



**VIRGINIA DEPARTMENT OF CONSERVATION  
AND RECREATION:  
2021 VIRGINIA COMMUNITY FLOOD PREPARDNESS  
FUND GRANT**

Application

Department of Public Works

Division of Environmental Stormwater Management

2233 McKann Ave

Norfolk, VA 23505



**VIRGINIA DEPARTMENT OF CONSERVATION  
AND RECREATION:  
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**Application**

Lake Whitehurst Hydrology and Hydraulics Study



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- Scoring (Appendix C)
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**Appendix A: Application Form for Grant Requests for All Categories**  
*Virginia Department of Conservation and Recreation*  
*Virginia Community Flood Preparedness Fund Grant Program*

**Name of Local Government:** City of Norfolk

**Category of Grant Being Applied for:** Study

**NFIP/DCR Community Identification Number (CID):** 510104

**Name of Authorized Official:** Dr. Larry H. Filer II

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9/1/2021 | 7:25 AM PDT

**Signature of Authorized Official:** \_\_\_\_\_

**Mailing Address:** 810 Union St, Suite 1101

**City:** Norfolk **State:** VA **Zip:** 23510

**Telephone Number:** [REDACTED] **Email Address:** [REDACTED]

**Contact Person (If different from authorized official):** Justin Shafer, Project Manager- Water Quality & Green Infrastructure

**Mailing Address:** 2223 McKann Avenue

**City:** Norfolk **State:** VA **Zip:** 23505

**Telephone Number:** [REDACTED] **Cell Phone Number:**

**Email Address:** [REDACTED]

**Is the proposal in this application intended to benefit a low-income geographic area as defined in the Part 1 Definitions?** Yes \_\_\_ No \_\_\_ X \_\_\_

**Study Grants (Check All that Apply)**

- Studies to aid in updating floodplain ordinances to maintain compliance with the NFIP or to incorporate higher standards that may reduce the risk of flood damage. This must include establishing processes for implementing the ordinance, including but not limited to, permitting, record retention, violations, and variances. This may include revising a floodplain ordinance when the community is getting new Flood Insurance Rate Maps (FIRMs), updating a floodplain ordinance to include floodplain setbacks or freeboard, or correcting issues identified in a Corrective Action Plan.
- Revising other land use ordinances to incorporate flood protection and mitigation goals, standards and practices.
- Conducting hydrologic and hydraulic studies of floodplains. Applicants who create new maps must apply for a Letter of Map Revision or a Physical Map Revision through the Federal Emergency Management Agency (FEMA). For example, a local government might conduct a hydrologic and hydraulic study for an area that had not been studied because the watershed is less than one square mile. Modeling the floodplain in an area that has numerous letters of map change that suggest the current map might not be fully accurate or doing a detailed flood study for an A Zone is another example.
- Studies and Data Collection of Statewide and Regional Significance.
- Revisions to existing resilience plans and modifications to existing comprehensive and hazard.
- Other relevant flood prevention and protection project or study.

**Location of Project (Include Maps):** Lake Whitehurst watershed and downstream drainage in Norfolk, VA



**NFIP Community Identification Number (CID#):** 510104



**Is Project Located in an NFIP Participating Community?**  Yes  No

**Is Project Located in a Special Flood Hazard Area?**  Yes  No

**Flood Zone(s) (If Applicable):** VE, AE, Shaded X (0.2% chance)

**Flood Insurance Rate Map Number(s) (If Applicable):** 5101040036H, 5101040037H, 5101040041H, 5155310016G, 5101040038H, 5101040039H

**Total Cost of Project:** \$1,000,000

**Total Amount Requested:** \$500,000



## Appendix C: Scoring Criteria for Studies

Virginia Department of Conservation and Recreation  
Virginia Community Flood Preparedness Fund Grant Program

<b>Applicant Name:</b>		City of Norfolk
<b>Eligibility Information</b>		
Criterion	Description	Check One
1.	<b>Is the applicant a local government (including counties, cities, towns, municipal corporations, authorities, districts, commissions, or political subdivisions created by the General Assembly or pursuant to the Constitution or laws of the Commonwealth, or any combination of these)?</b>	
Yes	<b>Eligible for consideration</b>	X
No	<b>Not eligible for consideration</b>	
2.	<b>Does the local government have an approved resilience plan and has provided a copy or link to the plan with this application?</b>	
Yes	<b>Eligible for consideration under all categories</b>	X
No	<b>Eligible for consideration for studies, capacity building, and planning only</b>	
3.	<b>If the applicant is <u>not a town, city, or county</u>, are letters of support from all affected local governments included in this application?</b>	
Yes	<b>Eligible for consideration</b>	X
No	<b>Not eligible for consideration</b>	
4.	<b>Has this or any portion of this project been included in any application or program previously funded by the Department?</b>	
Yes	<b>Not eligible for consideration</b>	
No	<b>Eligible for consideration</b>	X
5.	<b>Has the applicant provided evidence of an ability to provide the required matching funds?</b>	
Yes	<b>Eligible for consideration</b>	X
No	<b>Not eligible for consideration</b>	



<b>Studies Eligible for Consideration</b>		<input checked="" type="checkbox"/> Yes No	
<b>Applicant Name:</b>	City of Norfolk		
<b>Scoring Information</b>			
<b>Criterion</b>	<b>Point Value</b>	<b>Points Awarded</b>	
<b>6. Eligible Studies (Select all that apply)</b>			
<b>Revising floodplain ordinances to maintain compliance with the NFIP or to incorporate higher standards that may reduce the risk of flood damage. This must include establishing processes for implementing the ordinance, including but not limited to, permitting, record retention, violations, and variances. This may include revising a floodplain ordinance when the community is getting new Flood Insurance Rate Maps (FIRMs), updating a floodplain ordinance to include floodplain setbacks or freeboard, or correcting issues identified in a Corrective Action Plan.</b>	30	N/A	
<b>Creating tools or applications to identify, aggregate, or display information on flood risk or creating a crowd-sourced mapping platform that gathers data points about real-time flooding. This could include a locally or regionally based web-based mapping product that allows local residents to better understand their flood risk.</b>	15	N/A	
<b>Conducting hydrologic and hydraulic studies of floodplains. Applicants who create new maps must apply for a Letter of Map Revision or a Physical Map Revision through the Federal Emergency Management Agency (FEMA).</b>	35	35	
<b>Studies and Data Collection of Statewide and Regional Significance. Funding of studies of statewide and regional significance and proposals will be considered for the following types of studies:</b>			
◦ <b>Updating precipitation data and IDF information (rain intensity, duration, frequency estimates) including such data at a sub-state or regional scale on a periodic basis.</b>	45	N/A	
◦ <b>Regional relative sea level rise projections for use in determining future impacts.</b>	45	N/A	

o Vulnerability analysis either statewide or regionally to state transportation, water supply, water treatment, impounding structures, or other significant and vital infrastructure from flooding.	45	45
o Flash flood studies and modeling in riverine regions of the state.	45	N/A
o Statewide or regional stream gauge monitoring to include expansion of existing gauge networks.	45	N/A
o New or updated delineations of areas of recurrent flooding, stormwater flooding, and storm surge vulnerability in coastal areas that include projections for future conditions based on sea level rise, more intense rainfall events, or other relevant flood risk factors.	45	N/A
o Regional flood studies in riverine communities that may include watershed-scale evaluation, updated estimates of rainfall intensity, or other information.	50	N/A
o Regional hydrologic and hydraulic studies of floodplains.	45	N/A
o Studies of potential land use strategies that could be implemented by a local government to reduce or mitigate damage from coastal or riverine flooding.	40	N/A
o Other proposals that will significantly improve protection from flooding on a statewide or regional basis	35	N/A
<b>7. Is the study area socially vulnerable? (Based on ADAPT VA's Social Vulnerability Index Score.)</b>		
Very High Social Vulnerability (More than 1.5)	15	
High Social Vulnerability (1.0 to 1.5)	12	
Moderate Social Vulnerability (0.0 to 1.0)	8	8
Low Social Vulnerability (-1.0 to 0.0)	0	
Very Low Social Vulnerability (Less than -1.0)	0	
<b>1. Is the proposed study part of an effort to join or remedy the community's probation or suspension from the NFIP?</b>		
Yes	10	
No	0	0
<b>2. Is the proposed study in a low-income geographic area as defined in this manual?</b>		
Yes	10	10
No	0	

**3. Projects eligible for funding may also reduce nutrient and sediment pollution to local waters and the Chesapeake Bay and assist the Commonwealth in achieving local and/or Chesapeake Bay TMDLs. Does the proposed project include implementation of one or more best management practices with a nitrogen, phosphorus, or sediment reduction efficiency established by the Virginia Department of Environmental Quality or the Chesapeake Bay Program Partnership in support of the Chesapeake Bay TMDL Phase III Watershed Implementation Plan?**

Yes	5	
No	0	0
<b>Total Points</b>		88



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**Lake Whitehurst Hydrology and Hydraulics Study Narrative**

Department of Public Works

Division of Environmental Stormwater Management

2233 McKann Ave

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## **Lake Whitehurst Hydrology and Hydraulics Study** *Scope of Work and Budget Narratives*

### **1. Study Area and Background**

The City of Norfolk seeks support for a hydrology and hydraulics (H&H) study of the Lake Whitehurst watershed, including the weir, outfall, and upstream drainage connections. Lake Whitehurst is a branch of Little Creek impounded in the early 1900s to create a drinking water reservoir. The lake has a watershed of nearly 3000 acres, consisting largely of residential neighborhoods and several commercial corridors, as well as the adjacent Norfolk International Airport and Norfolk Botanical Gardens (Figure 1). At the southernmost upstream end of the lake, Denny’s Canal connects Lake Whitehurst to Lake Wright and the Moore’s Bridges Water Treatment Plant, which provides treated drinking water for much of Norfolk, Virginia Beach, and Chesapeake. In addition to the 3000-acre primary watershed of Lake Whitehurst, the Van Wyck Canal northeast of the airport connects the lake to Little Creek Reservoir in Virginia Beach and several other lakes to the south. Although these lakes have a primary outfall of their own, the Van Wyck Canal allows water to be pulled for treatment and distribution when necessary, such as during severe droughts. The primary outlet of Lake Whitehurst is at the northern end of the lake where Shore Drive forms a low dam that separates the lake from the Joint Expeditionary Base Little Creek (JEB Little Creek). A 175-foot spillway with stop log notches for water elevation control routes water into a culvert under Shore Drive and into a 600-foot canal on the northern side, where it ultimately drains under Amphibious Drive inside JEB Little Creek and out into Fisherman’s Cove and the mouth of Little Creek, a direct tributary of the Chesapeake Bay.

