areas for potential retreat (ODU).

C. Repetitive Loss Information:

Some repetitive loss information is available for research and planning purposes, but the information is not all in one place and contains holes and errors. In addition, the data passes through the state, rather than coming directly from FEMA to the user, which makes fixing holes and errors in the data difficult (ODU). Further, the data does not identify specific addresses or address policy information, due to privacy protection concerns, which makes research less precise (ODU).

D. Car Insurance Claims:

Data on car losses during flood events would be helpful, as car losses are reportedly worse than structural losses during events. Apparently, tax assessors keep records of all vehicles, but do not share it with City staff because of privacy concerns (Norfolk).

E. Post Storm Information:

It would be helpful to have easy access to information related to declared disasters and local damage data following flood events (DCR) (one resource called "Crisis Track" is made available to localities via VDEM). Guidance on how to connect damage data to models for recovery will help prevent delays in post-storm resilience and information about whether those recovery models have been tested elsewhere to benefit from lessons learned (ODU).

Mitigation Actions Data

A. Mitigation Co-Benefits:

It would be helpful to have dollar value amounts for the secondary or co-benefits of mitigation actions, such as habitat/recreation values in addition to the value of damages avoided. Not having the soft benefits valued creates an unbalanced reflection of the costs and benefits of mitigation activities (Hampton, Norfolk). A matrix of how the action can be additive to the value of the project would be helpful – for example, the sustainable infrastructure index has a scoring system that could be used as a model.

B. Flood Vents:

Data on the addition of flood vents and associated diffusion rates is needed (ODU).

C. Health Impacts:

Data on the health impacts of at-risk populations, such as the elderly, living in elevated structures for mitigation purposes is needed (ODU). Data on the connection between vulnerable areas and buyout areas and wellness impacts is needed (ODU).

D. Mitigation Projects:

Data on existing flood mitigation projects and their sources of funding for the work completed is needed (DCR).

E. CRS & Mitigation:

Data on the cost effectiveness of mitigation efforts that earn CRS credits would help demonstrate whether certain mitigation efforts creditable under the CRS Program are actually reducing flood damage and/or increasing flood safety (Portsmouth).

F. Mitigating Hazardous Materials:

Information about how to make industrial infrastructure with potentially hazardous waste and/or materials resilient in the face of disaster events. Data on the best practices for mitigating past and current industries is needed (ERP).

Legal & Policy Analysis Data

A. Liability Issues:

Information about legal implications of identifying retreat zones. Financing agreements with utilities companies guarantee the delivery of services, but is there information about either the private sector or localities identifying areas they plan to discontinue services at a certain time (Portsmouth)?

B. Ownership Issues:

Analysis is needed to outline ownership of newly formed bottomlands resulting from submerged uplands – “dynamic real estate” (A-NPDC).

C. Updated Legal Analysis:

One comment indicated that legal analysis is falling behind the technical pace of change. The suggestion is to shift legal analyses for the purpose of avoiding a no to the goal of getting a yes (NVRC).

D. Resilience Incorporation:

Information about how to optimize existing policies to incorporate resilience is needed (NVRC).

E. Accommodating Land Migration:

It would be helpful to have information about how to talk about and plan for wetlands encroaching into yards due to sea level rise. Information about how to encourage localities and homeowners to allow wetlands to move inland in urban communities that have no land to allow major accommodation. Is there messaging for getting homeowners to welcome wetland migration into their yard and see it as an advantage (Watershed Task Force)?

State Authority Data

A. State Authority:

Virginia is a Dillon Rule state, therefore, all localities need express authority from the General Assembly to plan and implement sea level rise adaptation. This authority is given to the Hampton Roads Planning District Commission, but should be expanded to include all PDCs (James, NWTF, VCPC, Wetlands Watch). The state needs to also exhibit leadership on coordinated and mandated planning, which will force coordination amongst regions, communities, and other stakeholders (VCPC). Clarifying local government authority to take actions to stabilize the tax base and the shorelines is needed (MPPDC).

Social Vulnerability Data

A. Community Resilience:

Need to improve networks of community resilience to educate communities about the importance of checking on one another during and after storm events. It would be helpful if we had best practices from other regions on how social networks work to increase individuals' resilience (Chesapeake, NWTF). Strengthen the link between utility companies or local government emergency managers and those people with special needs citizens (James).

B. Social Vulnerability:

Completing localized vulnerability analyses on a regular basis would assist emergency management programming and inform policy choices (Portsmouth). Communities reported the need for assistance to assess vulnerability information (NVRC, A-NPDC). Researchers reported the need for data related to the adaptive capacity of households.

What is the social capacity of households to become resilient to slow change and/ or a storm event? Macro model with sub micro models of the relationships among all individual investments and people's capacity (aesthetic, health, livable community, financing constraints, etc.) would be helpful (ODU).

