RESILIENT NORFOLK

COASTAL STORM RISK MANAGEMENT

ANNUAL PLAN 2026

Willoughby Spit

Riverview

BUILDING RESILIENCE

The Coastal Storm Risk Management (CSRM) Project, called Resilient Norfolk, is a collaboration between the U.S. Army Corps of Engineers (USACE) and the City of Norfolk to reduce the City's risk from coastal flooding and damage from nor'easters, hurricanes, and other significant storm events.

Lafayette River

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CRO MESSAGE

KYLE SPENCER

Chief Resilience Officer

As a thriving city on the Eastern Seaboard, Norfolk has a deeply interconnected relationship with water. Strategically located at the mouth of the Chesapeake Bay, our city benefits from its unique position as a global hub for international trade, the proud homeport of the largest naval base in the world, and a revitalized downtown that continues to attract visitors and investment. These assets not only define our identity, but they also drive our economy and elevate Norfolk as one of the East Coast's most vibrant coastal destinations.

Given our coastal location, we can't ignore the growing unpredictability of nature. Over the past 25 years, I've seen the power of nature. I've studied tides, erosion, and flooding—mapping patterns and working with major organizations to help drivers safely navigate Norfolk's streets during storms. Our city is experiencing more frequent and intense storms, rising tides, and nuisance flooding that affect where we live, how we commute, and how we design our infrastructure.

Norfolk is not an isolated community seeking ways to enhance its flood mitigation strategies; however, we are one of the only cities committed to protecting what makes us thrive by implementing a proactive resilience strategy before disaster strikes. Our vulnerability stems from how the city was built: floodplains were quickly urbanized and filled in over the last four centuries. Combined with our low elevation and proximity to the Chesapeake Bay, this makes us increasingly susceptible to costly storm damage.

Over the past three years, Norfolk's Office of Resilience has made meaningful progress toward building a more Resilient Norfolk. We're working to protect vulnerable neighborhoods, develop new resilience innovations, preserve our economy and heritage, and ensure our city can thrive for generations. In partnership with the U.S. Army Corps of Engineers Norfolk District, we're advancing the Norfolk Coastal Storm Risk Management (CSRM) Project into its next phase. You'll see us in your communities bringing the updates to you and asking for your input—because resilience is a shared effort, we hope you'll be part of the solution.

Together, we can reduce the impacts from major storms, protect our environment, and create a more Resilient Norfolk.

Warmly,

Kyle Spencer

[Main Photo]:
The Hague in Ghent

THE CITY OF NORFOLK

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LIVING IN A COASTAL CITY

While water is our greatest asset, it is also our biggest threat. At the junction of the Elizabeth River and the Chesapeake Bay, Norfolk is set up for boundless opportunities and, unfortunately, storm surges and heavy rains that can result in flooding. Extreme weather events have led to widespread flooding, causing damage to homes, businesses, and infrastructure. One of the most notable events occurred in September 1933 during the Chesapeake-Potomac Hurricane, which led to widespread flooding that submerged neighborhoods and disrupted daily life.

In the years that followed, other storms, such as Hurricane Isabel in 2003, have brought similar devastation. Additionally, the impact of rising sea levels, attributed to decades of climate change, has further intensified the risk of flooding, forcing the City to confront the challenges of a changing environment.

In response, Norfolk has implemented a variety of measures to enhance its resilience. The City has invested in infrastructure improvements, such as upgrading stormwater systems and creating green spaces that can absorb excess rainwater, and in Resilient Norfolk, the comprehensive flood mitigation plan, which includes structural, nonstructural, and natural and hybrid infrastructure solutions, as well as community outreach and education programs aimed at raising awareness about preparedness and response to flooding events. By addressing the history of flooding head-on, Norfolk continues to adapt and evolve, striving to protect its residents and preserve its vibrant coastal community for future generations.

WHY DO WE FLOOD?

As a coastal city, flooding in Norfolk comes from a variety of sources. Flooding from these sources can affect neighborhoods in different ways, requiring different solutions based on the cause of flooding.

