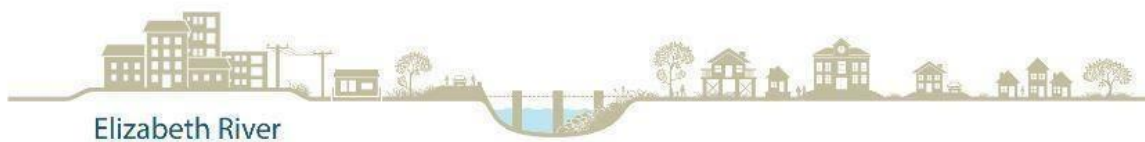


LEADERSHIP AND ADVOCACY FOR CLIMATE ADAPTATION

An Assessment of Virginia Beach's Sea Level Wise Program

Elizabeth River Watershed



XMNR 2020 Assignment 6.1 – Dr. David Robertson

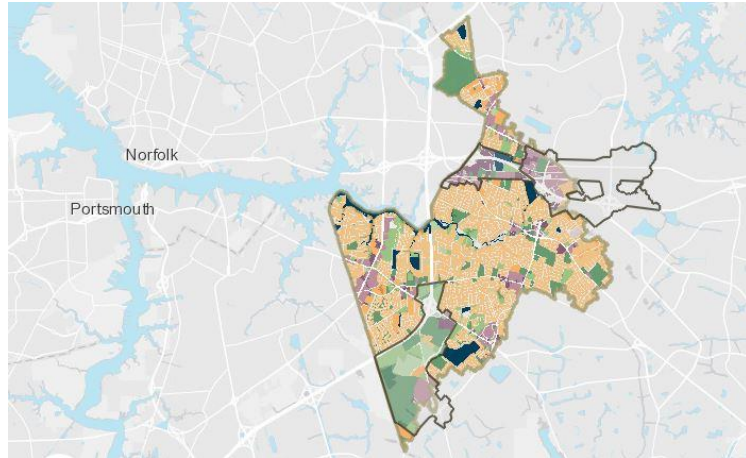
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PART I: The Elizabeth River Watershed

Coastal and Community Context

The Elizabeth River Watershed (ERW) is on the west side of the City of Virginia Beach (hereinafter called “the City”), Virginia. It is the City’s only fully inland watershed, sharing boundaries with the cities of Norfolk, Portsmouth, and Chesapeake.¹ With approximately 500,000 residents living in the watershed,² the ERW is dominated by low-density residential neighborhoods. Three out of the City’s eight Strategic Growth Areas (SGA)—Newton, Pembroke, and Centerville—fall within the boundaries of the watershed. With a steady residential population growth in this thriving community, the City aims to accommodate growth at higher densities, averting continued suburban sprawl while improving community preparedness for climate-induced sea-level rise impacts.



The Elizabeth River Watershed in the City of Virginia Beach. ArcGIS image provided by Dewberry.

The ERW is a significant commercial and military port facility for the Hampton Roads Area. Thus, it has a history of industrial pollution. The Eastern Branch of the Elizabeth River flows from Virginia Beach through Norfolk before joining the main river and the Chesapeake Bay. The branch consists of predominantly tidal marshes and wetlands which act as natural flooding buffers but, are degrading. Urban runoff pollution, sediment contamination, and toxic waste have damaged the health of the river. As a result, the Eastern Branch is the most important flood entry point into the watershed. Water levels in Hampton Roads have risen more than one foot over the past 80 years.³



Merchant and Miner’s Wharf by the Elizabeth River in Norfolk, Virginia. Library of Congress, 1910.

from Virginia Beach through Norfolk before joining the main river and the Chesapeake Bay. The branch consists of predominantly tidal marshes and wetlands which act as natural flooding buffers but, are degrading. Urban runoff pollution, sediment contamination, and toxic waste have damaged the health of the river. As a result, the Eastern Branch is the most important flood entry point into the watershed. Water levels in Hampton Roads have risen more than one foot over the past 80 years.³

The Challenge of Rising Sea Levels

Different from an inland river with a spring as origin, the Elizabeth River is a tidal estuary of the Chesapeake Bay with high levels of salt. Worsening rainfall events, high tides, and storm surges (10-year and 100-year storms) are drivers of coastal flooding. Two primary types of recurrent flooding in the watershed are tidal and wind-tide flooding.⁴

There are two future scenarios of increased sea level rise projections in the Sea Level Wise program (SLW). One is a planning scenario of 1.5 feet of sea-level rise for the region, another being 3 feet sea level rise within a 50-year horizon. We learn that 7% of the City's exposure to coastal flood loss is in the Elizabeth River; and for the 3 feet scenario, the Elizabeth River has a minor exposure at 4%.⁵ Although land elevations in the ERW are higher than other areas in the City—with only 3% of the total land area under 3 feet elevation—increased urbanization, degradation of naturalized landscapes, and aging infrastructure contribute to flood exposure and vulnerability in this area.⁶

As mentioned, three SGAs lie in the watershed with high-density development in mind. More than 80% of homes were built in the 1970s or earlier with low flood insurance policy penetration. When a structure is repeatedly exposed to saltwater flooding, it could lead to more serious structural problems and even collapse. In addition, sea-level rise and coastal flooding are posing serious risks to infrastructure, coastal habitats, biodiversity, residents, visitors, and businesses. The underserved community including the elderly, the ill, and the disabled will be hard hit.

Adaptation Vision

The City proposed to adopt structural and non-structural solutions to provide protection from sea-level rise and coastal flooding. These strategies fall into four aspects: Natural Mitigations, Engineered Defenses, Adapted Structures, and Prepared Communities. With natural and man-made barriers to block the critical flood entry point in the Eastern Branch of the Elizabeth River, along with multiple layers of protection from sea-level rise and coastal flooding, the City understands that the benefits of climate adaptation and mitigation will play out on different time scales. These measures are meant to ensure the ERW will provide varied ecosystem services that are essential to the residents, businesses, and visitors of the region.

PART II: Stakeholder Analysis

Our analysis was aimed at the stakeholders in the Elizabeth River Watershed, the stakeholder groups that appear in the following analysis in particular, and the key stakeholders of Virginia Beach’s Sea Level Wise program as well as climate concerned citizens. In order to apply the Advocacy Coalition Framework (ACF) to the stakeholder analysis holistically, we divided our stakeholders into five groups with a coalition focus on local governance, federal governance, civil society, businesses, and the watershed resident collective. The following section gives a detailed analysis of the elements of ACF applied to these stakeholder groups.

We also include a Stakeholder Materiality Matrix (Figure 1) that illustrates the levels of influence (1-10), interest (1-10), and engagement (1-4, represented by the size of the sphere) for each respective stakeholder group. Evaluating each one using this method helps to identify their importance and develop a strategy for engagement.

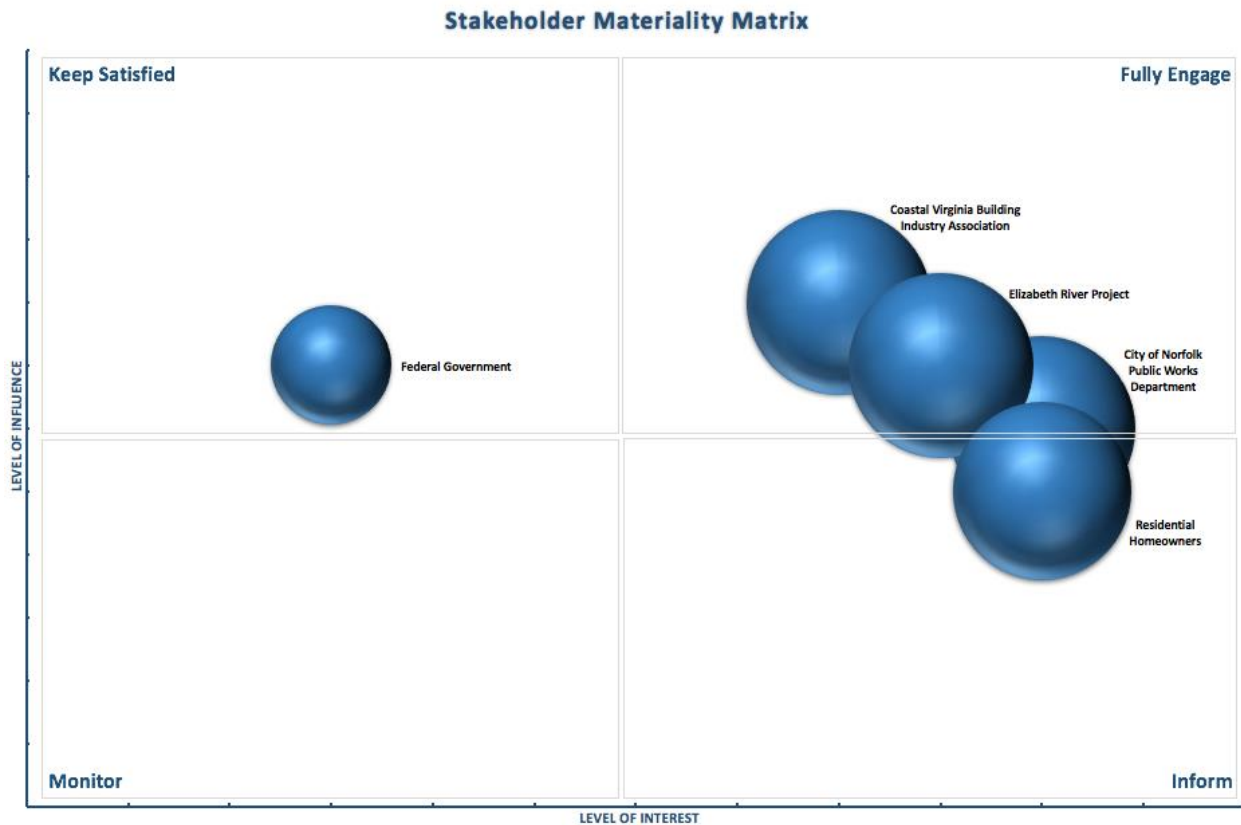


Figure 1 Stakeholder Materiality Matrix - Influence (1-10), Interest (1-10), Engagement (1-4)

1) Residential Homeowners

Rising sea levels pose a threat to every stakeholder in the Elizabeth River Watershed, but perhaps the most at risk based on tidal flood and storm projections are Residential Homeowners. Comprised mostly of low-density neighborhoods, the population continues to

grow with 58% of residents owning their homes and an additional five percent making up vacation rentals.⁷

Core or Policy Beliefs

Residents of the watershed obviously do not want to see their property affected by rising tides and storms resulting from climate change. Their beliefs lie in the desire to maintain the best quality of life possible. For the majority of the members of this group, that goes beyond their property lines with both employment security and preservation of recreational resources. It is also important to protect and increase their property values.