Public Information Data

A. Communication:

Stakeholders engaged in resilience work need to do a better job of communicating science to the most vulnerable (ODU). Similarly, resilience stakeholders need help explaining data terminology in a way the general public can understand (ex: tidal flooding v. surge flooding) and simplifying existing mapping resources for people with varying degrees of knowledge and sophistication (ERP). A Virginia specific sea level rise outreach material, such as a pamphlet, may be helpful to outline the sea level rise scenarios, risks, and outline potential actions individuals and communities can do to adapt to the impacts (Wetlands Watch). Increase public outreach on information about flood insurance and FEMA mitigation grants (Poquoson) (HRPDC is currently working on a flood insurance campaign). Improve communication among some of the biggest players in the resilience field – many are not talking to one another, particularly in the private sector (ODU). Need improved data sharing across the public and private sectors (Norfolk). The tidewater region would benefit from a campaign that explains those issues facing the region to the Piedmont region, which would help legislation pertaining to coastal resilience pass with more state-wide support (VA Beach).

B. Individual Knowledge:

One community reported the need for survey information on what people think about environmental resilience and their perceptions about what are worthwhile investments. This knowledge would help decision-makers (Chesapeake). Information about what individual property owners can do for themselves to protect their properties will help inform the public of their risks and mitigation options (Dewberry).

C. Engaging Industry:

Information about the concerns and resilience issues of emerging industries (poultry CAFOs, solar farms, etc.) would be helpful to promote economic resilience planning (A-NPDC). Assistance in helping promote trades and industries that focus on resilience will build resilience and a workforce to assistant the economy simultaneously (Hampton).

D. Locality Transparency:

Citizens need more education on the risks associated with sea level rise. The localities would normally be the purveyors of this information, but the more information localities provide the greater potential risks to their tax base and infrastructure funding support – need a way to overcome this circuitous barrier (Phillips).

Accessing Existing Data

A. Baseline Data:

One locality reported the need for guidance on what baseline data is most important. The more data the community receives the more they understand what additional information is needed. Specifically, data from outside locality staff is more influential when reaching decision makers (Portsmouth).

B. Finding Existing Data:

Information about who around the country is doing what research on the barriers to building resilience is difficult to find, which makes disseminating that information to decision makers difficult (NWTF, Stewart). Applying a state lens on the same issue, information about what projects have been completed will help inform future efforts. Many projects are completed in VA, but the reporting on implementation is an afterthought – the outcomes are not in the hands of the people that need it the most. Many stakeholders reported the need for reporting on research completed and where to locate the deliverables (NNPDC, ERP, Wetlands Watch). One stakeholder recommended creating a GIS map that shows projects and research based on location with links for additional information; this will also help reduce duplication of efforts, a need identified below (A-NPDC). Information about what higher standards or other adaptation tools (zoning, planning, etc.) localities are adopting would be helpful to encourage adoption in other communities (DCR, VCPC, ODU). Information about the number and types of grants and other funding sources the state and/or communities have used for resilience building would be helpful to keep track of both spending and protection projects (HRPDC, VCPC).

C. Using Existing Data:

One community reported the need for guidance on how to pull together all the data and make it interact to perform the results needed for a community's resilience planning - everything starts falling apart when you put it all together and try to work off multiple sources of data (Portsmouth). Existing data may not be in a format helpful to communities or other stakeholders. One stakeholder reported refinement of the existing data will help make it more user focused and user ready and also noted that stakeholders are good at collecting scientific data, but not good at leveraging the human behavior side of things – need to know the right questions to ask to get necessary data to the right users (ODU).

E. Duplication of Efforts:

Many stakeholders referenced the need for better coordination and cohesion among stakeholders to share existing reports, data, and research efforts to reduce the duplication of efforts and redundancy across the resilience field (VCPC, ODU, NNPDC, Wetlands Watch, A-NPDC). One recommendation is to establish a regional resiliency summary unaffiliated with any singular organization/entity to receive up to date information about who is doing what in the region and help fix the disconnect between localities and research institutions (ERP, A-NPDC). More localized symposiums were also recommended as a helpful method to reduce duplication of efforts and stay informed

of existing projects (A-NPDC).

F. Data Standardization:

Multiple efforts underway seek to address concerns that standardized data at the region or state level would help increase resilience, specifically in relation to future conditions. One community reported that the standardization of data terms and definitions across disciplines would help address the reality that resilience needs are truly interdisciplinary, although data does not match up across disciplines - communications across disciplines makes projects challenging (VA Beach). Data standardization would also help communities with fewer resources obtain data from those communities with more resources (Norfolk).

Building Coastal Resilience in Virginia: Funding Resources Review

Stakeholders interviewed were asked about the funding resources used to finance resilience projects, research, or programs.