The neighborhoods within the Lake Whitehurst watershed are a combination of high-income to low- and moderate-income residences. Commercial corridors along E Little Creek Road and N Military Highway are largely locally owned small businesses with several national franchises mixed across the area. The watershed crosses ten census tracts and social vulnerability classifications range from Low to High Vulnerability. Details of each tract are provided in Table 1. Based on an average score of the ten tracts, the Lake Whitehurst watershed is calculated to have Moderate Social Vulnerability with a score of 0.48. Residents and business owners in the Low and Moderate Vulnerability areas are often generally less able to afford optional flood insurance when not required nor to overcome setbacks from flood events.

**Table 1- Lake Whitehurst Social Vulnerability**

<b>Census Tract</b>	<b>Social Vulnerability Index Classification</b>	<b>Social Vulnerability Index Score</b>
58	High	1.3
66.06	Low	0.0
66.05	Moderate	0.6
400	Low	-0.2
59.01	High	1.2
66.07	Moderate	0.5
59.02	Moderate	0.3
59.03	Moderate	0.3
69	Moderate	0.9
68	Low	-0.1



To ensure safe yield for drinking water supply, water levels in Lake Whitehurst are managed at a conservatively high level, with stop logs placed in the summer to hold more water and removed before fall and winter to allow water levels to lower and refill during the wet season. While the primary function of the lake is as a drinking water reservoir, by necessity due to the large watershed, it also manages a significant amount of stormwater runoff. Over the past decade several large precipitation events, including Hurricane Matthew in 2016, have exceeded the managed level of the lake and resulted flooding higher in the watershed due to added tailwater reducing performance of culverts and outfalls. These areas are outside of FEMA flood zones and these events resulted in unexpected property damage with flooded streets and damaged buildings. In late 2020, the area reported flooded streets which impacts neighborhood and road accessibility. The Larrymore Lawns is a Repetitive Loss Area within the watershed located in the X flood zone that has created challenges for the City. The requested study will help assess the issue to uncover potential solutions for this area. Additionally, at the downstream outfall, water drains out of the culvert under Shore Drive into a narrow canal. During high tide and storm event, water exiting from the lake interacts with tidal waters to cause flooding out of the canal and onto Amphibious Drive. This road is the only internal east-west connection across Little Creek between two sections of JEB Little Creek. Combined with flooding along other sections of Shore Drive at major access gates, transit around the facility can be significantly hampered during flooding events, impacting this critical military facility.

The Norfolk and Virginia Beach Joint Land Use Study (JLUS) was completed in 2019 to assess impacts of existing and future flooding in the two cities as it relates to Department of Defense facilities and community infrastructure that support operational efficiency of Department of Defense (DoD) facilities, including JEB Little Creek. The JLUS ranked an H&H assessment of the Lake Whitehurst outfall and nearby areas of Shore Drive as its 3<sup>rd</sup> highest priority out of 22 identified areas of concern. Additionally, the JLUS ranked an assessment of drainage along Norview Avenue, in an upstream section of the Lake Whitehurst watershed, as its 15<sup>th</sup> highest priority due to flooding issues along this important route between the western half of Norfolk and the airport. The JLUS recommended the two studies be undertaken together. As with potential drainage connectivity problems along Norview Avenue, several other branches of the Lake Whitehurst watershed, such as the segment upstream of Azalea Garden Road, have expected drainage deficiencies that should be analyzed to establish a full understanding of hydrology and hydraulics through the lake.

The combination of impacts to essential transportation corridors, military readiness, socially vulnerable communities, and commercial districts during past severe weather events are predicted to increase in severity and frequency due to climate change. As a result, this makes the Lake Whitehurst watershed an important focus area for Norfolk. The proposed H&H study will provide high quality information to move forward on design and implementation of projects of various scales and timeframes to help the City and its neighbors address these risks.

## **2. Scope of Work**

Norfolk proposes to conduct a hydrology and hydraulics analysis of overall Lake Whitehurst drainage to determine existing and future impacts of tidal and precipitation on the watershed and downstream infrastructure. Overall watershed land cover and hydrology would be assessed to determine a baseline drainage condition for several scenarios of current and predicted future precipitation and tidal events. Alternatives for improvement of current and future conditions would be developed to determine future design and construction priorities.

Existing data from Norfolk's 2018 Green Infrastructure Plan would be utilized for land cover inputs to conduct hydrologic analysis, developing refined runoff rates for each outfall drainage area into the lake. Field verification of the City's existing GIS stormwater asset system would be necessary throughout the watershed to ensure pipe sizes and conditions were well understood. City inspectors would work with contracted surveyors to accomplish this work. Based off hydrologic analysis for different precipitation scenarios, hydraulic analysis would be conducted at key locations in the watershed for the same precipitation events and for concurrent precipitation/tidal events. Existing model information would be sought from the City of Virginia Beach to determine under which precipitation scenarios water from Little Creek Reservoir would most likely significantly impact Lake Whitehurst. The gathered survey and hydrologic data will be developed into a computer model to allow for conditions of various storm's impacts. As highlighted in Figure 1, specific focus areas for hydraulic analysis would include: 1) Outfall open channel from Shore Drive to Amphibious Drive, 2) Overflow weir into Shore Drive culvert, 3) Azalea Garden Road culvert between "Duck Pond" and main section of lake, 4) Narrow ditch behind Larrimore Lawns Elementary School, 5) Azalea Garden Road culvert south of Norview Avenue, 6) Norview Avenue culvert under N Military Highway, 7) Culverts under Norfolk Botanical Gardens entrance causeway, 8) Outfall of Mirror Lake between Norfolk Botanical Gardens entrance and Norfolk International Airport exit loop, and 9) headwater drainage through Denny's Canal. Additional analysis of upper reaches of watershed may be added if likely problem areas are identified through preliminary analysis.

Utilizing H&H information developed through the analysis and other gathered data, the study would conclude with recommendations for improvements at each focus area to address current and future precipitation or tidal flooding impacts. Upgrades may include: 1) enlargement of culverts and weirs, 2) installation of mechanized water control features, 3) channel armoring or widening, 4) road raising, 5) watershed runoff reduction through tree planting, BMPs, and other green infrastructure or LID options, 6) headwater dredging, and 7) shoreline stabilization. Management of a long-impounded freshwater lake for stormwater control is an example of large-scale green infrastructure. Focusing on options to further enhance green assets in the community will be sought through this analysis and a planned late 2021 design for outfall improvements and water quality retrofits within Lake Whitehurst would subsequently occur which will provide additional data to this analysis. Careful consideration and coordination with the Norfolk Department of Utilities will also be required for all developed options to ensure safe yield of drinking water supply and continued efficient operation of the Moore's Bridges Water Treatment Plant are maintained. Lastly, all proposed options must show improvement of current downstream conditions at JEB Little Creek, particularly on and immediately around Amphibious Drive.

### **3. Project Team**

The study would be managed through the Department of Public Works- Division of Environmental Storm Water Management. A local engineering consultant team would be chosen from amongst existing on-call consultants or via a competitive request for proposal (RFP) process. Target criteria for the chosen consultant would include: 1) extensive H&H analysis experience, 2) experience assessing future tidal and precipitation impacts, 3) experience and permissions for working on DoD facilities and with DoD data, and 4) capacity to move rapidly on the requested work. In addition to Norfolk Storm Water staff and consultants, study team members would include Norfolk staff from the Office of Resilience, Department of Utilities, Department of Planning, and Department of Recreation, Parks, and Open Space.



Proposed internal team members are noted in Table 2 below and additional outside team members or interviewees would be sought from relevant departments within the Department of Defense, City of Virginia Beach, Norfolk International Airport, and Norfolk Botanical Gardens.

**Table 2 – City of Norfolk Project Team**

John White, PE	Storm Water Engineer	Public Works
Reynaldo Hernandez, PE	Sr Design/Construction Project Manager	Public Works
Justin Shafer, CFM	Green Infrastructure Project Manager	Public Works
Kyle Spencer	Deputy Resilience Officer	Resilience
Matthew Simons, CFM	Floodplain Administrator	Planning
David Rosenthal, CLM	Reservoir Manager	Utilities
Steven Traylor, CA	City Forester	Recreation, Parks, & Open Space



#### **4. Expected Future Use and Applicability Across the Region and State**

With flood reduction needs and options for improvements identified through the H&H study, the City of Norfolk- Department of Public Works will vet preferred options with the Department of Utilities and Department of Defense. Agreed upon solutions on City property will be moved into design phase through the Norfolk Storm Water Capital Improvement Program (CIP) and solutions on JEB Little Creek will be addressed by DoD staff and processes. Impacts of some aspects during a future construction phase, such as weir and culvert upgrades with downstream channel or road improvements at the outfall, will require both the City and DoD to enter these construction phases simultaneously. Efforts would be made to schedule design and permitting to allow such coordination. Funding for construction would be sought through City and DoD CIP funds, as well as through grant programs such as the Department of Conservation & Recreation Community Flood Preparedness Fund, the Federal Emergency Management Agency Building Resilience Infrastructure and Communities grant, and the DoD Defense Community Infrastructure Program, as well as any future funding options for resilience projects that may become available.

While this study impacts only a portion of Norfolk, it supports an identified regional need for military readiness and community support. Shore Drive (US-60) is a major east west connector between the cities of Virginia Beach and Norfolk and the military facilities in each City. Norview Avenue is the primary route between the regional interstate system and the Norfolk International Airport. With future sea level rise and precipitation conditions, these roads may be impacted and the proposed study will help to assess this potential threat to the community.

Throughout the rest of Hampton Roads and the State of Virginia, the Department of Defense has many waterfront facilities within local communities. It is likely some of these have upstream impoundments similar to Lake Whitehurst where changing outfall conditions are a potential risk over time with climate change impacts. The proposed study may provide best practices that could be used as case studies in other settings of this type, while also providing a framework for coordination between localities and DoD on targeted infrastructure flood resilience problems.