Resources Controlled

Homeowners control the land they own with the option to either preserve or redevelop it. In addition, they make up 60 percent of the workforce within the watershed.⁸ Not only do they have voting power with local public officials, but they also pay taxes. Finally, homeowners associations and other neighborhood organizations are influenced by the local residents.

Coalition or Cluster Membership

Residential homeowners will be involved in and the main driving force for decisions made by homeowners associations and local civic leagues. They also hold positions of influence in other local groups such as religious organizations and community networks.

Venues Available for Advocacy

HOAs and civic leagues provide the best venues to advocate for their beliefs. Town hall meetings provide an opportunity to express support and concerns for local efforts as well. Lastly, residents can use local elections to back candidates that align with their values.

2) City of Norfolk Public Works Department

Public Works are a broad category of infrastructure projects, financed and constructed by the government, for recreational, employment, and health and safety uses in the greater community.⁹ As such, the City of Norfolk Public Works Department - in partnership with Virginia Beach - is integral to the advancement of activity to protect, improve, and restore the Elizabeth Watershed region. The City refers to Norfolk, Virginia in this segment. With authority and obligation for oversight and superintendence of the City's stormwater management systems and emergency response for flooding, the Department is an essential stakeholder in the Sea Level Rise program and its proposed flooding adaptation strategies.

Core or Policy Beliefs

The City of Norfolk Department of Public Works operates and maintains the "facilities that support and enhance the lives of Norfolk's citizens, businesses, and visitors." The Department is committed to making commuting "safe and efficient," neighborhoods more attractive, and the streets and sidewalks clean and well-maintained.¹⁰

Resources Controlled

The Public Works Department within most municipalities controls the physical facilities of the local area. Typically, under supervision from the City Manager, the Department creates programs that align with the long term community growth vision – evaluating budgets and employee requirements to complete the approved work. Customarily, the Department leads or participates in the selection process for contractors and vendors. Public Works also has charge of divisions within the Department such as Maintenance, Engineering, Utilities, and Code Enforcement. While not directly controlled by the Department, influence in the public sector is high. In addition, the quality of workmanship, proactivity, and agile, expeditious response to emergencies or citizen concerns influence public opinion.¹¹

Coalition or Cluster Membership

As a member of the public sector, the Public Works Department is part of the City governance cluster. Further, the Department is part of a larger group at the state and federal level of oversight and regulation. There is cluster membership with city officials, representatives of other agencies, contractors, vendors, and employees affiliated with each of the divisions within the Department as well. The American Public Works Association (APWA) is a coalition with more than 30,000 members nationwide, including those from local agencies. Their mission is to “support those who operate, improve and maintain public works and infrastructure through advocacy, education & member engagement.” Through the APWA, practically all communities are served, including Norfolk.¹²

Venues Available for Advocacy

There are myriad avenues for the Public Works Department to advance their goals. City Council meetings, referendums, legislation, leveraging federal, state and local requirements/regulations, and affiliation with local governing officials and agencies are a few. On a broader scale, the APWA has specific activity focused on advocacy and government affairs that can be leveraged by the City of Norfolk Public Works Department. The APWA “empowers public works professionals to be the voice for adequate investment in public infrastructure among local, state and federal policymakers. APWA’s Board of Directors, the Government Affairs Committee, APWA Chapters, the APWA Advocates, and other active APWA members create partnerships with key stakeholders, establish new lines of communication with decision-makers and extend outreach into the center of public policy discussions. The Government Affairs staff in the Washington, D.C. office work with Congressional leaders, the U.S. House Public Works & Infrastructure Caucus, Federal agencies, and like-minded partners, such as transportation, water, and emergency response organizations, to achieve APWA Advocacy objectives.¹³”

3) Elizabeth River Project

Another relevant stakeholder representing local environmentalists and nonprofits is the Elizabeth River Project (ERP).

Core or Policy Beliefs

Established in 1993, their mission is to “to restore the Elizabeth River to the highest practical level of environmental quality through government, business and community partnerships” so that residents and visitors to the watershed can safely enjoy outdoor recreation opportunities and to promote a thriving port economy within the state of Virginia.¹⁴

Resources Controlled

ERP’s Next Wave campaign is a \$9 million fundraising effort to construct a cutting-edge, green building, deemed the Resilience Lab, in Norfolk, VA, to expand their River Academy at Paradise Creek Nature Park in Portsmouth, VA, and to support 5 years of K-12 education on their Learning Barge.¹⁵ With an annual operating budget of \$2 million, they hire part-time sustainable landscape architects, contractors for residential wetland and oyster reef restoration, stormwater practices, and green architectural/engineering services, along with 13 full-time staff in fields such as environmental science, restoration, education, conservation, nonprofit administration, and finance.¹⁶

Coalition or Cluster Membership

ERP is a coalition of citizens, businesses, schools, and government. They also work in concert with other environmental nonprofits, such as the Living River Trust, the Chesapeake Bay Foundation, and Lynnhaven River Now. They have a coalition of volunteers and members who donate their time and money to support restoration projects and ERP’s Education work. Their River Star Programs create clusters of stakeholders who can be viewed as coalitions as well. The River Star Programs provide certification and acknowledgment for watershed residents, schools, youth groups, businesses, government facilities, universities, and religious organizations that prevent pollution from entering the Elizabeth River through restoration and conservation.

There are 173 River Star certified schools and youth organizations in the watershed and hundreds more River Star Businesses and Government Facilities honored by ERP for “voluntary pollution prevention and wildlife habitat enhancement results”, such as Virginia Beach Parks and Recreation, BAE Systems Norfolk Ship Repair, East Coast Bicycles, Norfolk State University, the Chrysler Museum of Art, and Coastal Virginia Unitarian Universalists. Finally, the River Star Homes Program offers an opportunity to engage HOAs and individual homeowners. ERP’s Board of Directors is comprised of regional decision-makers and community leaders, such as David Bernd, CEO Emeritus, Sentara Healthcare, The Hon. John Rowe, Mayor of Portsmouth, Dr. Amelia Ross-Hammond, Former Virginia Beach City Council, and Max Bartholmew, Regional Manager, Dominion Energy.¹⁷ This broad diversity of ERP partners and supporters speaks volumes of their standing within the Elizabeth River watershed and ability to influence change.

Venues Available for Advocacy

They communicate with their members and donors through their quarterly newsletter, Mudflats, and their social media channels, such as Facebook, YouTube, Instagram, and Twitter using #Loveliz to track their posts and engagement. They also reach the public through other digital and traditional media via mailing lists, email lists, their website, and their State of the

River Reports.¹⁸ These platforms are used to educate the public and raise awareness about current events impacting the Elizabeth River. ERP also garners positive press about its restoration and education work via local newspapers, such as The Virginian-Pilot, and local news stations, like 13 News Now and WAVY TV 10.

They employ a full-time Grassroots Coordinator who manages their community outreach and public speaking engagements, including large-scale community events like RIVERFest. This allows them to engage and educate the general public, building trust with the Hampton Roads community and relationships with local community leaders. Reviewing their list of Board of Directors, ERP is clearly well connected within the watershed and can leverage those relationships with decision-makers to advance their clean water agenda.

4) United States Federal Government

While it's not a formal requirement, federal governments are typically going to be considered as a stakeholder when it comes to most (if not all) significant city or state projects. While their active involvement may be sparse, federal governance is a key source of where states derive their policy guidance, regulations, and many other directional resources from as they set the tone of the basic requirements states must adhere to remain in compliance. Additionally, many states can be more stringent in their governance but may not be any less compliant than what guidance the federal government sets forth. Two prominent Federal agencies that are noteworthy in the SLW program are (FEMA) and the U.S. Department of Housing and Urban Development (HUD).

Core or Policy Beliefs

Since the Federal government is composed of different branches, agencies, and sub-agencies determining the core and policy beliefs for this stakeholder is not necessarily feasible without getting specific. Additionally, while no authoritative list of government agencies exists, the Federal Register reports that 454 agencies and sub-agencies exist that make up our government.¹⁹ One highly touted piece of literature that is considered the supreme law of our country is the U.S. constitution which is composed of seven articles and sets the framework on how the U.S. government should operate. Although political culture is subject to individual beliefs and experiences, Alexis De Tocqueville, a French explorer, does an excellent job summarizing the political culture. Tocqueville states that primary values that are embedded within the framework of the federal government are liberty, equality, democracy, individualism, the rule of law, nationalism, capitalism, and open markets.²⁰ With the federal government's existence being derived from the constitution and based on these key values, its core and policy beliefs reach far and wide.

Resources Controlled

As far as resource control goes we must further breakdown the federal government into its three main branches: the legislative, executive, and judicial branches. The legislative branch (Congress or better known as the Senate and House of Representatives) is responsible for

creating laws and guidance and in essence, can largely inform what resources go where. The executive branch (consists of all agencies and departments of the federal government) which is controlled by the president is responsible for the oversight of these laws and possesses the power to see whether these laws come into effect or not. The combination of both branches acts as a system of checks and balances to ensure neither branch possesses too much power. This is key in regards to resource control as neither branch can have too much say in what resources go where and must act in unison for law, policy, guidance, etc. to be legitimized. The judicial branch (better known as the federal court system) is responsible for the proper application of these said laws and also determining if each law holds adequate legitimacy. In theory all three branches of the government act dependent on one another as what decisions made by one branch largely informs the response of the other branches, however, this may not occur as adequately as some individuals would like.