Local Governments:

Most local governments interviewed reported the use of FEMA Hazard Mitigation Assistance grants to elevate structures, acquire properties located in the floodplain, assist emergency response preparations, etc. Some local governments reported using US Department of Housing and Urban Development (HUD) grants for neighborhood resilience related projects. Locality staff noted a problem with learning about grants far too late in the process, explaining the grant calendars do not match up with planning calendars, making it difficult to locate information about funding and plan the timeline to apply. A potential solution for this problem came in the form of a recommendation that a designated entity generate a monthly list of eligible grants with a one sentence descriptor and distribute it to relevant local government staff.

Research Based Institutions:

Researched based stakeholders reported the use of a myriad of federal and private funders, most notably from the National Oceanic and Atmospheric Administration (NOAA), US Fish and Wildlife Service (USFWS), the US Environmental Protection Agency (EPA), and more.

Planning Entities:

Regional planning entities reported use of many funding resources, most notably the VA Coastal Zone Management Program, NOAA funding administered through the VA Department of Environmental Quality.

Non-Profit Organizations:

Non-profit stakeholders reported reliance on foundational support, individual donations, as well as federal funding entities.

General Comments on the Resilience Funding Landscape in Coastal Virginia

- Current grant funding does not encourage, or even require, collaboration across sectors – resilience issues are inherently complicated, but the funding does not reflect an appropriate multidisciplinary response the complex nature of the issue
- Too few grants will pay for data outright or pay for planning projects
- Federal and state grants programs are not adapting to the resilience movement – they discuss resilience at 50,000-foot level, but are not localized enough for stakeholders with boots on the ground
- Grants may not be available every year or may be diminished year to year, making planning difficult – with variable amounts in FEMA HMA funding each year and VA SLAF grants receiving zero funding in 2018
- Private funders are not active in rural communities
- Need less attention to funding reports and studies and more focus on funding actual mitigation work
- Grants should require a human element in each project, such as an outreach requirement
- Traditional finance mechanisms only work for traditional projects – need examples of infrastructure projects that cross jurisdictional boundaries that would necessitate bond funding

Funding Resource Review Tables

As noted earlier in the document, this project originally intended to indicate what funding resources stakeholders employ for resilience. However, several interviews revealed a need for a continuously updated list of funding resources available, with detailed information such as match requirements, maximum grant award size, etc. Although such an extensive resource is outside the scope of this grant award, we attempted a framework for this reference document that could serve as a template for a future project.

State & Federal Funding Sources for Resiliency

Program Name (click for additional info)	Source	Eligible Projects	Funding Level	Funding Match	Eligible Recipients	Example	FY19 Application Deadline	Contact
Stormwater Local Assistance Fund	DEQ	Non-point source nutrient credits, stormwater projects	$50k - $5m ($20m in total). SLAF wasn't available in 2018	50% local match	Local governments	Hampton VA: SLAF grant awarded for Coliseum Lake stormwater retrofit	10/12/2018	Kelly Ward: kelly.ward@deq.virginia.gov
Clean Water Revolving Loan Fund	DEQ	Reduced interest loans for land conservation, stormwater BMPs, & living shorelines	$50k minimum loan, no maximum (appx. $80-100m annually)	Loan may cover 100% of eligible project costs	Local governments	Fairfax VA: NVA Regional Park Authority acquired and restored 3 acres for park purposes in 2018	07/20/2018	Karen Doran: karen.doran@deq.virginia.gov
Coastal Zone Management Program	DEQ	CZMA allows state CZM programs to use 10% of federal funds for land acquisition	$200k annually	50% local match	State CZM programs	Northampton VA: Pickett's Harbor Natural Area Preserve	N/A	Laura McKay: laura.mckay@deq.virginia.gov
VA Coastal & Estuarine Land Conservation Program	DEQ	Land acquisition (coastal/estuarine land with high ecological value)	Funding has not been appropriated since FY 2012	N/A	State CZM program (state agencies, local govt's eligible to receive funds)	Stafford VA: Crow's Nest: $3m awarded to conserve portion of 1100 acre property	N/A	Laura McKay: laura.mckay@deq.virginia.gov
FEMA Hazard Mitigation Grant Program	DEM	Mitigation following a Presidential Major Disaster Declaration, including acquisition, structure demolition, elevation, flood control projects, etc.	Varies	25% non-federal match	Individuals, businesses, private nonprofits via locality sponsorship	New Orleans LA: Used HMGP funding for reconstruction of stormwater infrastructure with increased green infrastructure	N/A	Robbie Coates: Robert.coates@vdem.virginia.gov