#### **5. Budget Narrative**

The City of Norfolk seeks 50% grant funding to support the proposed hydrology and hydraulics study of the Lake Whitehurst watershed. While the entire City is defined as a low-income community compared to the remainder of the state and the study will focus on corridors and assets critical to the city and region, the Lake Whitehurst watershed contains neighborhoods with a mixture of income levels and does not meet the criteria of low income. The Joint Land Use Study (JLUS) identified two important parts of the watershed for recommended study: the outfall under Shore Drive at JEB Little Creek and the Norview Avenue connection between Interstate-64, Military Highway, and Norfolk International Airport. Excerpts from the JLUS are included as attachments (Attachment A & B). The JLUS estimated a cost of between \$300,000-\$500,000 for each study. To assess these two focus areas and understand other flood prone areas within the watershed, Norfolk estimates a total cost of \$1,000,000 for the H&H study. This cost will fund contractor survey of drainage assets and consultant analysis of hydrology and hydraulics in the watershed, as well as appropriate reports to guide future design decisions. The City proposes to fund their 50% match of \$500,000 through existing approved Capital Improvement Program funds for drainage studies. All match funding will go towards contractor and consultant work, along with the requested \$500,000 in grant funds. Table 3 below summarizes project costs. In addition to the direct funding as



included match, Norfolk also commits to managing all aspects of project management and public outreach using existing qualified staff. Grant funds are not sought for this effort nor match applied. This leaves funds fully available for contracted work. Funds proposed as match are authorized through existing approved budgets and verified on the attached, signed City Manager Transmittal Form outlining grant and match funds for all Norfolk applications to the current Community Flood Preparedness Fund grant cycle. Upon award of grant funds, the City sets up a special revenue account that includes approved match funds and cash funds to cover awarded grant funding until reimbursement is received, allowing Norfolk to move through projects without delays for reimbursement requests.

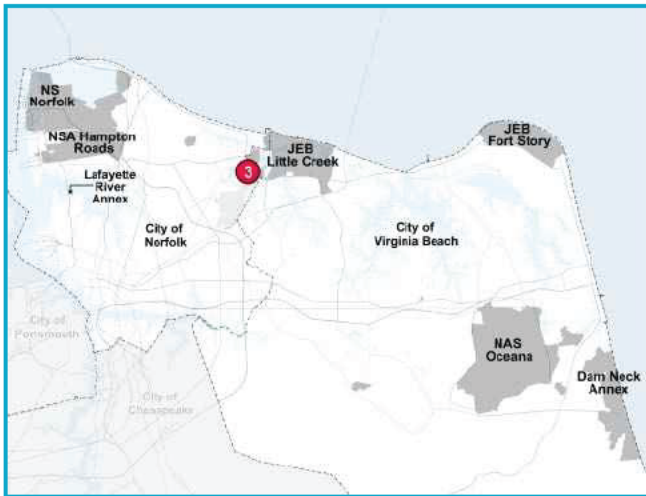
**Table 3- Project Costs**

	Grant Funds	Match Funds
Contracted Consultant and Survey Work	\$500,000	\$500,000

## Attachments

### 3.2.3 JEB Little Creek Gate 1 – Amphibious Drive – Shore Drive Flooding Study

# 3



This Action proposes undertaking a joint technical hydrologic and hydraulic (H&H) modeling study to determine causes of flooding on Shore Drive, near JEB Little Creek Gate 1, and Amphibious Drive, an internal on-base access route.

#### Action Score: 18

Installation Readiness: 9

DoD Personnel Readiness: 4

Co-Benefits: 1

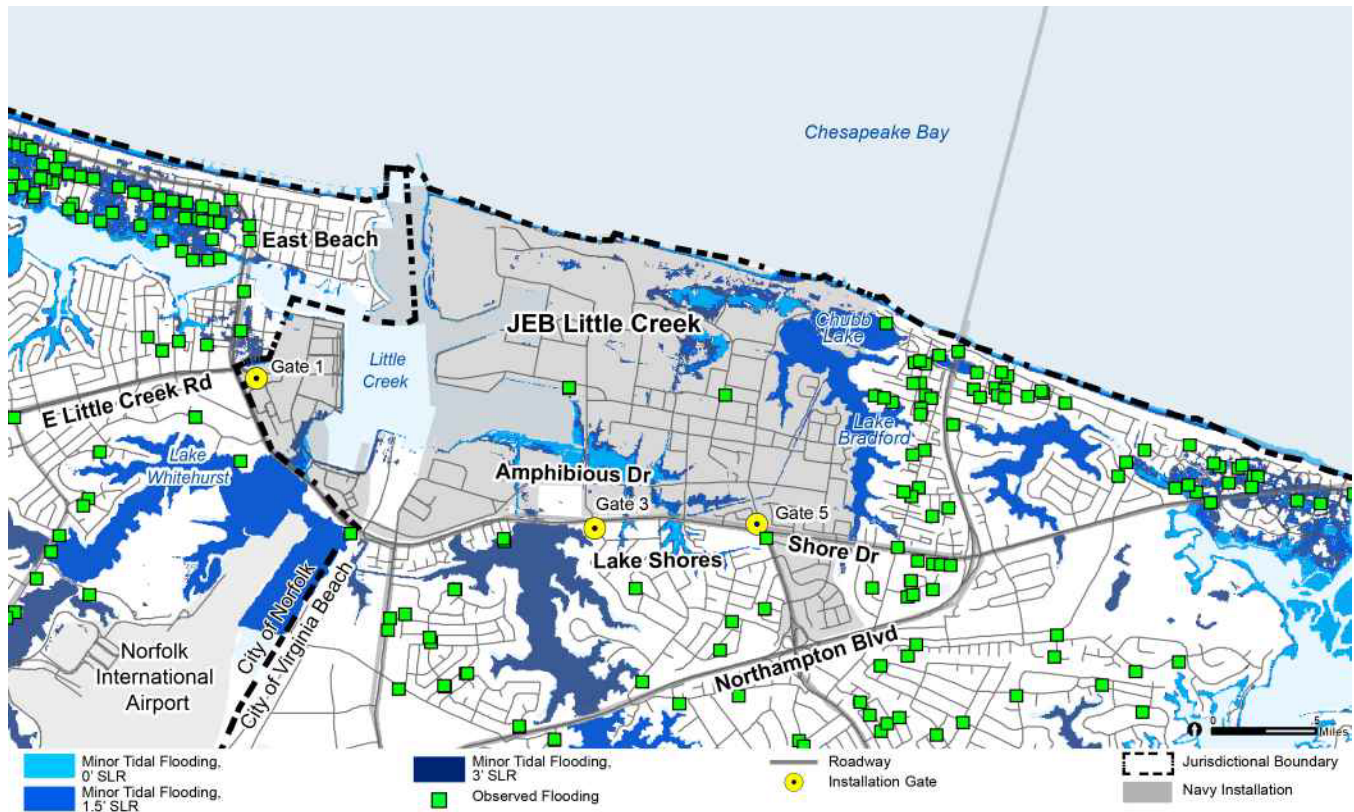
System Performance and Design: 4

Gate 1, located on Shore Drive in Norfolk, is a primary access point to JEB Little Creek. Currently, routine precipitation flooding around Gate 1 frequently causes congestion and delays for military personnel attempting to enter and exit the base. This issue can be compounded when recurrent flooding occurs on Amphibious Drive, the only internal roadway connecting the eastern and western sides of JEB Little Creek that roughly parallels Shore Drive. Shore Drive is a major east-west corridor connecting the cities of Norfolk and Virginia Beach, and is also the most direct route between JEB Little Creek and JEB Fort Story.

#### The Need for Action

During the JLUS process, concerns about flooding near Gate 1 on Shore Drive were raised. **Figure 3-10** shows the observed flooding reports in the vicinity, and the anticipated impact of sea level rise over time. According to base personnel, additional flooding occurs along Amphibious Drive, but is not depicted by the city data shown on the map.

Because recurrent flooding on Amphibious Drive is also an issue, base personnel rely upon Shore Drive to reach other areas of the base when access along Amphibious Drive is impeded. Recurrent roadway flooding can also compromise response times for emergency vehicles trying to access different parts of the base. When Shore Drive near Gate 1 is blocked or congested due to flooding, emergency vehicles may be required to take alternate routes to access the base and surrounding neighborhoods. Likewise,



**FIGURE 3-10: Action 3: Sea Level Rise Scenarios and Historical Flood Complaints**

access to other community assets, like schools and emergency shelters, may be reduced for some neighborhoods in this area, such as East Beach. Therefore, continuous access along both Shore Drive and Amphibious Drive is critical for military readiness.

**Figure 3-11** shows how long-term sea level rise could impact Shore Drive and Amphibious Drive over time.

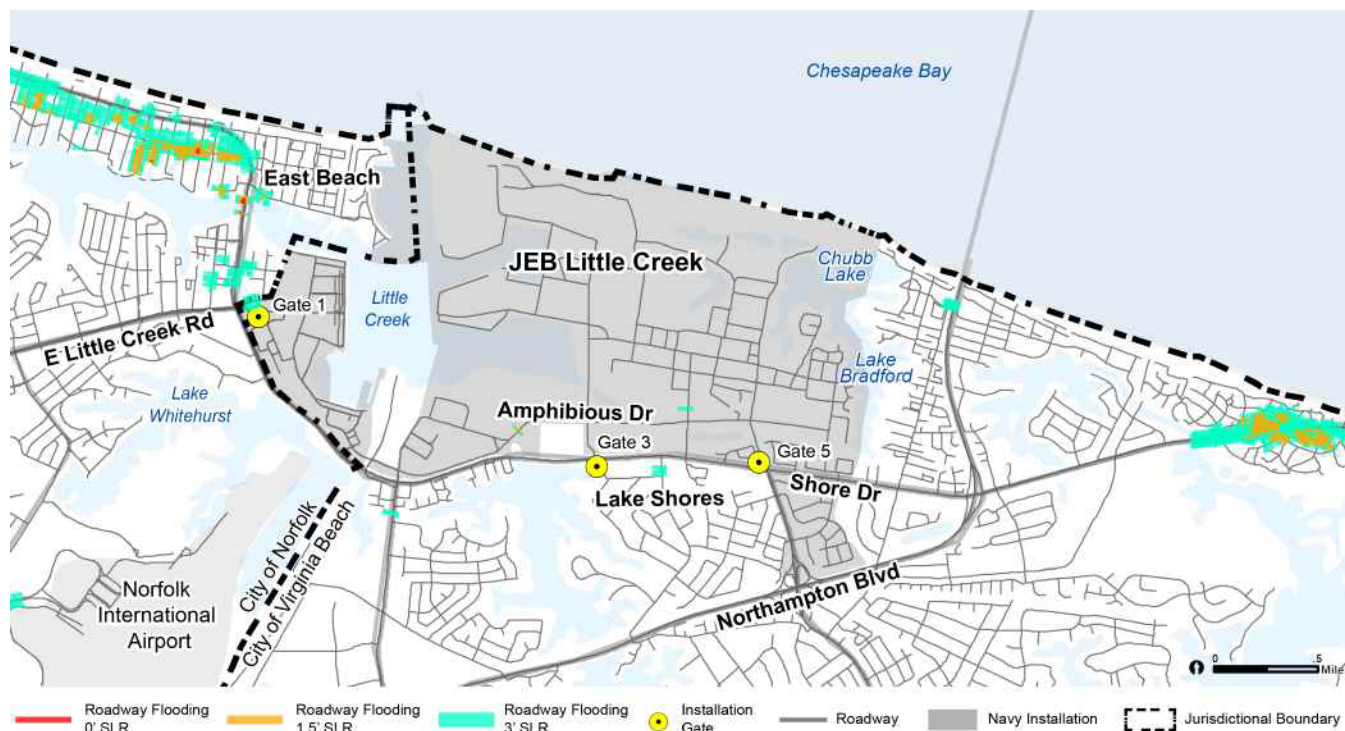
**Figure 3-12** shows how flooding could potentially affect access to nearby neighborhoods during minor tidal flooding plus 3.0 feet of SLR.