Coalition or Cluster Membership

Technically speaking the way the U.S. government is structured in a way to avoid any formation of coalitions within government as this would contradict the principle of democracy that the government's framework constantly relies on. Since the federal government of the U.S. is a democratic government political parties compete for support to benefit their own interests, political values, and policy proposals. If coalitions existed within the federal government political pluralism and competition would be hindered and thus compromising the functionality of democracy.²¹ This is the primary reason why coalitions cease to exist with the U.S. government. However, within congress, many "coalitions" may exist sanctioned under the name of a congressional caucus as members from both the House of Representatives and Senate meet to pursue a common goal but the difference being that a congressional caucus is deemed as an informal meeting.²²

Venues Available for Advocacy

Since there are no legitimate coalitions within the federal government there are no venues available to advance their goals.

5) The Coastal Virginia Building Industry Association

There are a number of relevant stakeholders in the category of businesses and industry. Two stakeholders are noteworthy—the Virginia Maritime Association (VMA) and the Coastal Virginia Building Industry Association (CVBIA). These two distinctive stakeholders represent the two powerful and important industries in the watershed—the maritime industry and the building industry. In connection with the City's Sea Level Rise program, the CVBIA may be a tad more influential to the implementation of the program. The structural solutions in the ERW strategy involve stakeholders of the building industry. As such, the author decides to provide below stakeholder analysis for the CVBIA.

Core or Policy Beliefs

This March, the home builders associations from the South Hampton Roads and the Peninsula

have combined forces as one industry organization, now known as the Coastal Virginia Building Industry Association. The CVBIA’s mission is “to improve the climate for quality housing for all incomes; promote the growth and development of the shelter industry; promote excellence and professionalism among members through educational and networking opportunities; and support and enhance the community through charitable projects.”²³

Resources Controlled

CVBIA has contributed to the community of South Hampton Roads through its Scholarship Foundation, which has awarded close to \$1.8 million in grants to high school students since it was founded in 1966. As an active stakeholder in the ERW, CVBIA has access to public opinion and information, and it may mobilize financial and effective leadership. A populous urban area is in the ERW, and CVBIA’s wide network of stakeholders overlaps the relevant stakeholders in the watershed.

Coalition or Cluster Membership

CVBIA is a local not-for-profit trade organization representing more than 500 companies involved with all aspects of the residential building industry. CVBIA members range from home builders to electricians to mortgage bankers to apartment property managers, and they employ more than 20,000 local residents.²⁴

CVBIA is affiliated with the Home Builders Association of Virginia, a non-profit with members and citizens of the Commonwealth of Virginia. CVBIA is also affiliated with the National Association of Home Builders (NAHB). The NAHB is one of the largest trade associations in the United States, representing the largest network of craftsmen, home builders, developers, contractors, and associated businesses.

Venues Available for Advocacy

CVBIA represents companies associated with residential and light commercial construction, remodeling, land development, mortgage banking and property management throughout Southeastern Virginia.²⁵ Wherever its members are present are also good venues for advocacy. In addition, the recent merger expansion amplifies the organization’s influence on the shelter industry in its new geographic footprint. On the one hand, with the City’s local program to buy out or elevate at-risk properties in flood-prone areas,²⁶ CVBIA members are required to comply with the City’s floodplain code of ordinances and building codes.

On the other hand, the community awareness of mitigating sea level rise and recurrent flooding is increasing. The building market is one of the early responders to the increasing demand for elevation projects. There has been a thriving competition among builders and contractors to elevate and protect homes in flood-prone areas.²⁷ The author assumes CVBIA with its good records of charity work to the community will advance their goals by providing up-to-date industry information to the public and the City Council. CVBIA may educate officials in order to request for modification of building ordinances to reflect the need of the market.

PART III: Rapid Climate Vulnerability Assessment

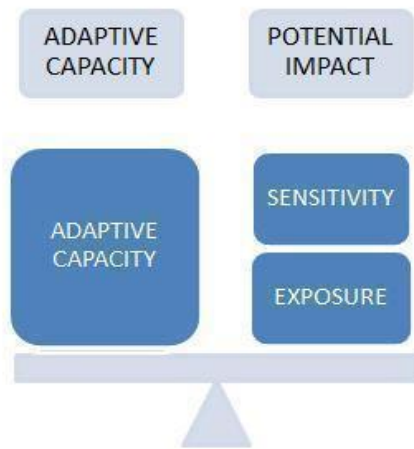


Figure 2 The balance between the components of vulnerability

Adapting to climate change requires understanding the physical aspects of vulnerability. Evaluating vulnerability is an exploration of risk variables based on exposure, sensitivity, and adaptive capacity. In order to use these three components to inform the following assessment on coastal flooding from climate-driven sea-level rise, we examine the interaction of the potential impact which is composed of exposure and sensitivity with adaptive capacity (Figure 2). We acknowledge that areas with very high potential impact and low adaptive capacity are most vulnerable. We are presenting our assessment for the selected five stakeholder groups, together with a climate vulnerability assessment table as follows.

Climate Vulnerability Assessment table

Stakeholder group	Exposure (<i>narrative</i>)	Sensitivity and Adaptive capacity (<i>narrative</i>)	Overall vulnerability (<i>H-M-L</i>)
Residential Homeowners	See Part III no. 1	See Part III no. 1	H
City of Norfolk Public Works Department	See Part III no. 2	See Part III no. 2	L-M
Elizabeth River Project	See Part III no. 3	See Part III no. 3	M
Federal Emergency Management Association (FEMA)	See Part III no. 4	See Part III no. 4	L
The building community	See Part III no. 5	See Part III no. 5	M

1) Residential Homeowners of the ERW Communities - Arrowhead, Fairfield, and Avalon Terrace neighborhoods

Exposure

Single and Multi-Family Homes are at the highest risk to rising sea levels within the ERW. Ten thousand residents are currently living in the areas subject to the greatest risk of tidal floods,

10-year storms, and 100-year storms, with the possibility of that tripling due to rising sea levels.²⁸ Residential population has also grown seven percent over the past decade, and 58 percent own their home rather than renting.²⁹

Sensitivity

The demographics of the residents include physical factors such as the elderly and disabled, as well as socioeconomic factors like limited English, limited income, and people of color. The increased need for assistance and support for these groups increases the stakeholder's sensitivity. Within the Watershed, flood insurance policy penetration is four percent lower than the overall rate across the City, leaving vulnerable neighborhoods under-insured.³⁰

Adaptive capacity

Using strategies that minimize sea-level rise will improve adaptive capacity in order to avoid the significant expected increases of residents impacted at a three-ft. sea-level rise. However, the greatest lever will come in the form of expanding flood insurance coverage to better recover from flooding and storms. While the majority of policies are held by residents along the river, there's a need to increase penetration to those that are at a higher risk should levels continue to rise.

Overall vulnerability (H-M-L): H

2) City of Norfolk Public Works Department

As the major port city at the Eastern Branch split of the Elizabeth River, Norfolk surrounds the gateway to the river's tidal marshes and wetlands habitats, recreational areas along the waterfront, and public parks – all at risk of tidal flooding with increased climate variability. (The City refers to Norfolk, Virginia in this segment.) As noted earlier, most of the area is currently protected from flooding due to the land elevation. However, increased urbanization, degradation of naturalized landscapes, and aging infrastructure, contribute to flood exposure and vulnerability in this area.³¹ The SLW assessment notes the vulnerabilities include buildings, infrastructure, habitats, and people.³² As stewards of each of these impacted sectors, the City of Norfolk Public Works Department is on the front lines of the Elizabeth River flood defenses.

Exposure

Defining exposure to mean the chance that assets will be impacted by climate change risk,³³ the Public Works Department currently has a medium-high level of exposure given they are located in a low-lying coastal area prone to three types of flooding: precipitation, storm and tidal.³⁴ Their exposure is exacerbated by the responsibility for responding to weather emergencies resulting in damage to infrastructure, municipal buildings, some local habitats, and ultimately the impact of that damage to the people of the city they serve. As the frequency, magnitude, and duration of weather events increases, so does exposure and sensitivity.

Sensitivity

Distinguishing sensitivity as the susceptibility of assets exposed to climate risk,³⁵ the Department is at a rating of low-medium. Aging infrastructure, deteriorating shorelines, and urbanization along the waterfront have resilience repercussions that are challenging to overcome. When weather events do occur, the infrastructure and shorelines may be irreparably damaged and urbanization adds stormwater management burdens as well. Fortunately, the land elevation works in their favor, protracting the timeline for adaptation measures to evolve.

Adaptive Capacity

The City of Norfolk's Office of Resilience has initiated several projects as part of its strategy to "design the Coastal Community of the Future." They were also the recipient of a \$110+ million HUD grant in support of their resiliency efforts and have initiatives in place to update zoning ordinances, complete a citywide coastal storm risk management study, and multiple redevelopment efforts, amongst others.³⁶ The Public Works Department is likely the executor of, or participant in, the completion of these projects along the Elizabeth River. The Department's adaptive capacity is directly tied to the funds flowing through the City's budgets and designated for flooding adaptive or mitigating measures. They have the personnel, partners, community, and government support for extensive adaptive capacity. One caveat is that their contribution to adapting to coastal flooding is largely dependent upon what adaptive actions Virginia Beach takes. These two cities share responsibility as they border portions of the opposite sides of the Eastern Branch of the Elizabeth River.

Ideally, the adaptive capacity of a stakeholder group equals or exceeds the average level of exposure and sensitivity, or potential impact. For illustrative purposes, the Public Works Department exposure is middle-high at 6.5, sensitivity is low-middle at 4, resulting in a potential impact of 5.25. If adaptive capacity is scored an 8, the overall vulnerability for this stakeholder is low-medium.