Program Name (click for additional info)	Source	Eligible Projects	Funding Level	Funding Match	Eligible Recipients	Example	FY19 Application Deadline	Contact
FEMA Pre-Disaster Mitigation Grant Program	DEM	Mitigation projects, generators for critical facilities	$235m in FY18 nationally. $10M federal cap for projects, $150k cap for hazard mitigation plan updates	25% non-federal match	States, localities (as a sub-applicant)	Darlington WI: Funded purchase and removal of recurrently-flood industrial property, site will become part of Pecatonica Riverside Park	10/12/2018	Robbie Coates: Robert.coates@vdem.virginia.gov
FEMA Flood Mitigation Assistance Grant Program	DEM	Flood mitigation projects, floodplain restoration	$160m in FY18. $100k federal cap for advanced assistance projects, $10m for mitigation projects	Non-federal match varies from 0% to 25%	States, localities (as a sub-applicant)	Baton Rouge LA: $4.9m awarded in 2018 to elevate 25 residential properties in Tammany Parish	10/12/2018	Robbie Coates: Robert.coates@vdem.virginia.gov
Virginia Shoreline Resiliency Fund	DEM	Low interest loan program for retrofitting structures for resiliency	Remains unfunded	N/A	VA residents, businesses	N/A	N/A	N/A
Supplemental Local Emergency Management Program Grant	DEM	Supporting local emergency management programs, priorities for sheltering supplies/equipment, and public notification systems	$30k project cap, $300k available statewide	50% local match (in-kind donations accepted)	Localities	Portsmouth VA: Received grant to purchase flood sensors	08/01/2018	Shannon Girouard: shannon.girouard@vdem.virginia.gov

Program Name (click for additional info)	Source	Eligible Projects	Funding Level	Funding Match	Eligible Recipients	Example	FY19 Application Deadline	Contact
Dam Safety and Floodplain Management Grants	DCR	Enhance public safety and reduce risk of dam failure/ property damage from flooding. Available for improved methods of flood protection	Determined by funding requested and available funds	50% non-federal match	Public & private dam owners, local governments	Chesapeake VA: Awarded to assess flood risks through revision of floodplain ordinance & flood mitigation strategies	05/30/2018	pco@dcr.virginia.gov
Community Development Block Grant	DHCD	Drainage/water improvements, acquisition, building demolition	Varies by grant type ($17m annually)	N/A	Eligible CDBG localities	Portsmouth, VA: Demolition of derelict structures	Varies by program	Tamarah Holmes: tamarah.holmes@dhcd.virginia.gov
Survey & Planning Cost Share Program	DHR	Projects that help localities inventory historic resources	Varies	50% local match	Local governments	Virginia Beach VA: used funding to incorporate sea level rise into archeological surveys and GIS database	Spring	Blake McDonald: blake.mcdonald@dhr.virginia.gov
BUILD Grants	DOT	Funding for infrastructure investments, past projects have included green infrastructure components	$25m maximum per project, $1.5b available in FY18	20% non-federal match	Broad eligibility	Miami Trail & Everglades Restoration Project (Example of TIGER grant, which was replaced by BUILD)	7/19/2018	buildgrants@dot.gov
319 Grant	EPA	Wide range of implementation to address nonpoint source pollution-green infrastructure is prioritized	$167m available in 2017	40% non-federal match	States	Waukegan IL: Waukegan River stream restoration in urban area	N/A	Nicole Sandberg: Nicole.sandberg@deq.virginia.gov

Program Name (click for additional info)	Source	Eligible Projects	Funding Level	Funding Match	Eligible Recipients	Example	FY19 Application Deadline	Contact
Smart Growth	EPA	Activities that improve the quality of development and protect human health & the environment	Grant offerings vary	N/A	N/A	South LA: Center for Planning Excellence awarded grant to develop model ordinances for land use planning	N/A	N/A
Environmental Justice Collaborative Problem-Solving Cooperative Agreement Program	EPA	Addressing environmental and public health concerns in local underserved communities	$120k per project, 10 awards in FY18	None	NPOs, tribal governments, tribal organizations	Buffalo NY: Environmental Stewardship Worker Training program for green infrastructure	02/16/2018	Reginald Harris: Harris.reggie@epa.gov
Wetlands Program Development Grants	EPA	Projects to promote research, training, demonstrations, and studies for wetlands programs	$350k in FY18, $350k in FY19	25% non-federal match	State, tribal, & local agencies	Ocean City College, NJ: Grant to develop monitoring procedures to assess marsh restoration	06/21/2018	Carol Petrow: Petrow.carol@epa.gov
Emergency Relief Program	FHWA	Repair or reconstruction of federal highways damaged from natural disasters-funding can be used to rebuild more resiliently	$100m authorized annually	10-20% non-federal match	States	Outer Banks NC: Program funded bridge construction of a flooded road segment, allowing for future beach migration	N/A	Greg Wolf: greg.wolf@dot.gov
Choice Neighborhoods Implementation Grants	HUD	Implementation & planning grants to support comprehensive approaches to neighborhood redevelopment	$150m annually in total ($145m for implementation grants)	Varies	Localities, Public Housing Agency	Newport News VA: Uses funding for neighborhood planning, and can incorporate resilience into projects	06/15/2018	N/A