Tidal Flooding: Norfolk is relatively flat, with all land elevation below 15 feet North American Vertical Datum of 1988 (NAVD 88). Along some land areas that are low in elevation, the City experiences nuisance-type or minor flooding during a normal astronomically high tide, even on a beautiful, sunny day. During those instances, tidal flooding may also be referred to (locally) as sunny day flooding.

Precipitation Flooding: Precipitation flooding can come from sudden and brief heavy downpours that overwhelm drainage systems or several days of steady rainfall that saturate the ground, increasing runoff into the street and drains. The surface water resulting from heavy rainfall is called stormwater.

Compound Flooding: Flooding can be significantly worse when tidal flooding is combined with rainfall events, referred to as compound flooding. Rising seas can backflow into stormwater pipes, reducing their capacity to discharge stormwater during heavy rains.

Coastal Flooding/Storm Surge: Storm surge is an abnormal and dangerous rise of water pushed onto the shore by strong winds from a hurricane or tropical storm. A storm surge can increase the normal high tide by 11 feet or more and is the main reason why evacuations of the coast are ordered.

Sea Level Rise: Norfolk has one of the highest rates of relative sea level rise on the East Coast, which can result in coastal erosion, inundation of normally dry lands, coastal flooding, and saltwater intrusion.

[Left]: With 70% of the state's population along the coast, the Department of Conservation and Recreation developed a Virginia Coastal Resilience Master Plan to address the growing threats of sea level rise and severe weather.

A global leader in resilience, the City of Norfolk is an integral part of the Master Plan, working with the state to unlock funding for this project as well as future resilience projects. Through its Floodplain Management Plan, the City has developed a comprehensive plan to address coastal resilience in Norfolk.

RESILIENT NORFOLK

TIDAL FLOODING

PRECIPITATION FLOODING

COMPOUND FLOODING

SEA LEVEL RISE

COASTAL FLOODING/ STORM SURGE

The Hague in Ghent,
Hurricane Erin,
August 2025

HISTORY OF THE RESILIENT NORFOLK PROJECT

The City of Norfolk's partnership with USACE was born out of both local need and national action. After Hurricane Sandy in 2012, Congress directed USACE to study coastal storm risks along the Atlantic Coast and identify communities most vulnerable to flooding. Norfolk, long recognized for its exposure to storm surge, heavy rainfall, and sea level rise, was selected as one of nine priority areas for in-depth analysis.

Recognizing the City's increasing vulnerability to coastal storms and tidal flooding, Norfolk joined forces with USACE to explore long-term, science-based solutions. This collaboration formally began with the Norfolk CSRM Feasibility Study, conducted between 2016 and 2019. The study analyzed a range of structural, nonstructural, and natural and hybrid infrastructure designed to reduce flooding and strengthen community resilience.

The partnership deepened as both federal and local leaders recognized that a shared investment was essential to protecting Norfolk's people, property, and economy. In spring 2023, Norfolk and USACE signed a Project Partnership Agreement (PPA), officially establishing a cost-sharing framework for the project's construction. This agreement also made the project eligible for funding through the Infrastructure Investment and Jobs Act (IIJA), marking a major milestone in turning years of study into action.

Together, the City and USACE are advancing a $6.1 billion CSRM Project, featuring nearly 9 miles of floodwalls and levees, 11 tide gates, 13 pump stations, and a series of nonstructural and natural and hybrid infrastructure—from home elevations and commercial floodproofing to oyster reefs, wetland restoration, and living shorelines. What began as a post-storm study has evolved into one of the largest resilience investments in Norfolk's history: a partnership grounded in science, necessity, and shared commitment to a safer future.

[Right]: In spring 2023, Norfolk and USACE signed the PPA.

Seated, Mayor Kenneth Cooper Alexander, Ph.D., City of Norfolk and Colonel Brian Hallberg.

Standing from the left, U.S. Sen. Mark R. Warner, Congressman Bobby Scott, U.S. Sen. Tim Kaine, and Michael Connor, Assistant Secretary of the Army for Civil Works.

PROJECT TIMELINE

The timeline is approximate and is subject to change over the life of the project.