Overall vulnerability (H-M-L): L-M

3) Elizabeth River Project

Exposure

Fortunately for ERP, most of their assets are resilient to the effects of flooding and sea-level rise. Their Learning Barge, sponsored by Dominion Energy, "is the world's first floating wetland classroom and America's Greenest Vessel."³⁷ ERP's Paradise Creek Nature Park is a 40-acre waterfront park that boasts "the largest restored wetland in the area that's open for public paddles" and "is a national model for urban river restoration."³⁸ Their restoration projects are designed to mitigate flooding and prevent erosion. Their financial investment in these projects will be long-lasting and bolster the resiliency of fellow ERW stakeholders.

ERP is currently in the process of moving its headquarters to a flood zone in Norfolk, VA as “a model for what building in waterfront areas can look like — one it hopes will inspire others to reinvest in threatened waterfront areas.³⁹” In fact, they are already 70% of the way toward their \$9 million fundraising goal for the Next Wave campaign which will construct a cutting-edge, green building, deemed the Resilience Lab, in Norfolk, VA, expand their River Academy at Paradise Creek Nature Park in Portsmouth, VA, and support 5 years of K-12 education on their Learning Barge.⁴⁰ Being in this position makes them financially resilient to current and near-term economic uncertainties.

Sensitivity and Adaptive Capacity

Being a smaller non-profit, their sensitivity to economic downturns is high. However, their broad coalition of supporters, funders, and partners gives them incredible adaptive capacity. Having achieved 70% of its fundraising goal for the Next Wave campaign, ERP is in a good position financially. They are also building a headquarters that is designed to withstand frequent flooding. According to Sam Bowling, from Work Program Architects, in his interview with *The Virginian-Pilot*, “Everything on the site is designed to be flooded, and if in 50 years the whole site is underwater, it doesn’t release anything harmful to the environment. The longer view — this is something that can be abandoned.⁴¹” ERP’s executive director, Marjorie Mayfield Jackson says in the same article that, “we know from scientist predictions [this site] will be underwater in 30-50 years”. This is certainly a risk but is one that they are willing to take to forge new partnerships and revitalize a historically marginalized and underinvested area of the city. “Old Dominion University President John Broderick also announced... that it would be moving its Institute for Coastal Adaptation and Resilience into a university-owned building right across the street from the new headquarters... to compliment the new development and encourage cross-pollination between the university and the nonprofit.⁴²”

Overall vulnerability (H-M-L): M

On the whole, their vulnerability to sea-level rise and flooding is medium. The risk is high. However, because their work is part of the solution, their resilience is also high.

4) United States Federal Government

Given the vast make-up of the various agencies and sub-agencies that the federal government is composed of, the author has identified FEMA as being a prominent federal agency in the SLW program, and will focus on the agency for the following steps. FEMA is a federal agency under the U.S. Department of Homeland Security whose mission is “Helping people before, during, and after disasters.⁴³” The agency employs approximately 14,000 individuals who all play a key role in emergency management in some capacity or another.⁴⁴ Since President Jimmy Carter signed the executive order that catalyzed FEMA’s inception, this agency has been coordinating the federal government's role in preparing for, preventing, mitigating the effects of, responding to, and recovering from all domestic disasters, whether natural or man-made, including acts of terror since 1979.⁴⁵

Exposure

Given that FEMA serves primarily as the backbone for the federal government in disaster response and management, this organization continues to change in regards to increased sea-level rise and flooding events. While FEMA may not have any direct exposure to the flooding and sea-level rise challenges, this agency still has a noteworthy exposure element within Virginia Beach considering its role in preparedness and disaster response within these areas. Preparedness and disaster response efforts reach far outside the scope of Virginia Beach as this agency serves as the government's disaster relief backbone and spans across all 50 states. As our climate continues to warm, our geography continues to change, social and political entities transition through terms, and the economic cycles continue, FEMA's organizational tasks will continue to adapt in unison with the changes. However, the goal of disaster relief and national preparedness will always remain this agency's primary focus. Additionally, since FEMA's interest covers all domestic disasters and not solely targeted on natural disasters, their interests are also influenced largely by what the U.S. population does. Analysis of the human response to climate stressors and resource scarcity for the populace is also taken into consideration.

Sensitivity

As previously stated, the federal government is always affected in some capacity when it comes to change. In regards to change in the SLW program, FEMA could have a small effect or moderate effect dependent on what lenses one was viewing the issues through. From a stability and operational standpoint, sea-level rise should have a relatively small effect on this agency as its funding and operational stability is backed by the government as a whole. In contrast, sea-level rise can have a moderate impact on FEMA's funding and resource control as the challenges associated with rising sea levels will largely dictate what financial, occupational, and resource capacity strain is put on FEMA. Furthermore, since FEMA also deals with man-made disasters, the effect on this agency could be increased significantly depending on the scenario. Hurricanes, for example, cause short-term challenges such as sea-level rise, intense winds, heavy rainfall/hail, and severe flooding, and this, in turn, would put a strain on the local populace which would affect FEMA to some capacity. However, the strain put on the populace has the potential to result in producing other domestic issues such as looting, rioting, being trapped, a temporary decrease of law enforcement capacity, etc. which would also affect this agency. Overall, given that this agency is primarily funded by the tax dollars of U.S. citizens, and is a federal entity, its capacity for sensitivity should be very good.

Adaptive capacity

The adaptive capacity of FEMA is overall excellent. As you can see below (Figure 3), FEMA's organizational hierarchy is multifaceted and allows great capacity for the agency to adapt to change. As you can see, the agency's multiple regions and offices allow for proper delegation of factors both internal and external to the group while also allowing for internal sectors outside of specific departments to assist if needed. Again, considering FEMA is a form of federal assistance and its source of funding is received in the form of grants and funds from Congress on an annual basis, this agency's adaptive capacity is very high.

In regards to the Virginia Beach SLW program, funding received from FEMA primarily comes from FEMA’s Disaster Relief Fund (DRF) which is an appropriation against which FEMA can “direct, coordinate, manage, and fund eligible response and recovery efforts associated with domestic major disasters and emergencies that overwhelm State resources pursuant to the Robert T. Stafford Disaster Relief and Emergency Assistance Act.⁴⁶” Through the DRF, FEMA can provide disaster support activities for the SLW program such as emergency protection and debris removal, the repair and restoration of qualifying disaster-damaged public infrastructure, hazard mitigation initiatives, and financial assistance to eligible disaster survivors.

It is important to note that since FEMA is a federal agency, its funding and operational capacity are subject to changes in political leadership such as presidential terms and priority in regards to the congressional budget; and this will affect the agency's adaptive capacity. Overall, given the large scale of FEMA and its far-reaching span, the adaptive capacity of this agency should be considered high.

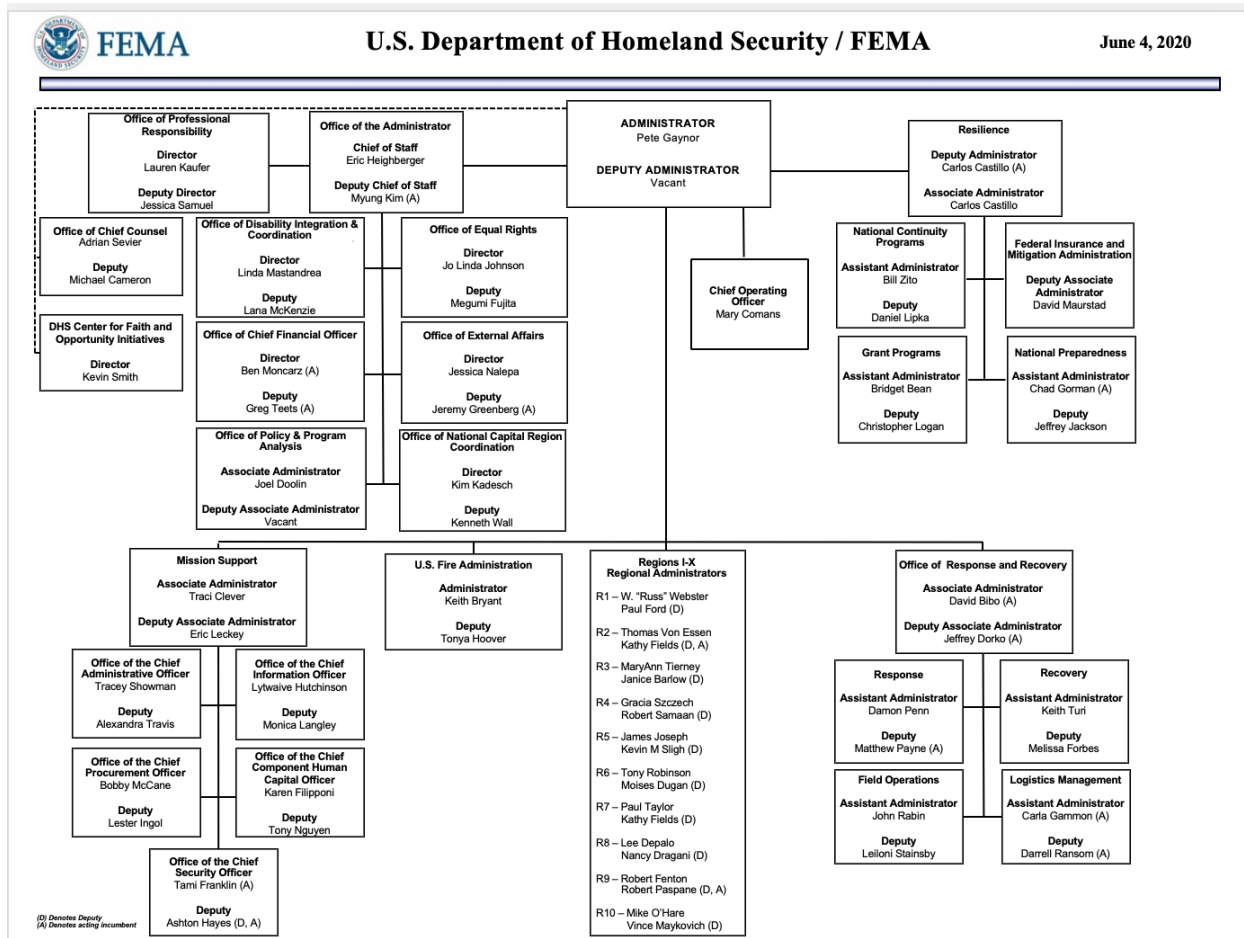


Figure 3 The FEMA organizational chart (June 4, 2020). For more see [FEMA.gov](https://www.fema.gov).