Program Name (click for additional info)	Source	Eligible Projects	Funding Level	Funding Match	Eligible Recipients	Example	FY19 Application Deadline	Contact
Communication Education, & Engagement Grant	NOAA	Develop tools that benefit practitioners, replicable campaigns for mapping expose to climate hazards, professional development	$25-50k per project, $250k annually	N/A	Varies	N/A	9/10/2018	David Herring: david.herring@noaa.gov
Climate Program Office	NOAA	10 competitive research programs to fund climate science, assessments, research, education, and capacity building	Between $50k-$300k per project, $11.25m in FY19	None	Academic institutions, NPOs, commercial organizations, state, local, Indian tribal governments	Nature Conservancy: Awarded funding in FY17 for managing resilience in coastal sites	11/20/2018	Diane Brown: diane.brown@noaa.gov
Coastal Resilience Grants Program	NOAA	Natural infrastructure, post-disaster recovery, risk assessment	$500k-$3m per project, $35m since 2015	50% non-federal match	NPOs, state agencies, local governments, educational institutions, tribal governments, for-profit organizations	Exeter NH: Removed obsolete dam, allowing for habitat restoration and reduced flood risk	08/07/2018	Michelle Pico: pico@nfwf.org
Coastal Zone Enhancement Grant	NOAA	Priority on coastal hazards, and aligned with emphasis on resilient coastal communities	$795k-$2.3m per project in FY17	N/A	Coastal states	N/A	N/A	N/A
Engineering for Civil Infrastructure Grant	NSF	Research exploring infrastructure as an integrated system	Varies	N/A	Academic & Research agencies	Partnerships for International Research and Education Project: Coastal Resiliency	Rolling	Richard Fragaszy: rfragasz@nsf.gov

Program Name (click for additional info)	Source	Eligible Projects	Funding Level	Funding Match	Eligible Recipients	Example	FY19 Application Deadline	Contact
Section 205 Flood Damage Reduction Projects	USACE	Plan, design, construct small flood control projects	$100k cap for feasibility studies	No match for studies. Final design & construction requires 35% non-federal match	Non-federal government agencies	N/A	N/A	hq-publicaffairs@usace.army.mil
Section 1135 Project Modifications for Improvement of the Environment	USACE	Review and modification of water structures to improve environmental quality, including restoration measures	Limited to $10m in federal costs	Non-federal match for 25% of design & construction, 100% of operation & maintenance	Non-federal government agencies	Stewart's Creek MA: Estuary Restoration Project of 14 acres of salt marsh in Barnstable County	N/A	N/A
Section 14 Emergency Streambank and Shoreline Protection	USACE	Bank protection projects to protect essential infrastructure	$5m maximum per project	Construction costs are 65% federal and 35% non-federal	Locality or government agency	N/A	N/A	Dan Hughes: Daniel.b.hugues@usace.army.mil
Section 103 Hurricane and Storm Damage Reduction Projects	USACE	Study, design, and construct small coastal storm damage reduction projects	$5m maximum per project	Between 35%-50% non-federal match	Locality or government agency	N/A	N/A	Dan Hughes: Daniel.b.hugues@usace.army.mil
Section 206 Aquatic Ecosystem Restoration	USACE	Aquatic ecosystem restoration and protection projects	$10m maximum per project	Between 35%-50% non-federal match	Locality or government agency	N/A	N/A	Dan Hughes: Daniel.b.hugues@usace.army.mil
Conservation Innovation Grants	USDA	Tools, technologies, strategies that drive innovation in resource conservation	$1-2m max per project. Appx. $20m annually, $286m awarded since 2004	50% non-federal match	State or local governments, NGOs, individuals	Ducks Unlimited: Awarded grant to develop protocols for quantifying carbon storage to inform carbon trading markets	Not yet announced	nrcscig@wdc.usda.gov

Program Name (click for additional info)	Source	Eligible Projects	Funding Level	Funding Match	Eligible Recipients	Example	FY19 Application Deadline	Contact
Emergency Watershed Protection Program	USDA NRCS	Available for repair of debris-clogged channels, stabilizing streambanks, restoring vegetation, etc. Floodplain Easement option is also available for land damaged by flooding	N/A	25% local match	Private landowners are eligible for assistance but must be represented by a locality sponsor	N/A	N/A	Shawn Anderson: shawn.anderson@wdc.usda.gov
Agricultural Conservation Easement Program	USDA NRCS	Financial and technical assistance for conservation of agricultural lands and wetlands	$250m in FY18	N/A	Localities and private entities/ NGOs with sponsor	3,212 acres of wetlands restored in FY15	N/A	N/A
Healthy Forests Reserve Program	USDA NRCS	Assists landowners in restoring, enhancing, and protecting forests on private lands	N/A	Varies based on enrollment option	Private landowners	N/A	Rolling	Steve Parkin: steve.parkin@wdc.usda.gov
Community Facilities Direct Loan & Grant Program	USDA RUS	Funding for clean drinking water systems, sanitary sewage disposal, storm water drainage in rural areas	N/A	Between 25%-85% non-federal match	State and local government entities, NPOs, Federally-recognized tribes	N/A	Rolling	Kent Ware: kent.ware@va.usda.gov