Shore Drive also experiences flooding in precipitation events, which could compound tidal flooding impacts in the sea level rise scenarios evaluated. If both Amphibious Drive and segments of Shore Drive local to JEB Little Creek were to flood at the same time, vehicular access from one side of JEB Little Creek to

the other would be cut off for the duration of the flooding event. A detailed H&H model and study would be needed to clearly understand how precipitation events and/or tidal events cause flooding in this area.

**Proposed Action**

This Action recommends an H&H study to identify the processes that cause flooding both on Shore Drive (along the entire length of JEB Little Creek) and along Amphibious Drive within JEB Little Creek. It is recommended that the H&H study be conducted jointly between Virginia Beach, Norfolk, and the Navy to ensure that the best available data on relevant infrastructure, tidal conditions, and precipitation events are included in the study.

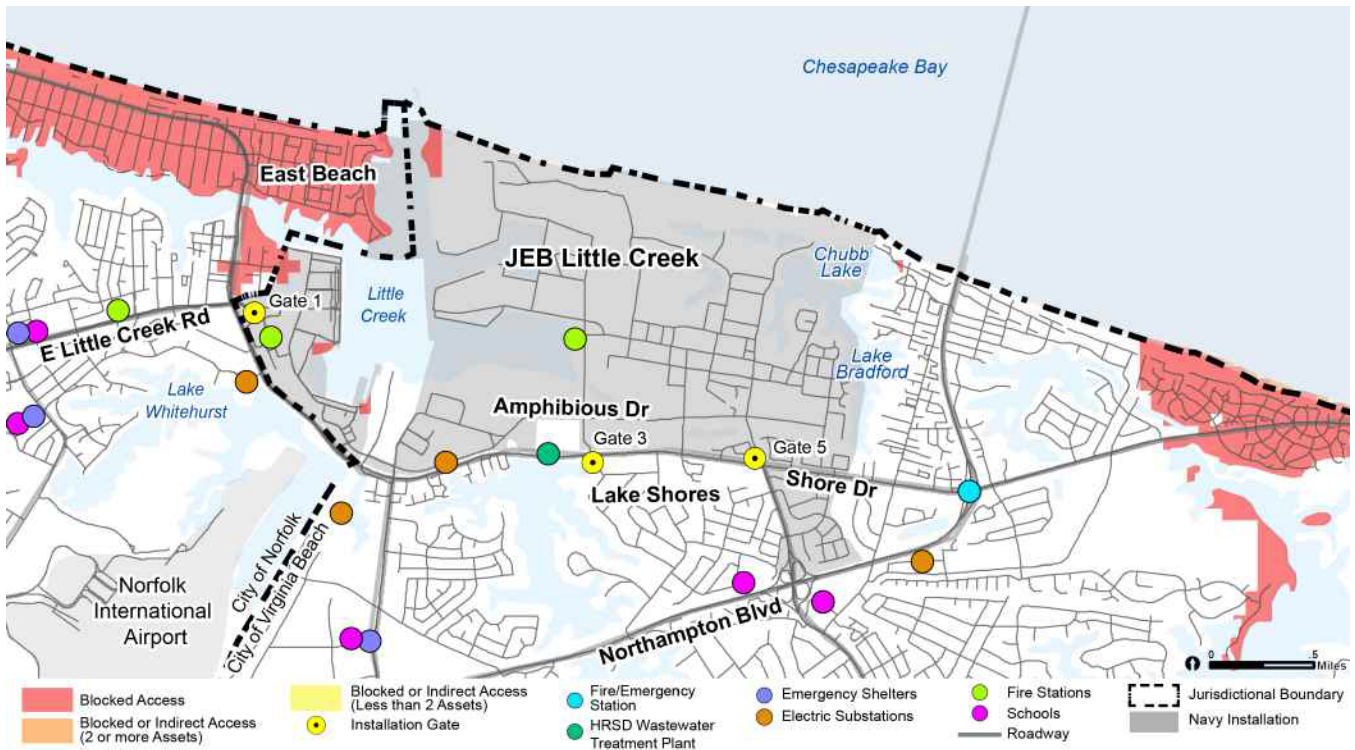


**FIGURE 3-11: Action 3: Transportation Infrastructure Vulnerability**

The H&H study is needed because there is not currently enough information available to determine the direct causes of the roadway flooding at the various reported recurrent flooding locations. The processes currently causing flooding along Amphibious Drive are most likely a combination of tidal flooding from the Chesapeake Bay through Little Creek Inlet, and precipitation flooding related to the capacity of existing inlets, pipes, and culverts to drain stormwater to Little Creek Harbor. The study should include the interactions of Lake Bradford, Chubb Lake, and Lake Whitehurst with Shore Drive, Amphibious Drive, and Little Creek Harbor, as well as the tidal and storm surge effects from the Chesapeake Bay. The long-term impacts from sea level rise could also affect the area around Lake Whitehurst and Shore Drive. The causes of flooding at one point may well be different than the causes of

flooding at other locations within this study area. A joint technical H&H study would help to locate and quantify the causes of flooding at different points along the roadways, which would then facilitate the identification and design of infrastructure and management solutions to address recurrent present flooding and potential future flooding related to sea level rise.

The proposed study should use the recently developed Virginia Beach *Stormwater Master Plan Update* models as a baseline. It is also recommended that the Pretty Lake watershed stormwater models that Norfolk completed in 2011 are updated as part of this effort, to ensure the data reflects more recent development in the area. Additionally, any changes to the drainage basins, the Pretty Lake watershed, and Lake Whitehurst that would occur related to the



**FIGURE 3-12:** Action 3: Access to Community Assets under Minor Tidal Flooding with 3.0 feet of SLR

proposed expansion project at Norfolk International Airport (ORF) should be considered in the proposed study.

The recommended H&H study findings should be utilized to inform the development of design solutions that will effectively manage stormwater and drainage around Gate 1, along this portion of the Shore Drive corridor, and along Amphibious Drive internal to the base. Project design should also account for the potential impacts of additional sea level rise. This Action would require coordination and sharing of data among technical staff from Norfolk, Virginia Beach, the USACE, and the Navy.

This Action is located adjacent to the proposed Pretty Lake Storm Surge Barrier (Action #8), which is recommended as part of the 2018 *City of Norfolk USACE CSRM Feasibility Study*. It is not fully

understood how the proposed surge barrier would or could influence current and future flood concerns around Gate 1 and along Amphibious Drive. The Navy has expressed concern about the Pretty Lake Storm Surge Barrier as it relates to navigational needs, and has requested that the USACE pursue sediment transport modeling during future phases of the project. A more complete description of the project and the Navy’s full list of concerns is included in Action #8. Therefore, as the USACE Pretty Lake Storm Surge Barrier project progresses, and Action #3 is pursued, it is recommended that the project partners work together to incorporate the additional hydrologic, hydraulic, sediment, and coastal modeling calculations and design efforts of both projects, to provide a comprehensive and appropriate solution.

### Action Benefits

- Could result in strategies to significantly reduce both current and future flood risk along portions of Shore Drive, a strategic corridor serving both the JEB Little Creek, and Amphibious Drive, a critical internal base access road.
- Could result in stormwater management and flood mitigation strategies to reduce roadway flooding and improve access to both JEB Little Creek installations for personnel residing in both Norfolk and Virginia Beach.
- Could result in strategies that improve access to community facilities that both DoD personnel and civilians rely upon, such as fire and emergency response stations and elementary schools/ emergency shelters, as well as improve the ability of emergency vehicles to access areas internal to the installation.
- Could result in strategies that reduce current flood risk to the surrounding neighborhoods and potentially mitigate some of the impacts of increased sea level rise in the future.
- Could present opportunities for incorporating green infrastructure elements into the ultimate stormwater management/flood risk mitigation design solution which could potentially provide greater ecological benefits.

### Implementation Steps

1. Create a working partnership between Norfolk, Virginia Beach, the Navy, and the USACE to coordinate and oversee the study.
2. Determine the scope for work for the study and pursue funding.
3. Update the existing watershed models developed for the Pretty Lake watershed (2011), and utilize the Virginia Beach *Stormwater Master Plan Update* (ongoing) and all other existing studies,

watershed and drainage basin models, and other planning and/or design work done for this area as a baseline.

4. As an input to the H&H study, undertake a field survey of known areas where flooding has historically occurred on Amphibious Drive. The survey should include a detailed survey of the stormwater system draining Amphibious Drive and Shore Drive in this vicinity.
5. Jointly determine preferred design solutions to address flooding based on study outcomes.
6. Identify phasing and jointly pursue funding for implementation of the preferred design solution.
7. Define applicable operating and maintenance parameters as part of any solution.

**Lead:** Norfolk, Virginia Beach

**Partners:** U.S. Navy, USACE, Norfolk International Airport

### Funding and Approval Status

Although studies and models exist for this area, no official study or planning work has been initiated for this Action. Norfolk and Virginia Beach should determine if ongoing studies can be updated or modified to address this Action. Funding sources for this specific study have not been identified.