Overall vulnerability (H-M-L): L

5) The building community

As the sea level is rising, it is inevitable that more and more residents in the ERW will be living in flood-prone areas. Designed and remodeled resilient housing and structures in coastal communities meet the demand of the market and can be viewed as a response to climate adaptation.

A community gives us a sense of belonging in which all actors that have an interest and/or influence in construction in the ERW are obliged to share responsibility for the community vitality. The building community in the following climate vulnerability assessment is a stakeholder group representing stakeholders of commercial, residential, and public works (government) projects in the watershed. The Coastal Virginia Building Industry Association in the Stakeholder Analysis (See Part II) is part of the building community.

Exposure

As the urban population is increasing steadily in the ERW, there is an increasing demand for houses, apartment buildings, and even larger multi-story high-rise buildings resulting from the City's SGA plan to accommodate growth at higher densities. As of 2019, 58% of the City's residents in the ERW own their homes, 38% of residents are renters, and 5% are vacation rentals.⁴⁷ The thriving property market attracts competitors from the region as well as outside the project area. As a result, a large number of individuals in the building community have higher exposure to accelerated sea-level rise and extreme rainfall events. Outdoor building projects are vulnerable to unstable bad weather. In other words, the socioeconomic development resulting from urbanization, population growth, and increased resilient housing demand will affect the building community and its interests.

Sensitivity

Any kind of flooding can lead to erosion underneath a man-made structure. Saltwater can damage the quality of the soil itself, causing corrosion inside the structure. The Elizabeth River is a tidal estuary of the Chesapeake Bay with high levels of salt. This adds more risks to structures in the ERW during saltwater flooding. The interior of the structure, from walls to wood and metal materials, is sensitive to corrosion. Mold resulting from water damage is harmful to the occupants.

Given the fact that natural and human-driven subsidence rates can be greater than the rate of climate-driven sea-level rise predicted for the remainder of the 21st century,⁴⁸ structures in the ERW such as family homes, residential and commercial buildings, shopping malls, restaurants, storage facilities, parking lots, roads, bridges, and even power facilities are highly susceptible to flood hazards. In particular, structures that are located in the land area which is under 3 feet elevation in the watershed (3% of the total land area is under 3 feet elevation) are sensitive to recurrent flooding.

Recurrent flooding in the ERW occurs relatively frequently. These low-levels of inundation typically do not pose significant threats to public safety, but can cause minor property damage, disrupt routine day-to-day activities, and put added strain on infrastructure such as roadways and storm systems.⁴⁹ Besides, there are a few “pre-existing conditions” in the watershed, including chronic water pollution in the river, degrading natural flooding buffers (e.g. marshes and wetlands loss), and aging infrastructure (e.g. an older overall building stock with homes built to lower codes or standards than in place today).

As a result, the building community is very sensitive to unexpected, unseasonal, and severe rainfall events and storm surges. Rising sea levels also threaten the low-lying coastal wastewater treatment plants in the ERW. A study by Advancing Earth and Space Science shows that untreated sewage could affect five times more people than direct flooding.⁵⁰ In other words, public works projects in the building community will be affected greatly by sea-level rise and coastal flooding.

Adaptive capacity

As mentioned, the building community is obliged to share responsibility for the community vitality and for the common cause of social, political, and economic justice. Given the fact that coastal municipalities are heavily dependent on property taxes as a major local revenue source,⁵¹ the City is in the implementation stage of the SLW program. This program provides a detailed study and pragmatic solutions to mitigate coastal flood risks in the ERW.

Some of the structural solutions in the ERW strategy will significantly improve the adaptive capacity of the building communities. These solutions include commercial floodproofing, floodplain regulation, resilient roadways, responsible development, and building elevation. The non-structural measures delineated in the ERW strategy such as residential community education, flood insurance expansion, and business outreach and education can also strengthen the preparedness and resilience of the building community.

With solid support from state and federal assistance (e.g. FEMA’s Community Rating System) and the nature of an efficient property market, coupling with the urgency and severity of climate change-induced impacts, the building community is rapidly adapting to climate change, including finding solutions to expand the home-raising workforce capable of addressing the increasing need to protect coastal properties.

Overall vulnerability: M

Part IV: Adaptation Consequences Analysis

As coastal flood risks increase from sea level rise, the five diverse stakeholder groups in Part III will step into a bigger role for the implementation and engagement of the City’s SLW program. As a team, we applied the following three adaptation strategies to the adaptation consequences analysis for the Elizabeth River Watershed:

Natural Mitigations | Land Conservation
 Adapted Structures | Floodplain Regulation
 Adapted Structures | Responsible Development

The table below consolidates the examination of how the likely near- and long-term costs and benefits of each selected adaptation strategy influence the five stakeholder groups, followed by an in-depth analysis of each. At the close of the section, we address two aspects of the selected adaptation measure—meeting our stakeholder’s needs and coalition building in support of our selections.

Adaptation Consequences Table

Stakeholder Groups	Adaptation Measures		
	Land Conservation	Floodplain Regulation	Responsible Development
Residential Homeowners			
Near-term costs	Low	Low	Low
Near-term benefits	High	High	Medium
Long-term costs	Low	Low	Low
Long-term benefits	Medium	High	Medium
City of Norfolk Public Works Department			
Near-term costs	Low	Low	Low
Near-term benefits	High	High	High
Long-term costs	Low	Low	Low
Long-term benefits	High	High	High
Elizabeth River Project			

Near-term costs	Medium	High	Medium
Near-term benefits	High	High	High
Long-term costs	Low	High	Medium
Long-term benefits	High	High	High
Federal Emergency Management Association (FEMA)			
Near-term costs	Low	Low	Low
Near-term benefits	Medium	Low	Low
Long-term costs	Uncertain	Uncertain	Uncertain
Long-term benefits	High	High	High
The Building Community			
Near-term costs	Low	Low	Medium
Near-term benefits	High	Medium	Low
Long-term costs	Medium	High	High
Long-term benefits	High	High	High

1) Residential Homeowners

Land Conservation

Near-term Costs – This is a low-cost solution monetarily, however it does hinder residential development in a location with a growing population. Fortunately, SGAs are established in areas that are least affected by SLR allowing for conservation efforts to be made in the neighborhoods along the River.

Near-term Benefits – Residents who own property receive tax benefits for entering into a conservation easement agreement. This protects the natural capital and ecosystem services provided by the Elizabeth River, as well as the land from future development. Preserving the natural habitats will also support the City’s goal of maintaining outdoor recreation as part of its economy. Lastly, the undeveloped land will act as a water sink during flooding and storms. The use of voluntary acquisition by the City would also provide an opportunity for residents to relocate to SGAs or another low-risk area.

Long-term Costs – Conservation easements would keep the lands from being developed within those communities, potentially lowering home values and allowing for redeveloped homes that are more resistant to flooding.

Long-term Benefits – Conserving the land preserves the natural systems for future generations and protects the residents from further development along the river outside of the SGAs.

Floodplain Regulation

Near-term Costs – The near-term cost of updating floodplain regulations to this stakeholder would be minimal for those already living in high-risk zones. Any redevelopment by homeowners would require them to follow regulations that may result in higher costs due to required floodproofing provisions.

Near-term Benefits – These neighborhoods already fall within the existing floodplain, so there would be no immediate benefit. New revisions by FEMA may place residents inside high-risk flood zones that were initially located outside of the limits. For those residents, they will benefit from the 15 percent premium reduction for flood insurance provided by FEMA.⁵²

Long-term Costs – Unsure of the long term costs.

Long-term Benefits – These are established neighborhoods that already fall within the regulatory floodplain so the benefit would be indirect. It would protect the watershed as a whole, resulting in a more resilient community to support the local economy and infrastructure, as well as quality of life.

Responsible Development

Near-term Costs – Increased regulations could limit economic growth opportunities resulting in opportunity cost to residents.

Near-term Benefits – With a growing population, developing responsibly will help preserve natural habitats and protect critical assets for the current residents.

Long-term Costs – Increased regulations could limit economic growth opportunities resulting in opportunity cost to residents.

Long-term Benefits – Responsible development will allow for long-term growth that is more resilient to flooding and storms. Residential homeowners will benefit from this as it applies to the impact on new critical assets. Selecting locations based on new floodplain regulations and SGAs will increase the adaptive capacity of the residents of the ERW.