Program Name (click for additional info)	Source	Eligible Projects	Funding Level	Funding Match	Eligible Recipients	Example	FY19 Application Deadline	Contact
Planning Program and Local Technical Assistance Program	USEDA	Promote effective economic development programs through projects such as feasibility studies and impact analyses	$300k project cap	Yes, unspecified	Academic institutions, NPOs, state, local, Indian tribal governments	Funded ANPDC to assess vulnerability & resilience planning for different industries, supports dredging, supports collaborative work with NASA/Wallops, supports navigable water committees	Rolling	Bob Gittler: bgittler@eda.gov
National Coastal Wetlands Conservation Grant Program	USFWS	Long-term conservation of coastal wetlands through acquisition, restoration, enhancement, and management	$1m project cap, between $13-17m awarded annually	25%-50% non-federal match	Coastal States	Elk River Estuary CA: Awarded $1m to protect/restore 150 acres of wetlands for habitat and public access	6/29/2018	Shelly DiBona: shelly_dibona@fws.gov
North American Wetlands Conservation Act Grants Program	USFWS	Long-term protection of wetlands and associated uplands habitats (Acquisition, Restoration, Enhancement, etc.)	Small Grants cannot exceed $100k. $1m soft limit for Standard Grants. (Over $1.48 billion awarded)	50% non-federal match	Range of partners eligible	Virginia Tidal Rivers & Bays: Localities partnered with Ducks Unlimited to acquire 850 acres of wetlands, 565 acres of uplands, and enhancement across 6 sites	7/13/2018	Anya Rushing: anya_rushing@fws.gov
Tribal Wildlife Grants	USFWS	Conservation of wildlife, with a number of projects that have focused on climate change impacts. Can include conservation easements and habitat restoration	Up to $200k per project, over $76m awarded since 2003	None	Federally recognized Tribal governments	Eastern Band of Cherokee Indians NC: Awarded for habitat assessment and wildlife surveys	N/A	N/A

Program Name (click for additional info)	Source	Eligible Projects	Funding Level	Funding Match	Eligible Recipients	Example	FY19 Application Deadline	Contact
Rural Transportation Planning Assistance Program	VDOT	Transportation planning and research	$72,500 annually (VDOT provides $58,000 and the PDCs provide remainder)	20% PDC match	Rural Virginia Planning District Commissions	Funded ANPDC & VIMS project to create a ditch center line GIS database	N/A	N/A
Port of VA Aid to Local Ports Program	VPA	Dock replacement, terminal development, dredging, shoreline restoration, etc.	$1m annual budget	25% local match	Local governments	Poquoson VA: received $202,125 for construction of a second breakwater at Messick Point	03/01/2018	Chris Gullickson: cgullickson@ portofvirginia.com

Private Foundation Funding Sources for Resiliency

Program Name (click for additional info)	Source	Eligible Projects	Funding Level	Funding Match	Eligible Recipients	Example	FY19 Application Deadline	Contact
Resilient Cities, Healthy Communities Program	Bullitt Foundation	Sustainable/green infrastructure	Between $15k to 125k per project	N/A	NPOs	Portland State University: Expansion of Portland Climate Action Collaborative model	Two annual funding cycles (3/15 & 9/15	grants@bullitt.org
Special Initiatives Program	Charles Steward Mott Foundation	Address uncommon environmental issues	Appx. $20m in Environment program from FY15	N/A	NPOs, academic institutions, governmental agencies	General support to the Climate Leadership Council	Rolling	N/A
Green Streets, Green Jobs, Green Towns Program	Chesapeake Bay Trust	Designing, financing, and implementing green streets	$15k for conceptual plans, $30k for engineered design projects, $75k for implementation projects	Encouraged but not required	local governments, NPOs, community associations	Ashland VA: LID Retrofit for the Ashland Municipal Parking Lot	03/16/2018	Jeffrey Popp: jpopp@ cbtrust.org
Coordination and Collaboration in the Resilience Ecosystem Grants	Climate Resilience Fund	Coordination of climate adaptation and resilience services	$25k per organization	50% match	NPOs	American Society of Adaptation Professionals: Enhancing online resources for adaptation practitioners	Not yet announced	info@ climateresiliencefund.org
Acorn Foundation Grant	Common Counsel Foundation	Support for community-based organizations working to advance conservation and sustainability	$5-10k per organization	N/A	Community-based organizations	N/A	Rolling	N/A