### Cost Range

- \$ (\$100 – \$500K)
- Defined cost range attempts to reflect the potential cost of a more detailed study of this Action

### Potential Funding Sources

- VA DCR Dam Safety and Floodplain Management Grants
- VA DEQ Stormwater Local Assistance Fund

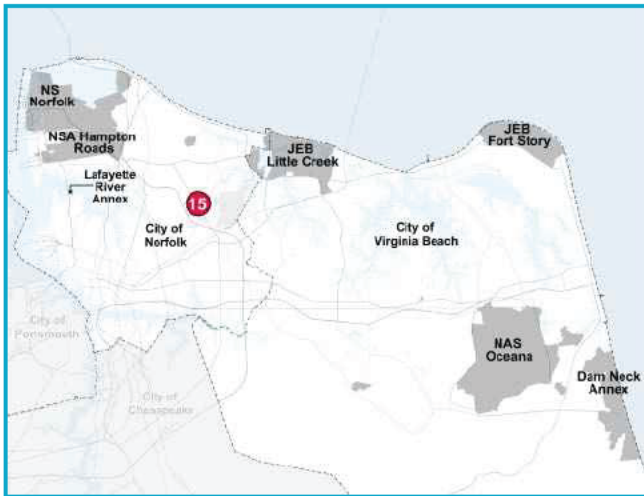


## **FINAL** TARGETED AREA RECOMMENDATIONS

- VA DEQ Stormwater Loans
- U.S. DoD Community Infrastructure Program
- U.S. DoD OEA Implementation Grants
- U.S. DOT National Infrastructure Investments-BUILD Transportation Planning Grants
- FHWA Defense Access Road Program

## 3.2.15 Norview Avenue Drainage Study

# 15



This Action recommends undertaking a study of the drainage patterns along Norview Avenue to understand the cause(s) of the recurrent flooding and to identify mitigation strategies.

**Action Score: 9**

Installation Readiness: **0**

DoD Personnel Readiness: **4**

Co-Benefits: **1**

System Performance and Design: **4**

Norview Avenue is the primary access route for Norfolk International Airport, the major airport serving the entire southside Hampton Roads region. The airport is critical to the economy in Hampton Roads and serves as a major regional hub for both military and civilian passengers, as well as for cargo (freight and mail). According to its 2008 Master Plan, ORF serves nearly four million arriving/departing passengers and accommodates more than 68 million pounds of air cargo per year.<sup>1</sup> Access to the airport is important for military personnel and their families.

### The Need for Action

During the stakeholder interview process, concerns were raised about recurrent flooding along Norview Avenue, particularly near Norfolk Fire and Rescue Station 14. However, the cause of the flooding (undersized stormwater infrastructure, drainage patterns particular to that area, etc.) is uncertain. This section of Norview Avenue is adjacent to a small creek that feeds into Lake Whitehurst, but that has not been determined to be the cause of the flooding.

**Figure 3-38** shows the location of this action.

Flooding along Norview Avenue also impacts access to community facilities for civilian and DoD residents in the surrounding neighborhoods. These impacts could worsen with additional sea level rise, as shown in **Figure 3-39**, in future tidal flooding scenarios that could overtop the lake's weir adjacent to Little Creek Harbor.

<sup>1</sup> *Master Plan Update: Norfolk International Airport*. Norfolk International Airport, 2008. Accessed May 6, 2019. <http://www.orfmasterplan.com/resources/documents/ORFMasterPlanUpdate2008-Executive%20Summary.pdf>.

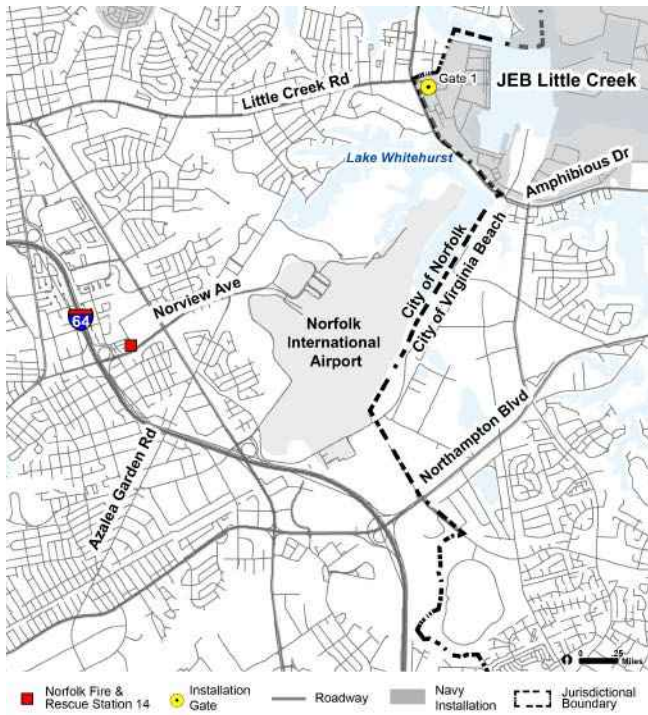


FIGURE 3-38: Action 15: Approximate Action Location

**Proposed Action**

This Action recommends undertaking a study of the drainage patterns along Norview Avenue to understand the cause(s) of the recurrent flooding. A better understanding of the causes of flooding in this area will help Norfolk more effectively manage stormwater drainage along the corridor. Future project design should also account for the potential impacts of additional sea level rise and management of water levels in Lake Whitehurst.

It is recommended that this project be considered in conjunction with Action #3, JEB Little Creek Gate 1 – Amphibious Drive – Shore Drive Flooding Study. This Action will require modeling of the same watershed (that leads into Lake Whitehurst), so pursuing them together could maximize efficiencies (and potential cost savings) for both projects.

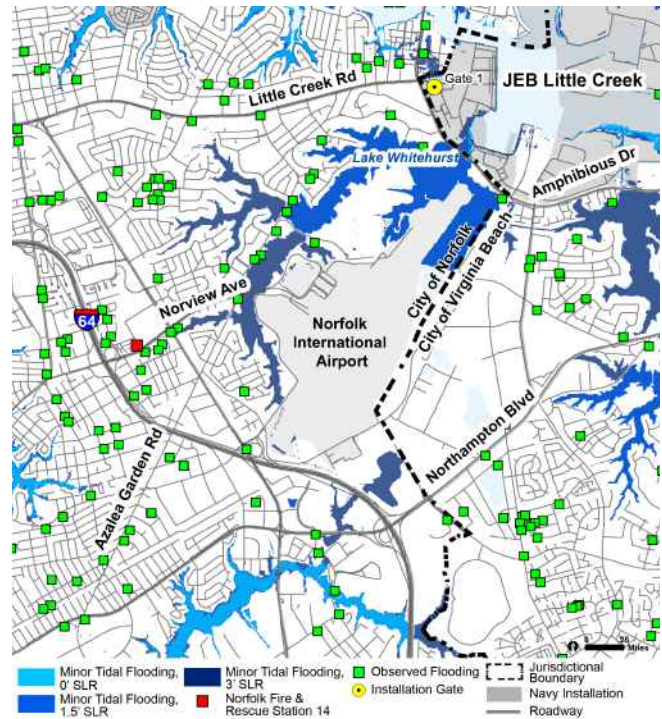


FIGURE 3-39: Action 15: Sea Level Rise Scenarios and Historical Flood Complaints

**Action Benefits**

- Could identify opportunities to improve access to the region’s primary airport.
- Could identify opportunities to reduce current flood risk to the surrounding community, as well as protecting it from some of the impacts of increased sea level rise in the future.
- Could identify opportunities to ensure access to community assets along Norview Avenue that both DoD personnel and civilians rely upon, including a fire station and several elementary schools that also serve as emergency shelters.
- Could identify opportunities for incorporating green infrastructure elements.

- Could identify opportunities for increased ecological benefits. Proposed action considers future conditions, including additional sea level rise.

### Implementation Steps

1. Create a working partnership between Norfolk and ORF to coordinate and oversee the study. If this action is pursued with Action #3, the partnership should also include the Navy and Virginia Beach.
2. Pursue funding for study.
3. Utilize all existing studies, watershed models, and other planning and/or design work done for this area as a baseline for this study.
4. Once causes of flooding are determined, jointly determine preferred design solutions to address flooding.
5. Identify phasing and jointly pursue funding for project implementation.
6. Define applicable operating and maintenance parameters as part of any solution.

**Lead:** Norfolk

**Partners:** Norfolk International Airport

### Funding and Approval Status

- Funding sources for study are currently undetermined.
- No official study or planning work has been initiated for this Action.

### Cost Range

- \$ (\$100 – \$500K)
- Defined cost range attempts to reflect the potential cost of a more detailed study of this Action

### Potential Funding Sources

- Norfolk CIP Funding
- VA DCR Dam Safety and Floodplain Management Grants
- VA DEQ Stormwater Local Assistance Fund
- VA DEQ Stormwater Loans
- FEMA National Public Infrastructure Pre-Disaster Hazard Mitigation (Section 1234)
- FEMA Flood Mitigation Assistance program (Section 1366)
- USACE Section 205: Flood Risk Management Program
- 2018 USACE Supplemental Appropriation