2) City of Norfolk Public Works Department

Land Conservation

Using nature’s green infrastructure to provide flood abatement is a low-cost near-term strategy that provides a water sink during flood and storm events. The City refers to Norfolk, Virginia in this segment. There are a number of land conservation techniques the City can employ to protect and expand existing assets. If they choose to follow the SLW recommendations for their city as proposed for Virginia Beach, the City of Norfolk Public Works Department stands to gain land from the money spent by the city to acquire property and development rights along vulnerable shorelines, conservation easements on undeveloped land, and setbacks and buffers between natural and developed areas. These lands could be used as parks and recreation amenity areas that enhance local and tourist activity or simply as green infrastructure beautification regions that make neighborhoods more attractive. The increased safety against flooding could protect the aging infrastructure and allow proper egress in the event of a storm or tidal flood threat.⁵³

Responsible Development

In areas where building occurs, responsible development as a low-cost mid-term strategy to oppose flood risk is a straightforward proposition. As the saying goes, measure twice and cut once. Responsible development requires some modification to the way things have always been done but those adjustments are sound investments when faced with rebuilding after catastrophic storm events. The fiscal cost of moving buildings and infrastructure away from shorelines to create water sinks, preserving tree canopies, and increasing the use of green infrastructure to manage stormwater are negligible considering the significant benefits created. This sister strategy to land conservation has many of the same short and long-term tradeoffs, costs, and benefits in addition to neutralizing reconstruction costs for physical assets.⁵⁴

Floodplain Regulation

Underpinning the conservation of land and responsible development of the SGAs is expanding the boundary of the regulatory floodplain. As the third pillar of our adaptation strategy for the Elizabeth River Watershed, enlarging the floodplain is a low-cost near-term measure that allows for secure growth, reduced susceptibility to flooding, and the safeguarding of life and physical assets. As these three strategies are thematically similar, the costs and benefits for the Public Works Department are consistent.⁵⁵

In the near and long-term, the Department bears scant fiscal costs to implement the adaptive measures but could suffer losses if they do not go forward. The risks to physical assets and the redistribution of dollars to repairs rather than improvement must be considered in the cost-benefit analysis. Likewise, the near-term benefits of the adaptive measures solidify over time to offer greater intergenerational shoreline resilience thus reducing emergent responses and redirection of resources to rebuilding after catastrophic storm events.

3) Elizabeth River Project

For the Elizabeth River Project (ERP), the cost/benefit analysis takes into consideration financials, opportunities, and goodwill.

Land Conservation

Near-term Costs – No financial cost to ERP. However, staff time and resources may be diverted to help promote land conservation efforts.

Near-term Benefits – Land conservation will help ERP achieve its mission. By conserving land, forests, and marshes in the Elizabeth River Watershed, water quality will improve, resulting in an increase in tourism, recreation, and ultimately, local business.

Long-term Costs – None.

Long-term Benefits – Improved water quality and habitat along the Elizabeth River.

Floodplain Regulation

Near-term Costs – ERP is currently in the process of raising \$4.5 million to build in an existing floodplain. Their Resilience Lab is a green building designed to withstand frequent flooding. However, if these regulations halted construction, it would cause a dramatic shift in ERP's plans and allocation of their resources.

Ultimately, ERP's core beliefs would align with this strategy. Their mission to restore the Elizabeth River also strives to create a thriving port economy that enables residents of the watershed to safely enjoy outdoor recreation on and around the river. Tightening building standards within the floodplain ensures residents' homes are safe from flooding. A policy ERP would certainly get behind.

Near-term Benefits – Could boost publicity for the construction of their new Resilience Lab.

Long-term Costs – ERP fully understands that their multimillion-dollar, state of the art Resilience Lab might be swallowed by rising seas in the next 50 years. The building is designed to be absorbed by the river and not release any harmful elements into the environment. It can safely be abandoned.

Long-term Benefits – ERP's Resilience Lab could be heralded as a prototype for building in coastal communities.

Responsible Development

Near-term Costs – ERP is already committed to responsible development in the region, incorporating green infrastructure into their facilities and construction plans. No added costs here.

Near-term Benefits – Positive press surrounding their Resilience Lab and expansion of their River Academy facilities.

Long-term Costs – The costs are already built into their long-term planning. Staff and hired contractors are dedicated to role modeling responsible development in ERP’s facilities and promoting it across the region.

Long-term Benefits – Prosperous, thriving community to engage in ERP’s work. Improved water quality and consequently, more opportunities for local tourism and seafood industries.

4) United States Federal Government

In regards to the three measures chosen to implement by our team, FEMA bears minimal cost in the actual implementation of the said measures but can benefit greatly as the implementation of these measures should significantly reduce the repercussions associated with natural disasters. However, if these measures were not implemented successfully or did not produce the desired impacts, then costs associated with predicted sea-level rise and future weather events could cost the organization an exponential amount of resources and money. In regards to land conservation, near term costs for FEMA would be very minimal as most forms being implemented by the SLW program exist in the form of conservation easements. This doesn’t require the agency’s involvement and is dealt with at the state or city level. If land conservation were not implemented and development took place along the Elizabeth River, then FEMA would have costs associated with natural disasters that impacted this development but would be on a minimal scale. FEMA would gain lessened involvement if proper safety measurements work according to design however if safety measurements were to fail then the organization might be forced to get involved. If the SLW program were to successfully refine its floodplain boundaries and focus on future responsible development practices the cost for FEMA would be very low and the benefits would be significant as this would allow the organization’s resources to be used elsewhere.

Near-term Costs

Near term costs associated with FEMA would be minimal as this federal government does not pay for the implementation of any of the above measurements selected. In contrast, the cost of not implementing these measurements would provide costs for this agency as the likelihood of impacts from natural disasters and flooding from the Elizabeth River would continue to increase. Costs associated with no implementation is uncertain for FEMA as the agency’s involvement with the SLW program takes more of a reactive role. It is safe to assume that the agency will aid Virginia Beach in disaster preparedness but the costs associated with that on behalf of FEMA is likely to be minimal.

Near-term Benefits

As previously stated near term benefits of the three selected measures could be significant for FEMA but the actual monetary value is uncertain. Speculative the more successful the above measures were when implemented the less involvement the agency should have in regards to response which in turn should save money. Other near term benefits for FEMA would include a successful program model to refer to when providing aid/relief to other states, fostering

relationships with local state, city, and population without being associated with just disaster response efforts, and increased resource availability between interagency departments.

Long-term Costs

Since the Federal government is more of a “hands-off” entity and looks upon local state and city agencies to enforce the baseline requirements set forth by them, long term costs for FEMA in regards to the implementation of these measures should be relatively low. However, monetary and resource costs associated with disaster response preparedness and relief efforts will vary for FEMA as weather events are expected to worsen and sea level will continue to rise. Uncertainty lies within the long term costs for this agency.

Long-term Benefits

In contrast, if the above measurements deliver what is expected of them to lessen flood vulnerability and combat rising sea levels then the benefits for FEMA could be significant in the future. However, due to socioeconomic factors interconnected with flooding and sea-level rise leaves a level of uncertainty of how much benefit will be provided for this agency. In theory, less flooding should aid in economic development which should produce more tax dollars generated which in turn should provide more funding for FEMA however there is no way to guarantee this would happen. Essentially the long term benefits for FEMA if the above measures prove successful would essentially be a multiplier effect of the short term benefits. Successful land conservation, floodplain regulation, and responsible development measures should stimulate significant benefits for FEMA.

5) The Building Community

Near-term Costs

The three measures—land conservation, floodplain regulation, and responsible development—are low-cost measures to mitigate coastal flood risks. A conservation easement would be a voluntary option for residents or commercial property owners. It would depend on how much flood risk awareness and financial support that land developers have that incentivizes them to install land conservation features to the development projects that border the Elizabeth River.

Floodplain regulation may prohibit some stakeholders in the building community to alter the landscape within the new regulatory floodplain after its expansion of the area. Displacement of residents in aging housing may be necessary in order to implement the new floodplain regulations; however, an opportunity may arise for rehousing development.

Responsible development may require investments in new data and research for the watershed. Small and medium-sized stakeholder groups in the building community operate their businesses like a mom-and-pop store. They have limited resources to upgrade business technology to the extent of precision and accuracy of flood risk assessments at the academic level. More urban planning and regulations with long-term vision seem to be inevitable in order

to implement responsible development, and yet, it may disincentivize some ambitious stakeholders in the building community.

Near-term Benefits

All three measures can provide near-term benefits. The building community will receive tax benefits for conserving the land. The green infrastructure added to the new development and the existing gray infrastructure will increase property value. The Eastern Branch of the Elizabeth River protected under conservation easements is already a favorite transportation route for nature lovers.⁵⁶ The additional natural assets resulting from land conservation will attract more business opportunities for the riverside properties and pertinent industries.

Floodplain regulation and responsible development are risk management strategies for the building community. As extreme flood and storm events become more frequent resulting from climate change, the benefits from these two strategies can be seen in the near term if precautionary action is taken promptly. As mentioned, floodplain regulation may lead to an opportunity for rehousing development to shelter displaced residents from floodplain areas. Similar public works opportunities are foreseen for the critical facilities relocation projects such as power facilities, wastewater treatment plants, public schools, and fire stations.

Long-term Costs

Long-term costs involve repair, maintenance, and replacement costs. Green infrastructure is widely used in our selected measures—land conservation and responsible development. Green infrastructure maintenance is labor-intensive until humankind can fully grasp exponential technologies (e.g. AI, data science, biotech, nanotech, robotics, etc.) to reduce labor costs. This should not discourage the implementation of green infrastructure because it is a cost-effective approach to treat stormwater runoff at the source. The building community will also need to factor in investments in technology upgrades and professional training for green infrastructure management in the long-term ledger balance. This trade-off is pronounced in responsible development for small and medium-sized stakeholders in the building community. Would they make these investments to enhance competitiveness in the long run or would they rather maximize long-term free cash flow for flood disaster response?

There is not much detail about how to implement floodplain regulation in the ERW. If engineered structures (e.g. levees and floodwalls) are to be installed, the building community will need to consider the repair and replacement costs. These factors are also determined by long-term inflation expectations and building material pricing over time. The building community will also need to consider how to cut the cost of home elevations and reduce the increasing cost of flood insurance premiums outside the expanded “future 100-year floodplain” or the 500-year floodplain.

There is little mentioning about wastewater treatment plants in responsible development. The author believes they should be considered part of the City’s critical assets and facilities (See the rationale in the sensitivity of the community in Part III Climate Vulnerability Assessment). The sea-level rise only increases risks to aging sanitation systems in the coastal communities. The

construction cost of a wastewater treatment plant can reach a budget of seven figures. Public works in the building community will need to mull over the tradeoffs. Will the City relocate these facilities from low-lying flood-prone areas now or spend more to rebuild in the aftermath of a disaster? Will the City's bursar be capable of funneling the tax dollars in responsible development for these critical assets?