Program Name (click for additional info)	Source	Eligible Projects	Funding Level	Funding Match	Eligible Recipients	Example	FY19 Application Deadline	Contact
Open Space Institute Resilient Landscape Initiative	Doris Duke Charitable Foundation	Acquisition of land or conservation easements	$5.5m in capital grants	80% match	Qualified non-profit organizations located within the OSI Resilient Focus area	Catawba Headwaters: Acquisition of 256 acres to be added to Preserve	Rolling application	Bill Rawlyk: brawlyk@osiny.org
Resilience Adaptation Feasibility Tool	Institute for Environmental Negotiation	Full service tool to assist coastal localities increase Resilience	N/A	N/A	Local governments	Pilot program underway	N/A	Tanya Denckla Cobb: Td6n@eservices.virginia.edu
Environmental Program Grant	The Kresge Foundation	Building capacity, strengthening evidence base, transforming key urban systems to address climate change	Appx. 150m annually		NPOs	Chesapeake Bay Foundation: Grant to support pilot projects demonstrating feasibility of innovative financing for green infrastructure	Varies	N/A
Climate Solutions Grant	MacArthur Foundation	Efforts to address climate change and emissions reductions	N/A	N/A	NPOs, local governments and agencies, academic institutions	EcoAmerica: Guide for community leaders working for climate solutions locally	N/A	N/A
Chesapeake Bay Stewardship Fund- Small Watershed Grants	National Fish and Wildlife Foundation	Protection and restoration of Chesapeake Bay watershed	$20k-200k per project ($8-12m annually)	25-33% local match	Partnerships with private organizations and local agencies	MD Department of Natural Resources: Grant to develop Oyster Management Public-Private Partnership in 2016	11/13/2018	Jake Reilly: jake.reilly@nfwf.org

Program Name (click for additional info)	Source	Eligible Projects	Funding Level	Funding Match	Eligible Recipients	Example	FY19 Application Deadline	Contact
Resilient Communities Program	National Fish and Wildlife Foundation	Supporting priority projects in states/ communities associated with Wells Fargo operations	$10m over the 4-year life of the program. Between $100k to 500k per project	50% match	NPOs, localities, tribal governments	Greater Miami FL: Partnership with Museum of Science to restore 17 acres of coastal wetland and dune habitat	02/15/2018	Carrie Clingan: carrie.clingan@nfwf.org
Five Star and Urban Waters Restoration Grant Program	National Fish and Wildlife Foundation	Priorities include on-the-ground wetland, riparian, coastal habitat restoration	$20k-$50k per project, appx. $2.5m annually	1:1 match	NPOs, local governments, Indian tribes, educational institutions	Hillsborough NC: Public Works relocation and Eno River Restoration	01/31/2018	Danny Bowater: daniel.bowater@nfwf.org
National Coastal Resilience Fund	National Fish and Wildlife Foundation	Restore/expand natural features that minimize storm impacts	$30m annually, $500k to $3m per project	50% non-federal match	NPOs, localities, tribal governments, municipal governments, academic institutions, for profit organizations	Inaugural year of funding	08/07/2018	Erika Feller: Erika.feller@nfwf.org
Coastal Community Resilience Challenge	RISE Resilience Innovations	5 resiliency topics that can be demonstrated in Hampton Roads, are economically-viable, and scalable to other communities	For-profit small businesses and NPOs	N/A	$150k-$750k per organization, over $1m in total	N/A	09/30/2018	N/A

Program Name (click for additional info)	Source	Eligible Projects	Funding Level	Funding Match	Eligible Recipients	Example	FY19 Application Deadline	Contact
Sustainable Environments Grant	Surdna Foundation	Provides support for nonprofits focused on fostering sustainable communities, with a focus on people of color and low-income communities	Varies	N/A	NPOs	Building Equity and Alignment for Impact: Supports grassroots environmental justice organizations	Grants will be announced October 2018	grants@surdna.org
VKRF Grant	V. Kann Rasmussen Foundation	Projects that target ecosystems resilience, protection, restoration, and frameworks of ecological stability	Appx. $140m since 1991	N/A	Small/midsize organizations	Columbia University: Expand educational and training programs for Center for Environmental Research and Conservation	No open submissions in 2018/2019	Irene Krarup: ikrarup@vkrf.org
Resilience Research & Design Collaboratory	Wetlands Watch	Neighborhood-scale flood interventions & planning	Travel and lodging expenses	None	Academic institutions, localities and community organizations	Ingleside, Norfolk: Neighborhood-wide resiliency plan	Rolling	Ross Weaver Ross.weaver@wetlandswatch.org
Climate Adaptation Fund	Wildlife Conservation Society	1 to 2-year projects to implement on-the-ground actions that assist wildlife and ecosystems adaptation to climate change	$50k-$250k per project, $2.5m annually	50% match	Conservation NPOs	Audubon LA: Improve functionality & resiliency of 4k wetland acres through construction of earthen terraces in wetland management area	04/06/2018	Liz Tully etully@wcs.org