Appendix D  
Required Attachments









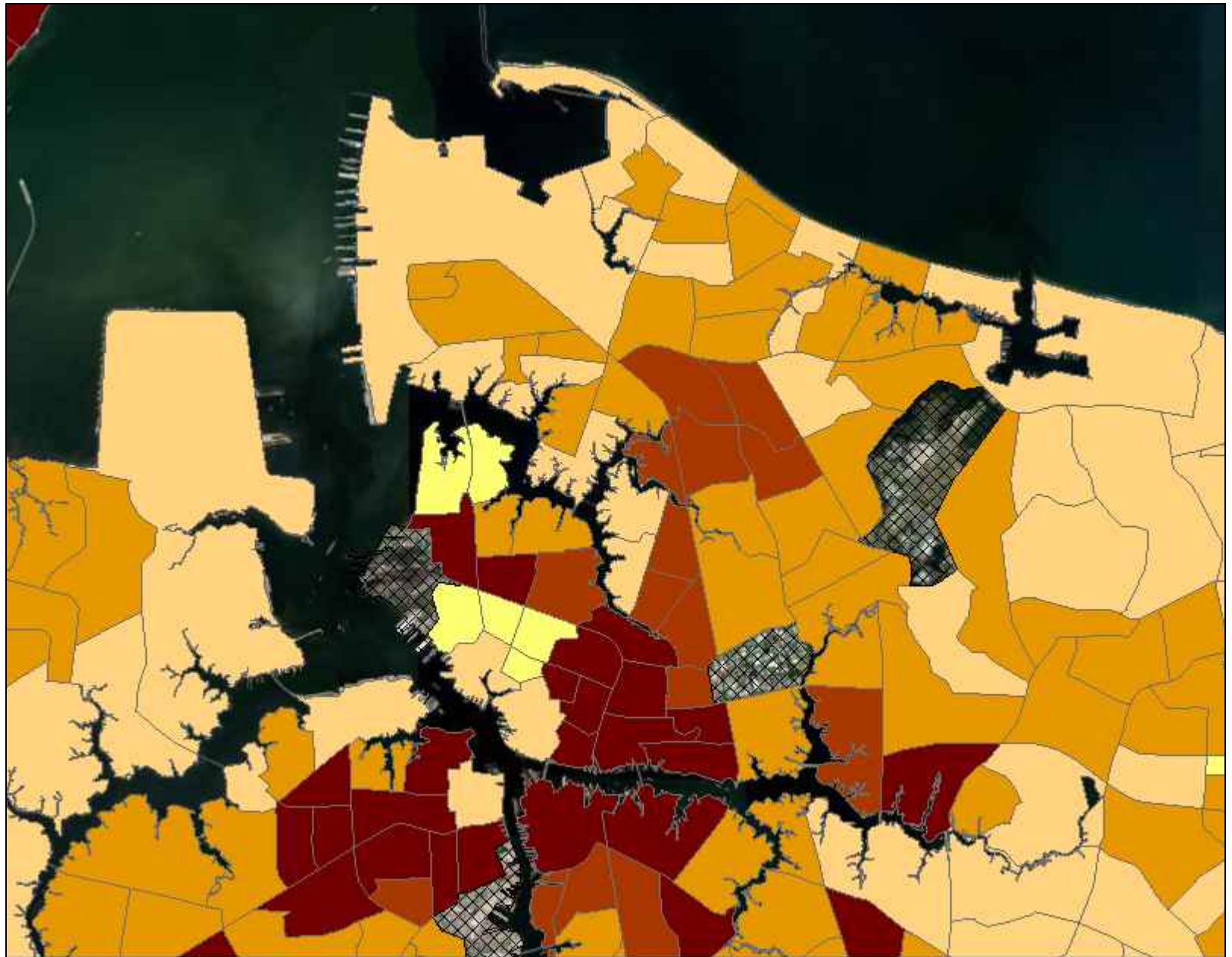
Scope of Work Narrative	
Supporting Documentation	Included
Detailed map of the project area(s) (Projects/Studies)	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
FIRMette of the project area(s) (Projects/Studies)	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
Historic flood damage data and/or images (Projects/Studies)	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
A link to or a copy of the current floodplain ordinance	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
Non-Fund financed maintenance and management plan for project extending a minimum of 5 years from project close	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A
A link to or a copy of the current hazard mitigation plan	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
A link to or a copy of the current comprehensive plan	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
Social vulnerability index score(s) for the project area from <a href="#">ADAPT VA's Virginia Vulnerability Viewer</a>	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
If applicant is not a town, city, or county, letters of support from affected communities	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A
Completed Scoring Criteria Sheet in Appendix B, C, or D	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
Budget Narrative	
Supporting Documentation	Included
Authorization to request funding from the Fund from governing body or chief executive of the local government	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
Signed pledge agreement from each contributing organization	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A

**Figure 1: Lake Whitehurst Watershed**



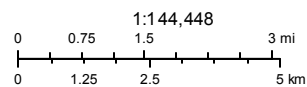
**Social Vulnerability Index Score**

-  Very Low Social Vulnerability
-  Low Social Vulnerability
-  Moderate Social Vulnerability
-  High Social Vulnerability
-  Very High Social Vulnerability
-  Not included in the analysis



August 3, 2021

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



Created from the Virginia Vulnerability Viewer



**ADAPTVA**



# Norfolk Social Vulnerability Index Score

Census Tract Name	Social Vulnerability Index Score
Census Tract 25, Norfolk city, Virginia	1.69
Census Tract 27, Norfolk city, Virginia	1.71
Census Tract 29, Norfolk city, Virginia	1.37
Census Tract 31, Norfolk city, Virginia	1.40
Census Tract 34, Norfolk city, Virginia	2.33
Census Tract 35.01, Norfolk city, Virginia	2.25
Census Tract 41, Norfolk city, Virginia	3.62
Census Tract 42, Norfolk city, Virginia	4.47
Census Tract 43, Norfolk city, Virginia	2.28
Census Tract 44, Norfolk city, Virginia	1.37
Census Tract 45, Norfolk city, Virginia	1.83
Census Tract 46, Norfolk city, Virginia	2.34
Census Tract 47, Norfolk city, Virginia	2.84
Census Tract 48, Norfolk city, Virginia	3.44
Census Tract 50, Norfolk city, Virginia	1.66
Census Tract 51, Norfolk city, Virginia	2.44
Census Tract 57.01, Norfolk city, Virginia	1.20
Census Tract 59.01, Norfolk city, Virginia	1.22
Census Tract 69.02, Norfolk city, Virginia	1.63
Census Tract 20, Norfolk city, Virginia	1.48
Census Tract 26, Norfolk city, Virginia	0.15
Census Tract 28, Norfolk city, Virginia	0.50
Census Tract 32, Norfolk city, Virginia	1.08
Census Tract 33, Norfolk city, Virginia	1.38
Census Tract 57.02, Norfolk city, Virginia	1.17
Census Tract 58, Norfolk city, Virginia	1.33
Census Tract 62, Norfolk city, Virginia	0.90
Census Tract 64, Norfolk city, Virginia	0.89
Census Tract 70.02, Norfolk city, Virginia	1.28
Census Tract 9.01, Norfolk city, Virginia	0.26
Census Tract 1, Norfolk city, Virginia	-0.42
Census Tract 11, Norfolk city, Virginia	0.00
Census Tract 12, Norfolk city, Virginia	-0.48
Census Tract 13, Norfolk city, Virginia	0.29
Census Tract 14, Norfolk city, Virginia	0.75
Census Tract 15, Norfolk city, Virginia	-0.51
Census Tract 16, Norfolk city, Virginia	0.55
Census Tract 17, Norfolk city, Virginia	0.28
Census Tract 2.01, Norfolk city, Virginia	0.01
Census Tract 2.02, Norfolk city, Virginia	0.38

Census Tract 21, Norfolk city, Virginia	-0.27
Census Tract 22, Norfolk city, Virginia	-0.93
Census Tract 23, Norfolk city, Virginia	-1.28
Census Tract 24, Norfolk city, Virginia	-1.16
Census Tract 3, Norfolk city, Virginia	-0.21
Census Tract 30, Norfolk city, Virginia	-0.08
Census Tract 36, Norfolk city, Virginia	-1.10
Census Tract 37, Norfolk city, Virginia	-1.29
Census Tract 38, Norfolk city, Virginia	-1.31
Census Tract 4, Norfolk city, Virginia	-0.08
Census Tract 40.01, Norfolk city, Virginia	-1.96
Census Tract 40.02, Norfolk city, Virginia	-0.95
Census Tract 49, Norfolk city, Virginia	-0.44
Census Tract 5, Norfolk city, Virginia	0.15
Census Tract 55, Norfolk city, Virginia	0.11
Census Tract 56.01, Norfolk city, Virginia	0.24
Census Tract 56.02, Norfolk city, Virginia	0.23
Census Tract 59.02, Norfolk city, Virginia	0.26
Census Tract 59.03, Norfolk city, Virginia	0.26
Census Tract 6, Norfolk city, Virginia	0.12
Census Tract 60, Norfolk city, Virginia	0.58
Census Tract 61, Norfolk city, Virginia	0.60
Census Tract 65.01, Norfolk city, Virginia	0.43
Census Tract 65.02, Norfolk city, Virginia	-0.56
Census Tract 66.01, Norfolk city, Virginia	-0.18
Census Tract 66.02, Norfolk city, Virginia	0.33
Census Tract 66.03, Norfolk city, Virginia	0.10
Census Tract 66.04, Norfolk city, Virginia	0.69
Census Tract 66.05, Norfolk city, Virginia	0.64
Census Tract 66.06, Norfolk city, Virginia	-0.03
Census Tract 66.07, Norfolk city, Virginia	0.54
Census Tract 68, Norfolk city, Virginia	-0.07
Census Tract 69.01, Norfolk city, Virginia	0.57
Census Tract 7, Norfolk city, Virginia	-0.17
Census Tract 70.01, Norfolk city, Virginia	0.01
Census Tract 8, Norfolk city, Virginia	-0.31
Census Tract 9.02, Norfolk city, Virginia	-0.32
<b>Norfolk Average Social Vulnerability Index Score</b>	<b>0.59</b>

Matthew J. Strickler  
Secretary of Natural and Historic  
Resources and Chief Resilience Officer

Clyde E. Cristman  
Director



**COMMONWEALTH of VIRGINIA**  
DEPARTMENT OF CONSERVATION AND RECREATION

Rochelle Altholz  
Deputy Director of  
Administration and Finance

Nathan Burrell  
Deputy Director of  
Government and Community Relations

Darryl M. Glover  
Deputy Director of  
Dam Safety & Floodplain  
Management and Soil & Water  
Conservation

Thomas L. Smith  
Deputy Director of  
Operations

August 9, 2021

Matt Simons, AICP CZA CFM  
Principal Planner and Floodplain Administrator  
Department of Planning and Community Development  
810 Union St, Suite 508  
Norfolk, VA 23510

RE: City of Norfolk Resilience Plan Second Submission - CFPF

Dear Mr. Simons:

Thank you for providing an overview of your Resilience Plan, and informing DCR of the various plans that the City of Norfolk will be utilizing to fulfill the Resilience Plan submission requirements. After careful review and consideration, the Virginia Department of Conservation and Recreation has deemed the Plan complete and meets all the criteria outlined in the June 2021 Community Flood Preparedness Grant Manual. This approval will remain in effect for a period of three years, ending on August 8, 2024.

The following elements were evaluated as part of this review:

**1. Element 1: It is project-based with projects focused on flood control and resilience. DCR RESPONSE**

- a. Project-based: Nine watersheds—each with a defined geographic area, analysis of community social and environmental characteristics, types of flooding, and a tailored flood resilience strategy divided into 15 project areas, each with discrete projects identified.
- b. Projects focused on flood control and resilience included city-wide and various coastal projects and a specific project in Chesterfield Heights.

**2. Element 2: It incorporates nature-based infrastructure to the maximum extent possible. DCR RESPONSE**

- a. Natural and nature-based flood management measures are identified for use in projects throughout the city in the *Final Integrated City of Norfolk Coastal Storm Risk Management Feasibility Study / Environmental Impact Statement*, the *Combined Coastal and Precipitation Flooding Master Plan*, the *Hampton Roads Mitigation Plan* and *A Green Infrastructure Plan for Norfolk: Building Resilient Communities*.