Long-term Benefits

As mentioned, green infrastructure is widely used in land conservation and responsible development. Green infrastructure creates jobs as building jobs can't be outsourced. The building community will benefit from a diverse community-based green infrastructure workforce and the expansion of the home-raising workforce.

Long-term benefits boil down to a well-thought-out planning at the outset. Inland conservation and responsible development, the City will see the long-term benefits as described in EPA's "Green Streets, Green Jobs, Green Towns (G3)" Initiative. The G3 grant program⁵⁷ may benefit the City's urban planning and the building community for implementing green infrastructure. With creativity, designing green infrastructure with low-maintenance plants and native plants is an option to reduce long-term labor costs for green infrastructure maintenance.

Floodplain regulation and responsible development ensure safer long-term growth and reduce vulnerability to flood risks for new development and substantial redevelopment. If the City is to implement these measures with diversity and inclusion in mind, there will be long-term benefits for the underserved population in the building community (e.g. pieceworkers, the "bottom rung") by offering professional training and repayment employment to them in the flood-resilient building community. The possibility of expanding green infrastructure and floodproofing retrofits on the vacant, abandoned or foreclosed properties through land banking will boost innovations and attract entrepreneurial stakeholders in the building community.

Adaptation Measures - Issues to Explore

Meeting the Needs and Exploring Trade-offs

After evaluating the three adaptation strategies we selected against our stakeholder groups, we concluded they are a good start and as outlined in the SLW, must be taken in tandem with additional measures long-term. With two exceptions, the Elizabeth River City-Wide Alignment and Resilient Roadways, the adaptation strategy costs are low with reasonable benefits. In contrast, the selected strategies could lessen economic growth and require some lower-income residents and small businesses to relocate, neither of which are well equipped to do so. Ultimately, our strategies support a resilient community with opportunities for new development that could compensate for the economic consequences.

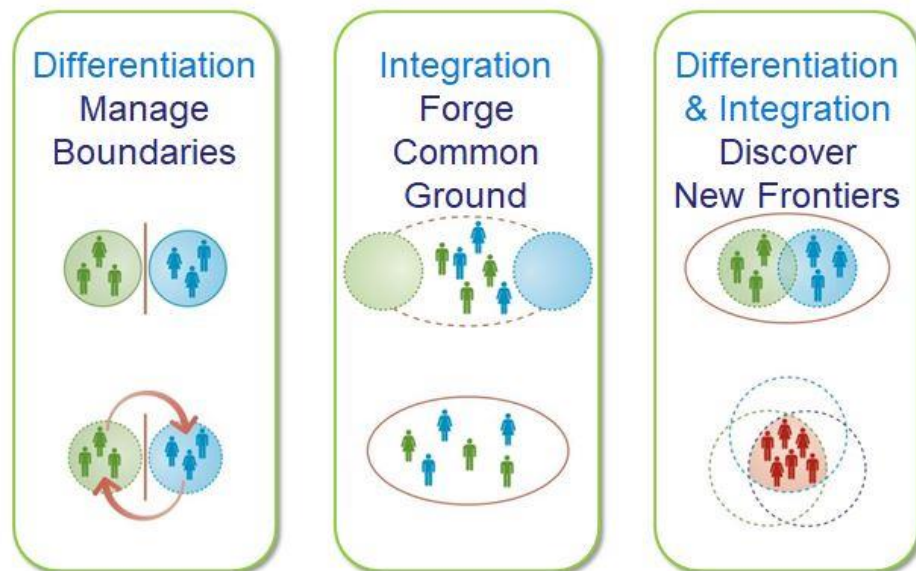
Lobbying Through Stakeholder Coalitions

We fully expect a redefined Floodplain Regulation to require the full support of all our stakeholders as it has far-reaching implications for compliance. As the City explores the future

100-year and 500-year floodplains, the stakeholders must consider that the land area imprint is approximately the size of 750+ football fields for the 100-year floodplain and would likely expand farther to account for a 500-year flood event. It is reasonable to assume that local and state governments would be apprehensive to go to these extremes, but if the stakeholder groups are intent on intergenerational equity and preservation of life and physical assets, they will need to lobby for the change.

PART V: Boundary Spanning Leadership (BSL) Analysis

Analyses from the preceding sections inform us that the five stakeholder groups in the Elizabeth River Watershed share common understanding about the impact of coastal flooding on prosperity. The health of the watershed sustains the survival and prosperity of the stakeholders across municipal and geographical boundaries. Boundary spanning leadership (BSL) is a social science-based approach for stakeholders to optimize cross-sector resources effectively in order to tackle coastal flooding and disasters associated with sea level rise. We aim to include as large an audience as possible in this section, and the figure below (Figure 4) is to sum up the essence of BSL for those non-technical, climate concerned citizens.



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Figure 4: In each of the three strategies, there are two boundary spanning practices. All six boundary spanning practices are illustrated in the following BSL analysis table. Courtesy of Center for Creative Leadership.

After a thoughtful discussion of exploring each stakeholder’s strengths and weaknesses, our team decided that out of the five boundaries spanning types stakeholder and demographic boundaries are the top two boundaries present amongst all five stakeholder groups. It is important to note that there may be more boundaries present for the stakeholders. In the following BSL analysis, we will examine how the selected five stakeholder groups utilize different BSL tactics in stakeholder and demographic boundaries to support the implementation of the floodplain regulation within the SLW program.

In the table below you will see a green check mark underneath each BSL tactic that indicates the two most pertinent tactics identified for each stakeholder group to effectively span boundary challenges associated with the SLW program. We concluded that there is no one-size-fits-all solution when it comes to trying to span boundaries whether it is within your own organization or reaching across multiple organizations. In order to successfully span boundaries,

an individual must establish a shared vision/goal with the other entity with whom they are trying to span boundaries.

Boundary Spanning Leadership Analysis table

Stakeholder Group	Boundary Type	Buffering Tactic	Reflecting Tactic	Connecting Tactic	Mobilizing Tactic	Weaving Tactic	Transforming Tactic
Residential Homeowners	Stakeholder Demographic Geographic		✓		✓		
City of Norfolk Public Works Dept.	Vertical Stakeholder Demographic					✓	✓
Elizabeth River Project	Stakeholder Demographic Geographic	✓				✓	
U.S. Federal Government	Stakeholder Demographic Vertical			✓		✓	
Coastal Virginia Building Industry Association	Stakeholder Demographic Geographic			✓	✓		

1) Residential Homeowners

Stakeholders Boundary

Mobilizing Tactic

Utilizing mobilizing as a tactic will allow residents to forge common ground with the City’s SLW and other stakeholders. This could come in the form of a town hall meeting or another open-forum gathering that provides shared, equal space for opinions to be shared. This will build a sense of community once the groups realize they have similar goals, concerns, and missions.

Transforming Tactic

Transforming would allow residential homeowners to have greater input into SLW strategies for how to adapt in the future. SLW team could give them the option to take on greater

responsibility when it comes to engaging with other residents in their community and educating them about the risks they face.

Demographic Boundary

Reflecting Tactic

It can be difficult for members of different socioeconomic groups or those with limiting physical factors to understand the challenges that the others face. Add on climate change and sea-level rise and the concerns are even greater. Reflecting gives the various stakeholders a chance to share experiences. Creating a shared space would help SLW better understand these dynamics and help raise awareness and build respect.

Connecting Tactic

By creating physical, shared spaces, residents of all demographics can better understand the effects of climate change on sea levels. This could come in the form of existing, public recreation areas or local parks that contain educational signs to encourage conversation.

2) City of Norfolk Public Works Department

Stakeholder Boundary

Weaving Tactic

Use of a community based public-private partnership could be used to cross sectors, pulling in various stakeholders with differing strengths and areas of expertise to undertake the implementation of the natural mitigations.

Transforming Tactic

If a CB3P is used as a weaving tactic, the communities of stakeholders could have an open event aimed at celebrating the implementation of the adaptive measures that support the shared vision of their future.

3) Elizabeth River Project

Stakeholder Boundary

Buffering Tactic

Through their Next Wave Campaign, ERP is constructing a state of the art, green building on the banks of the Elizabeth River. This building, deemed the Resilience Lab, is designed to be a prototype for coastal communities. It will be an example of how to build sustainably in a floodplain. It will be a hub for people with shared expertise and serve a place for community engagement. The Resilience Lab will celebrate forward progress in engineering and sustainable

design and garner positive attention for the entire region, highlighting how we can develop responsibly and in a way that is harmonious with the natural world.

Weaving Tactic

To advance floodplain regulation for the region, ERP could benefit from partnering with local city governments of the Elizabeth River Watershed. Together, they could set up a mentorship program for City Planners on how to design sustainably in a floodplain, using their Resilience Lab as a model. ERP could host a series of city meetings at their Resilience Lab focused on sustainable development and implementation of the SLW program.

4) U.S. Federal Government

Connecting Tactic

Stakeholder Boundary — Have dedicated point of contact from FEMA’s Region III Regional Emergency Communications Coordination Working Group (RECCWG) to visit and coordinate with other prominent SLW stakeholders (Dewberry, Public Works Stormwater Engineering Center, SLW scientists, etc.) to grasp a better understanding of programs strengths and weaknesses and determine the other ways FEMA can assist besides providing funding.

Demographic Boundary — FEMA could participate in local disaster awareness fundraisers or getting more involved in education outreach programs that are specific to the SLW program.

Weaving Tactic

Stakeholder Boundary — Given that FEMA’s Flooding Mitigation Assistance Grant Program (FMA) process takes years to complete and implement, FEMA could partner with other SLW stakeholders and Virginia Beach insurance agencies to see if brainstorming amongst local floodplain subject matter experts could produce ways to make the FMA process more efficient, reduce time to implementation, or find a loophole within a policy framework that would allow overall residents of VB to meet the qualifications of the program.