Interview Participants & Recommendation Contributors

Shannon Alexander, Accomack-Northampton Planning District Commission (A-NPDC), VA

Elizabeth Andrews, VA Coastal Policy Center at the College of William & Mary Law School (VCPC), VA

Michael Allen, Old Dominion University (ODU), VA

Tom Allen, Old Dominion University (ODU), VA

John Bateman, Northern Neck Planning District Commission (NNPDC), VA

Brian Batten, Dewberry, VA

Joshua Behr, Old Dominion University (ODU), VA

Mark Bittner, Crater Planning District Commission (CPDC), VA

Pam Boatwright, The Elizabeth River Project (ERP), VA

Louis Bott, City of Newport News, VA

Nathan Bowman, City of Norfolk, VA

Robb Braidwood, City of Chesapeake, VA

Tom Brockenbrough, Accomack County, VA

Coastal VA CRS Workgroup Members, VA

Carol Considine, Old Dominion University (ODU), VA

Tanner Council, Chesapeake Bay Foundation (CBF), VA

Michelle Covi, Old Dominion University (ODU), VA

Shannon Cunniff, Environmental Defense Fund (EDF), DC

Shanda Davenport,
City of Virginia Beach, VA

Gina DiCicco, VA Department of Conservation & Recreation (DCR), VA

Kate Gibson, George Washington Regional Commission (GWRC), VA

Ashley Gordon, Hampton Roads Planning District Commission (HRPDC), VA

Michelle Hamor, United States Army Corps of Engineers (USACE), VA

John Harbin, City of Chesapeake, VA

Carl Hershner, VA Institute of Marine Science at the College of William & Mary (VIMS), VA

Greta Hawkins, City of Hampton, VA

George Homewood, City of Norfolk, VA

Shereen Hughes, Wetlands Watch (WW), VA

David Imburgia, City of Hampton, VA

Ellis James, Norfolk Environmental Commission, VA

Greg Johnson, City of Virginia Beach, VA

Whitney Katchmark, Hampton Roads Planning District Commission (HRPDC), VA

Angela King, VA Coastal Policy Center at the College of William & Mary Law School (VCPC), VA

Tim Komarek, Old Dominion University (ODU), VA

Lewie Lawrence, Middle Peninsula Planning District Commission (MPPDC), VA

Eric Martin, City of Chesapeake, VA

Pam Mason, VA Institute of Marine Science at the College of William & Mary (VIMS), VA

Ben McFarlane, Hampton Roads Planning District Commission (HRPDC), VA

Stuart McKenzie,
Northumberland County, VA

Whitney McNamara,
City of Virginia Beach, VA

Dale Medearis, Northern VA Planning District Commission (NVPDC), VA

Cory Miles, Northern VA Planning District Commission (NVPDC), VA

Molly Mitchell, VA Institute of Marine Science at the College of William & Mary (VIMS), VA

Dennis Morris, Crater Planning District Commission (CPDC), VA

City of Norfolk Watershed Task Force Members, VA

Kristin Owen, VA Department of Conservation & Recreation (DCR), VA

Ann Phillips, Rear Admiral US Navy (Ret.), VA

Meg Pittenger, City of Portsmouth, VA

Jeff Raliski, City of Norfolk, VA

Mark Reed, City of Virginia Beach, VA

Joe Reiger, The Elizabeth River Project (ERP), VA

Ellen Roberts, City of Poquoson, VA

Jennifer Seay, Old Dominion University (ODU), VA

PJ Scully, City of Virginia Beach, VA

Justin Shafer, City of Norfolk, VA

Curt Smith, Accomack-Northampton Planning District Commission (A-NPDC), VA

Scott Smith, City of Norfolk, VA

Kyle Spencer, City of Norfolk, VA

Emily Steinhilber, Old Dominion University (ODU), VA

John Stewart, Lafayette Wetlands Partnership, VA

Sarah Stewart, Richmond Regional Planning District Commission (RRPDC), VA

Mary-Carson Stiff, Wetlands Watch (WW), VA

William “Skip” Stiles, Wetlands Watch (WW), VA

Brian Swets, City of Portsmouth, VA

Robert Tajan, City of Norfolk, VA

VA CRS Coordinators Interviewed for Wetlands Watch Report: Costs & Benefits of the CRS Program in VA

Ross Weaver, Wetlands Watch (WW), VA

Katie White, City of Norfolk, VA

Justin Wilson, City of Alexandria, VA

Wie Yusuf, Old Dominion University (ODU), VA