600 East Main Street, 24<sup>th</sup> Floor | Richmond, Virginia 23219 | 804-786-6124

*State Parks • Soil and Water Conservation • Outdoor Recreation Planning  
Natural Heritage • Dam Safety and Floodplain Management • Land Conservation*

**3. Element 3: It includes considerations of all parts of a locality regardless of socioeconomics or race. DCR RESPONSE**

- a. All parts of a locality: Locality divided into 9 watersheds, with 90 planning districts covering the entirety of the jurisdictional boundary.
- b. Social vulnerability: Social implications of flood hazards and analysis of populations at-risk documented in the USACE *Final Integrated City of Norfolk Coastal Storm Risk Management Feasibility Study / Environmental Impact Statement*, the *Combined Coastal and Precipitation Flooding Master Plan* and in *PlaNorfolk 2030*.
- c. Demographic Analysis: Demographic Analysis conducted by USACE, utilizing U.S. Census Bureau, Bureau of Labor and Statistics, Virginia Employment Commission, and other information from local planning agencies, and incorporated into the *Final Integrated City of Norfolk Coastal Storm Risk Management Feasibility Study / Environmental Impact Statement*.

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

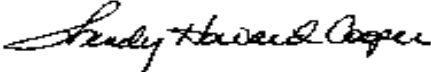
- a. Coordination with other projects, plans, and activities: Contains the planning processes and frameworks which outline local and regional plans used by the City and address resilience; and how they have been integrated for flood adaptation planning.
- b. Clearly articulated timeline or phasing for plan implementation: 5 year timeline presented in the *Combined Coastal and Precipitation Flooding Master Plan*. Phased time-line for completion found within *PlaNorfolk 2030*, *Vision2100*, and *A Green Infrastructure Plan for Norfolk: Building Resilient Communities*. Phased approach for project implementation contained within the *Fugro Atlantic Norfolk Preliminary City-wide Coastal Flooding Mitigation Concept Evaluation and Master Plan Development*. Program phases clearly articulated and an impact statement completed in USACE *Final Integrated City of Norfolk Coastal Storm Risk Management Feasibility Study / Environmental Impact Statement*.

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

- a. Technically backed water-resources analysis, sea level rise projections, storm surge, and climate change incorporated into the strategic approach presented in the *Hampton Roads Hazard Mitigation Plan*, the *Final Integrated City of Norfolk Coastal Storm Risk Management Feasibility Study / Environmental Impact Statement*.

VA DCR looks forward to working with you as you work to make the City of Norfolk a more resilient community. If you have questions or need additional assistance, please contact us at [cfpf@dcr.virginia.gov](mailto:cfpf@dcr.virginia.gov). Again, thank you for your interest in the Community Flood Preparedness Fund.

Sincerely,

A handwritten signature in black ink, appearing to read "Wendy Howard Cooper". The signature is written in a cursive style with a large initial 'W'.

Wendy Howard Cooper, Director  
Dam Safety and Floodplain Management

cc: Darryl Glover, DCR

## Resilience Planning Overview for the City of Norfolk

In response to the resilience planning requirements of the **Community Flood Preparedness Fund** (“the CFPF” or “Fund”) outlined within the [2021 CFPF Grant Manual](#) (Appendix G: Elements of Resilience Plans), the City of Norfolk (“the City”) has prepared the following Resilience Planning Overview of formal and relevant plans utilized for resilience planning efforts by the City to prioritize potential projects and to assist the City in its efforts to secure funding for such critical resilience plans, studies and projects.

The **Elements of Resilience Plans** taken from Appendix G of the 2021 CFPF Grant Manual, from which communities are expected to highlight the stated resilience planning contents as they related to CFPF grant applications, are as follows:

1. *It is project-based with projects focused on flood control and resilience.*
2. *It incorporates nature-based infrastructure to the maximum extent possible.*
3. *It includes considerations of all parts of a locality regardless of socioeconomics or race.*
4. *It includes coordination with other local and inter-jurisdictional projects, plans, and activities and has a clearly articulated timeline or phasing for plan implementation.*
5. *Is based on the best available science, and incorporates climate change, sea level rise, storm surge (where appropriate), and current flood maps.*

Norfolk’s resilience planning elements are not contained within an adopted “stand alone” plan. However, Norfolk’s utilizes various plans within a resilience repertoire, which altogether serve multiple needs for various audiences; from technical to public-facing to operational. This Resilience Planning Overview will expressly identify to the grant reviewer, and to the public, how various resilience planning documents of the City of Norfolk satisfy all the CFPF Resilience Plan elements.

The following plans for the City of Norfolk will contribute to this Resilience Planning Overview:

- [plaNorfolk2030](#) (2013, as amended)
- [Vision2100](#) (2016)
- [Hampton Roads Hazard Mitigation Plan](#) (2017)
- [Combined Coastal and Precipitation Flooding Master Plan](#) (2017)
  - Appendix A: [Norfolk Preliminary City-wide Coastal Flooding Mitigation Concept Evaluation and Master Plan Development](#) (Fugro Atlantic)
  - Appendix B: [City-wide Drainage and Watershed Master Plan](#) (Timmons Group)
- [A Green Infrastructure Plan for Norfolk](#) (2018, as amended)
- [USACE Coastal Storm Risk Management \(CSR\) Feasibility Study and Environmental Impact Statement](#) (2019)
- [Zoning Ordinance of the City of Norfolk](#) (2018, as amended)
- [Development of an Urban Resilience Analysis Framework with Application to Norfolk, VA](#) (2016)

Responses are provided below in red based on the various Norfolk plans for the following example resilience elements outlined in Appendix G of the 2021 CFPF Grant Manual:

- ***Equity based strategic policies for local government-wide flood protection and prevention.***  
The [Hampton Roads Hazard Mitigation Plan](#) recommends the highest priority of protection to be reserved towards protection projects for severe repetitive loss areas (Mitigation Actions 8 &

11) in Norfolk. Research in Norfolk has shown that these areas are often places where the most vulnerable residents are housed.

Additionally, Mitigation Action 12 recommends Norfolk begin risk/hazard mitigation efforts equitably by first implementing a major flood control project within the historically black community of Chesterfield Heights; implementation of a \$112M HUD project awarded through the National Disaster Resilience Competition (construction currently underway).

- **Proposed projects that enables communities to adapt to and thrive through natural or human hazards.**

The [Combined Coastal and Precipitation Flooding Master Plan](#) (Norfolk's "Flooding Master Plan") is based on a major multi-year study effort supported by technical analyses and recommendations from Fugro Atlantic within the [Norfolk Preliminary City-wide Coastal Flooding Mitigation Concept Evaluation and Master Plan Development](#) (the "Fugro report"). The Flooding Master Plan is also supported by a thorough analysis and priority ranking technical guide of the City's drainage conveyance system, [City-wide Drainage and Watershed Master Plan](#) by Timmons Group.

Together, with this technical supporting documentation, the [Flooding Master Plan](#) provides the framework for Norfolk to intelligently review and prioritize flood protection projects to enable Norfolk to adapt and thrive to current and future flood threats.

- **Documentation of existing social, economic, natural, and other conditions present in the local government.**

Sandia National Laboratories provided an analysis framework ([Development of an Urban Resilience Analysis Framework with Application to Norfolk, VA](#)) for conceptualizing the resilience needs for Norfolk, including vulnerability assessments for critical infrastructure with the context of local economic and logistical impacts. The findings of which have been incorporated into other resiliency plans such as the USACE Coastal Storm Risk Management Study.

The [USACE Coastal Storm Risk Management \(CSRM\) Feasibility Study and Environmental Impact Statement](#) presents a robust analysis of the best recommendations for City-wide flood protection measures for the City of Norfolk. This report includes 10% engineered designs for the various flood protection measures recommended throughout the entire community, and a preliminary Environmental Impact Statement is included outlining the existing social, economic, natural conditions, vulnerabilities and stressors within the natural and social environment, as well as proposed impacts. See the various CSRM appendices for these detailed conditions and impact reports.

- **Review of the vulnerabilities and stressors, both natural and social in the local government.**  
See CSRM comment above. Additional overview of the vulnerabilities and stressors can be found in the [Hampton Roads Hazard Mitigation Plan](#).

- Forward-looking goals, actionable strategies, and priorities through as seen through an equity-based lens.**

Norfolk remains committed to presenting all action plans through an equity-based lens, as found within the actionable strategies of [A Green Infrastructure Plan for Norfolk](#) and the [Hampton Roads Hazard Mitigation Plan](#). Both plans are tactical, and recommendations are based on a 5-year forward-looking outlay. Recommendations of the Fugro report are based on a 50-year outlay, and recommendations of [Vision2100](#) geared towards the year 2100.
- Strategies that guides growth and development away from high-risk locations that may include strategies in comprehensive plans or other land use plans or ordinances or other studies, plans or strategies adopted by a local government.**

[Vision2100](#) is serves a land use guide for the City. The plan divides Norfolk up into four main areas by which the City will focus new investments and make necessary steps to prepare for a changing environment:

  - ✓ Purple: Low Flood Risk / Low Degree of Civic Assets: Establishing Neighborhoods of the Future
  - ✓ Green: Low Flood Risk / High Degree of Civic Assets: Designing New Urban Centers
  - ✓ Yellow: High Flood Risk / Low Degree of Civic Assets: Adapting to Rising Waters
  - ✓ Red: High Flood Risk / High Degree of Civic Assets: Enhancing Economic Engines (protect!)
- Proposed acquisition of land or conservation easements or identification of areas suitable for conservation particularly areas identified as having high flood attenuation benefit by *ConserveVirginia* or similar data driven tools.**

[Vision2100](#) provides the framework for selecting the areas suitable for conservation easements. The [Norfolk Zoning Ordinance](#) provides the mechanism for purchasing land conservation easement credits from the [Coastal Resilience Overlay](#) through transferring [Resilient Quotient points](#) to the [Upland Resilience Overlay](#) (requires extinguishment of a density unit – developable dwelling unit). The conservation easement, while recorded on the deed and kept on file with the Planning Department, can be held by the property owner, the Zoning Ordinance also permits it to be placed in a land trust.
- Identification of areas suitable for property buyouts in frequently flooded areas.**

See [Vision2100](#) “Yellow” areas (High Flood Risk / Low Degree of Civic Assets: Adapting to Rising Waters) and Coastal Resilient Overlay areas on the [Norfolk Zoning Map](#).
- Identification of critical facilities and their vulnerability throughout the local government such as water and sewer or other types identified as “lifelines” by FEMA.**

A list of all critical facilities is contained within the *Norfolk Emergency Operations Manual (2020)*. See Mitigation Action 5 from [Hampton Roads Hazard Mitigation Plan](#): “Purchase and install generators or other continuous power sources for critical facilities and infrastructure. This action may include, but is not limited to pump stations, EOC (Emergency Operations Center), shelters, underpasses and important traffic signals.” The critical facilities list is available upon request.