Demographic Boundary — FEMA could consult with local educational institutions to consult with experts in fields related to flooding (i.e. hydrologist, biologist, biomimicry, civil engineers, etc.) to explore what, if any, advancements are being made to address floodplain issues. Perhaps FEMA could provide a grant to these institutions to contribute to the further advancement of this field.

5) Coastal Virginia Building Industry Association

After the merger this March, Coastal Virginia Building Industry Association (CVBIA) represents a wider network of stakeholders in the region. CVBIA fits the description of stakeholder boundaries (See table “Boundary Type”). CVBIA might use Connecting Tactics and Mobilizing Tactics to forge common ground.

Connecting Tactic

Stakeholder Boundary — In light of COVID-19, virtual meetings may attract a bigger turnout of the CVBIA members. They may take this platform to gather feedback about floodplain regulation. They may share the same concern about how this strategy would affect individual business.

Demographic Boundary — CVBIA may organize social activities for members of all ages and backgrounds to mingle. For example, getting home builders and residents together for a sporting event or a Fourth of July cookout. They may use the occasion to share ideas about the floodplain regulation.

Mobilizing Tactic

Stakeholder Boundary — CVBIA may gather the feedback from its stakeholders and draw up a common agenda. It is a vision that includes a common understanding of floodplain regulation and a joint approach to respond to the adaptation strategy through agreed-upon actions.

Demographic Boundary — As an affiliate member, CVBIA may review a core set of standard industry practices for housing affordability from the Home Builders Association of Virginia and the National Association of Home Builders (NAHB). CVBIA could incorporate these practices into its own and better inform its stakeholders for the development of flood-prone areas.

PART VI: Leadership and Advocacy Recommendations

The impact of climate change is wide, deep, and costly, like the current COVID-19 pandemic. Extreme weather patterns are unexpected, severe, unseasonal, and regional. The price of inaction to coastal flood risks and sea-level rise is too high to ignore. If adaptation measures are not taken in a timely manner, the ERW stakeholders are liable for damages to property and infrastructure in the aftermath of a disaster. Coupled with an increased risk of social vulnerability, the losses of human life and ecological assets on which the stakeholders depend are irreversible. Benjamin Franklin once said, “An ounce of prevention is worth a pound of cure.” Climate change doesn’t respect borders. Nor does our pursuit of prosperity across generations. With a stellar reputation for its diverse collection of industries and working forces, the ERW is a testament to the iconic tourism slogan of “Virginia is for lovers.” This unique, regional identity offers ample opportunities for collaborative leaders and responsive stakeholders to achieve climate resilience for people, planet, and profit.

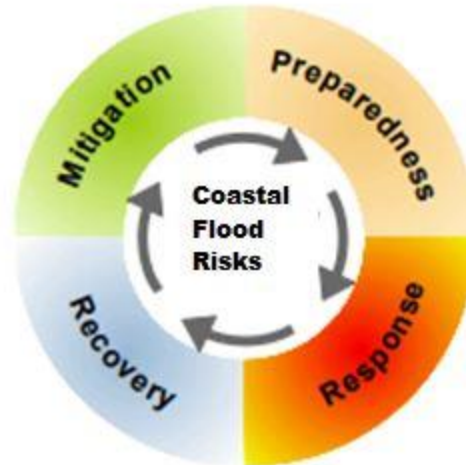


Figure 5 Climate adaptation cycle of coastal flood risks.

After an in-depth study of Virginia Beach’s SLW program and our expansive, interdisciplinary research on the ERW stakeholder groups, the following recommendations highlight our reflective learning about coastal climate change adaptation and leadership.

Stakeholder Engagement

1. Expand cross-departmental collaboration and communication in the City government during the implementation phase.

Drawing from the case study of Clean Water Partnership (CWP) for Prince George’s County, MD, we learned that the planning stage of CWP involved a great amount of interdepartmental communication and decision making in the local government. In principle, many people accept the trend of dissolving sector boundaries; in practice, however, they continue to toil in silos. Even within sectors, communities are fragmented by roles. Because local governments are taking climate adaptation matters into their own hands, duplication of effort, reinventing the wheel, and negative externalities to neighboring cities could be prevalent.⁵⁸ The use of collective impact and fiscal partnerships could help. Hampton Roads has the chance to break this cycle and the barriers between government agencies through implementing the SLW program. In order to optimize human resources and tax dollars for the best outcomes of the SLW program, the City may consider expanding cooperation and communication among its departments and offices during the implementation phase. The

public works may want to adopt BSL horizontal and vertical best practices.

Community-based, public-private partnerships could also be employed to speed the implementation of Natural Mitigations, Engineered Defenses, and Prepared Communities. The CWP model in Prince George's County is an excellent example to reference.

2. Deepen cross-sector, cross-jurisdictional collaboration among the stakeholders of the ERW.

The ERW has a unique geography that covers four cities. Besides, both flood mitigation (e.g. nature-based and engineered solutions) and stormwater management (e.g. green infrastructure) are related to water. In the face of increasing urbanization, coastal floods, and water scarcity in the watershed, it is paramount for best water management practices that target adaptation measures. The recent state legislative victory in Virginia leading to full participation in the Regional Greenhouse Gas Initiative and the Blue Carbon Initiative will significantly enhance the incentives for entrepreneurship and leadership in the sea level rise adaptation. Investment and policy shifts in a healthy watershed and water infrastructure call for cross-sector cooperation and cross-jurisdictional policy collaboration. The Boundary Spanning Leadership is a good approach to experiment (See Part V).

3. Enhance visual appeals to raise public awareness of coastal flooding and motivate community action.

Make climate change visible in public spaces. Local municipalities in the ERW may consider using markers to show higher sea level rise tides along publicly accessible coastal areas such as parks and boardwalks. They may also use climate adaptation projects to increase the beauty and livability of cities rather than be simply utilitarian, engineered solutions, and use before and after visuals to engage and motivate local advocacy. People have a strong connection to their local places and that can be motivation to take action, especially when local residents observe climate change impacts.⁵⁹

4. Encourage stakeholders to share their flooding experiences and leverage storytelling to influence policy change.

Create a multi-stakeholder social media platform to encourage cross-sector collaboration and encourage communication amongst stakeholders of all levels of importance. Platforms such as Reddit, where there are minimum qualifications to join but allow anyone with interest to have their voices, ideas, concerns, etc. heard, could be used. Features like upvoting and downvoting might prove beneficial in sorting the most pressing issues.

Use personal experience to drive advocacy and engagement. Use that flooding experience to ground the community in the work that needs to be done to address flooding.⁶⁰

Application of Equity and Justice

1. *Include Social Vulnerability Index (SVI) in the master planning of a flood mitigation strategy.*

Social vulnerability refers to the socioeconomic and demographic factors that affect the resilience of communities.⁶¹ The Center for Disease Control and Prevention (CDC) maintains an SVI. We learn that there are mainly two types of solutions for flood mitigation in the SLW program—structural (i.e. engineering and flood-resistant building) and non-structural (i.e. nature-based solutions). Both solutions are necessary, and their near- and long-term benefits are tangible. However, we are aware that socially vulnerable populations (e.g. the economically disadvantaged, communities of color, physically and mentally disabled, the uninsured, the elderly, and minors) are more likely to be adversely affected by climate change-induced flooding. An EPA study shows that areas of higher social vulnerability are more likely to be abandoned than protected in response to unmitigated sea level rise.⁶² The key stakeholders of the SLW program may want to incorporate SVI into the implementation of the SLW program to gain a bigger popularity and positive outcome.

2. *Explore funding and grant opportunities for environmental justice (EJ) study with the Virginia Department of Environmental Quality (DEQ) and the United States Environmental Protection Agency (EPA).*

With the lens of SVI to implement the SLW program, key stakeholders may champion scalability, accessibility, and equity for the underserved populations in all four watershed strategies. In light of the current political and social climate in the country, diversity and inclusion cannot be understated. The SLW program could become a good case study with EJ in mind, and if the program is implemented effectively, it could become a success story and subsequently improve the City's national reputation. The City may look into state and federal EJ grants and assistance. We are aware of the EJ study programs in both DEQ⁶³ and EPA.⁶⁴

3. *Expand flood insurance through strategic outreach.*

Residential property owners are the most vulnerable stakeholder in the ERW. A vast majority of the residents are also employed in the community. Despite quality of life being one of their core beliefs, the homeowners are generally underinsured with flood insurance coverage. We see the barrier to insurance as a lack of education or awareness. Our recommendation for the ERW is to take a more proactive approach to engaging and educating this stakeholder group using consistent outreach and boundary spanning leadership techniques previously mentioned. The specific focus should be expanding flood insurance coverage. This will require strategic engagement through their venues for advocacy.

4. *Investigate options for managed retreat or a voluntary acquisition program.*

Although flood insurance is at times considered a mitigation strategy, it does not prevent damage incurred from flooding, which leaves obligatory repairs and reconstruction in its wake. Perhaps the most effective way for homeowners to improve quality of life and mitigate risks of climate change is by relocating to lower-risk areas within the watershed. We recommend offering a voluntary acquisition program that will allow the City to purchase property from homeowners, and when available, manage the land to store flood water during tidal floods and storms. With SGAs already established, there is an opportunity to create a formal managed retreat plan such as those used in New York City and New Orleans. It might also be beneficial to collaborate with a congressional caucus such as The Natural Disaster Caucus to encourage a coalition for policy change and spread awareness of issues associated with rising sea levels and flooding.

Implementation Framework

As SLW transitions to the final Implementation stage, a clear and logical plan for execution of the proposed strategies is essential. Drawing from the case study of Community Energy Planning (CEP) for Arlington County, VA, we assume that a five-year implementation framework alongside an annual work plan in which the most feasible goals (e.g. low-hanging fruit) are included will ensure the effectiveness of each strategy and achieve collective impact with stakeholders.



Figure 6: The seven goals in Virginia Beach Sea Level Rise Policy Response Report (April 2, 2019)

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