- **Identified ecosystems/wetlands/floodplains suitable for permanent protection.**  
 See [A Green Infrastructure Plan for Norfolk](#), this includes an *Action Plan Appendix for Threatened and Endangered Species* within critical floodplain habitats, as well as a detailed ecological inventory with recommendations for floodplain protection measures within an connected open space corridor network.
- **Identified incentives for restoring riparian and wetland vegetation.**

  - The City's Public Works Division of Stormwater Management offers the [Stormwater Fee Reduction Program](#) for homeowners and businesses who opt to implement water quality improvements on their private property including riparian buffer and shoreline management improvement.
  - [Environmental Conservation Consulting](#) – Norfolk annually funds a contract to coordinate with residential property owners for implementation of water quality improvements on their private property including riparian buffer and shoreline management improvement through a cost-share program. Property owners get a percentage of the project paid through the contractor via the Environmental Conservation Consulting services contract.
  - Norfolk regularly applies for grants to partner with community organizations for implementation of green infrastructure of public lands – projects are reviewed by the **Watershed Management Task Force** to ensure that projects are furthering the goals and objectives of the adopted [Green Infrastructure Plan for Norfolk](#).
- **A framework for implementation, capacity building and community engagement.**  
 The **Watershed Management Task Force** and the recently created Program for Public Information committee are two groups made up of joint staff/citizen/technical expert members, which collectively drive the City's ongoing programming for green infrastructure projects and flood mitigation messaging. Capital Improvement Project funding recommendations from the [Green Infrastructure Plan for Norfolk](#) are also reviewed monthly by the Watershed Management Task Force.
- **Strategies for creating knowledgeable, inclusive community leaders and networks.**  
 The 12-member Norfolk Coastal Management Review Board (CMRB) provides recommendations to the 7-member Erosion Advisory Commission, which is partially comprised of members of the CMRB. The CMRB is made up of elected leaders, civic league presidents/community leaders and technical experts from the Virginia Institute of Marine Science, Virginia Marine Resources Commission, Army Corp of Engineers, Old Dominion University Department of Ocean, Earth and Atmospheric Sciences, and city technical staff, providing workshops, seminars and project assessments of coastal mitigation and erosion projects; specifically intended to build grassroots technical capabilities and citizen champions within the community. The Norfolk CMRB and Erosion Advisory Commission is established by [City Code](#) and guided by the City's adopted [Sand Management Plan](#).
- **A community dam safety inventory and risk assessment posed by the location and condition of dams.**  
 Not applicable in Norfolk – not at dam risk.

- **A characterization of the community including population, economics, cultural and historic resources, dependence on the built environment and infrastructure and the risks posed to such infrastructure and characteristics by flooding from climate change, sea level rise, tidal events or storm surges or other weather.**

This general characterization is well documented within the general/comprehensive plan for the City of Norfolk – [plaNorfolk2030](#). This includes dozens of resiliency recommendations for flood risk reduction and communication.

- **Strategies to address other natural hazards that would cause, affect or result from flooding events including:**
  - **Earthquakes.**
  - **Storage of hazardous materials**
  - **Landslides/mud/debris flow/rock falls.**
  - **Prevention of wildfires that would result in denuded lands making flooding, mudslides or similar events more likely.**
  - **Preparations for severe weather events including tropical storms or other severe storms, including winter storms.**

The [Hampton Roads Hazard Mitigation Plan](#) is a FEMA-accredited all-hazards plan.

DS  
KM



For CM Office use only:  
DTS # \_\_\_\_\_

DS  
[Signature]

**DOCUMENT TRANSMITTAL FORM**

DS  
AMS

DS  
AV

Use for All City Documents Which Require the City Manager's Staff Approval

**\* PLEASE INDICATE IF THERE IS A LEGITIMATE DUE DATE BY WHICH THE CITY MANAGER MUST RESPOND \***

Due Date: 9/1/2021:

Return Completed Document To: Stephanie Daniel - Resilience

5 DEPARTMENT

Public Works / Resilience

**A. TO BE COMPLETED FOR CONTRACTS, AGREEMENTS, & GRANTS:**

TITLE

Sept 2021 Community Flood Preparedness Fund application

PARTY (Company and principal's names with which the City is entering into the agreement.)

Virginia Department of Conservation and Recreation (DCR)

EFFECTIVE DATES (Start & end dates)

6/9/2021 – 1/1/25

TOTAL DOLLAR VALUE

\$3,558,977 (\$2,227,488 grant request; \$1,331,489 match)

FUNDING SOURCE (Operating or capital budget; budget year; grant or other source. Show account information)

**SOURCE:** STORM WATER  
**ACCOUNT:** 2300-35-4299-FY21 (\$500,000 for Lake Whitehurst Study); 2300-35-4313-FY21 (\$500,000 for Colley Ave PS); 2300-35-3035-FY20 (\$219,489 for Colley Ave PS); 4000-35-4188-FY16 (\$100,000 for CSRM Studies); 2300-35-010-5303-712 (\$12,000 for Floodplain Management Plan)

TYPE (New or extension)

New

SUMMARY OF SCOPE OF SERVICE/ PROGRAM

Requested grant funds will support 1) Studies required through Coastal Storm Risk Management Study; 2) Flooding study of Lake Whitehurst watershed; 3) Floodplain Management Plan development, and 4) Construction of Colley Ave Pump Station upgrades

**VALIDATION OF PROCUREMENT:** I HEREBY CERTIFY THAT THE GOODS AND/OR SERVICES TO BE PROVIDED UNDER THIS AGREEMENT WERE PROCURED IN ACCORDANCE WITH THE REQUIREMENTS SET FORTH IN CHAPTER 33.1 OF THE NORFOLK CITY CODE.

N/A

**REVIEWED BY PURCHASING:** \_\_\_\_\_  
Signature and Date

**B. TO BE COMPLETED FOR HUMAN RESOURCES DOCUMENTS:**

TYPE OF DOCUMENT:

N/A

BRIEF DESCRIPTION:

**Certificate of Satisfaction:** I (We) hereby certify that all reasonable due diligence has been performed to sufficiently develop the contents and implications of the attached document in a manner to protect and account to the public. Further, all City policies and procedures have been adhered to and therefore, I (we) recommend the City Manager execute this document.

Justin [Signature] 8/26/21  
Document Owner Date

[Signature] 8/27/2021  
Department Signature Date

Richard [Signature] 8/26/2021  
Department Signature Date

Review by DCM

Approve  Disapprove

Review by CM

Approve  Disapprove

Patrick Roberts 8/31/2021 | 1:33 PM EDT  
Deputy City Manager Date

[Signature] 9/1/2021 | 7:25 AM PDT  
City Manager Date

AE9590A303EB478

C45AA22E7D6047B...



## Required Documents: Links

**FIRM Maps:** <https://drive.google.com/drive/folders/1zISYqMWhmwSFTz1-5gWA61RVpD1GRy45?usp=sharing>

**Comprehensive Plan (plaNorfolk2030):** <https://www.norfolk.gov/DocumentCenter/View/2483>

**Green Infrastructure Plan:** <https://www.norfolk.gov/DocumentCenter/View/38067>

**Vision2100:** <https://www.norfolk.gov/DocumentCenter/View/27768>

**Hampton Roads Hazard Mitigation Plan:** <https://www.hrpdcva.gov/library/view/620/2017-hampton-roads-hazard-mitigation-plan-and-appendices/>

**Norfolk Floodplain Ordinance:** [https://www.norfolkva.gov/norfolkzoningordinance/#Norfolk-ZO/3\\_9\\_Overlay\\_Districts\\_and\\_Designations.htm#\\_Toc502655724?TocPath=Article%25203%253A%2520Zoning%2520Districts%257C3.9%2520Overlay%2520Districts%2520and%2520Designations%257C\\_\\_\\_\\_\\_7](https://www.norfolkva.gov/norfolkzoningordinance/#Norfolk-ZO/3_9_Overlay_Districts_and_Designations.htm#_Toc502655724?TocPath=Article%25203%253A%2520Zoning%2520Districts%257C3.9%2520Overlay%2520Districts%2520and%2520Designations%257C_____7)



CFPF, rr &lt;cfpf@dcr.virginia.gov&gt;

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**City of Norfolk: Virginia Community Flood Preparedness Fund Grant Application**

1 message

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**Spencer, Kyle** <[REDACTED]>

Fri, Sep 3, 2021 at 3:28 PM

To: "cfpf@dcr.virginia.gov" &lt;cfpf@dcr.virginia.gov&gt;

Cc: "Shafer, Justin" [REDACTED], "Simon, Matthew" [REDACTED], "Daniel, Stephanie F" [REDACTED]

Good Afternoon,

On behalf of the City of Norfolk, please find attached the City's grant application submission for the Virginia Community Flood Preparedness Fund for review and consideration. Please find attached the following documents which contain four separate grant submissions:

1. CID510104\_CityofNorfolk\_CFPF-1
  - a. (Lake Whitehurst Hydrology and Hydraulics Study)
2. CID510104\_CityofNorfolk\_CFPF-2
  - a. (Colley Avenue Pump Station Upgrade Project)
3. CID510104\_CityofNorfolk\_CFPF-3
  - a. (Floodplain Management Study)
4. CID510104\_CityofNorfolk\_CFPF-4
  - a. (United States Army Corp of Engineer (USACE) Coastal Storm Management Study Coastal Analysis)

Please let us know if you have any questions. Thank you for your time and consideration.

Best Regards,

Kyle

Kyle Spencer

Deputy Resilience Officer



City Manager's Office of Resilience

501 Boush Street

Norfolk, VA 23510





Connect with us:

[www.norfolk.gov](http://www.norfolk.gov)



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**4 attachment**

-  **CID510104\_CityofNorfolk\_CFPF-1.pdf**  
2790K
-  **CID510104\_CityofNorfolk\_CFPF-2.pdf**  
7773K
-  **CID510104\_CityofNorfolk\_CFPF-3.pdf**  
6618K
-  **CID510104\_CityofNorfolk\_CFPF-4.pdf**  
7705K