The Resilient Norfolk Coastal Storm Risk Management Project timeline has been developed to provide the public a general guideline on the timing of various stages of the project.

** Sitework includes utility relocations and real estate certification.*

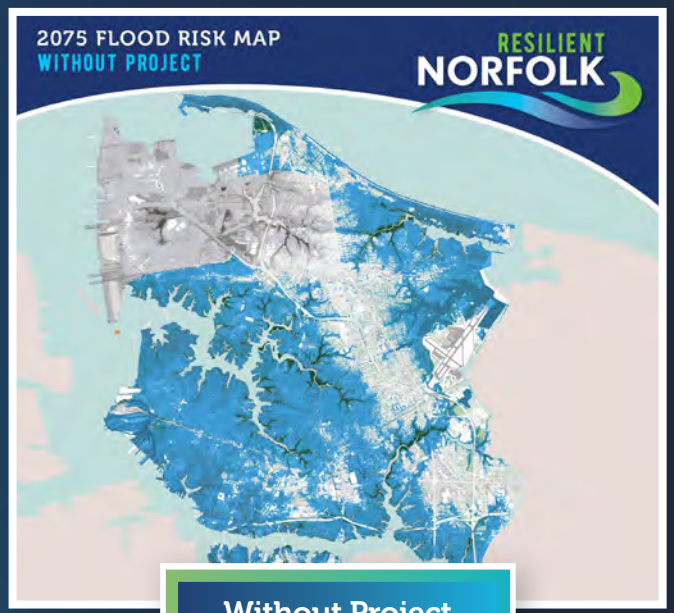
Design
2021-2033

Sitework
2023-2033

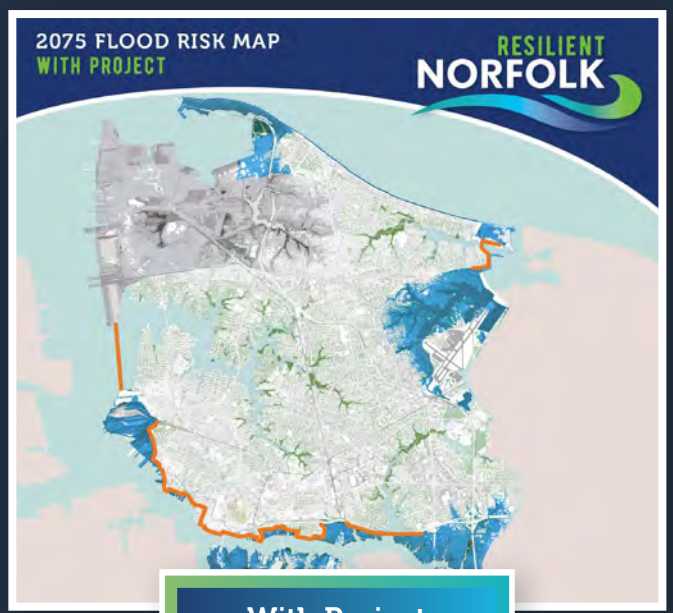
Construction
2027-2040

Final Completion
2040

By 2075, without the CSRM Project, much of the City of Norfolk could be underwater, facing potential damages between $355 million and $606 million per catastrophic storm, along with severe economic losses from disrupted productivity, reduced regional gross domestic product (GDP), and impassable flooded streets.



Without Project



With Project

IMPLEMENTATION PHASES

The citywide project is divided into 5 implementation phases.

1 Downtown

A system of floodwalls with a levee, surge barriers, and natural and hybrid infrastructure, extending from Ghent through downtown and connecting to the Ohio Creek Watershed Project.

2 Pretty Lake

A system of floodwalls and storm surge barriers to reduce storm surge from entering Pretty Lake at Shore Drive.

3 Lafayette

A storm surge barrier from Norfolk International Terminal (NIT) to the Lambert's Point area to reduce storm surge risk to the Lafayette River watershed.

4 Broad Creek

A system of floodwalls, storm surge barriers, and tide gates to reduce storm surge from entering Broad Creek at I-264.

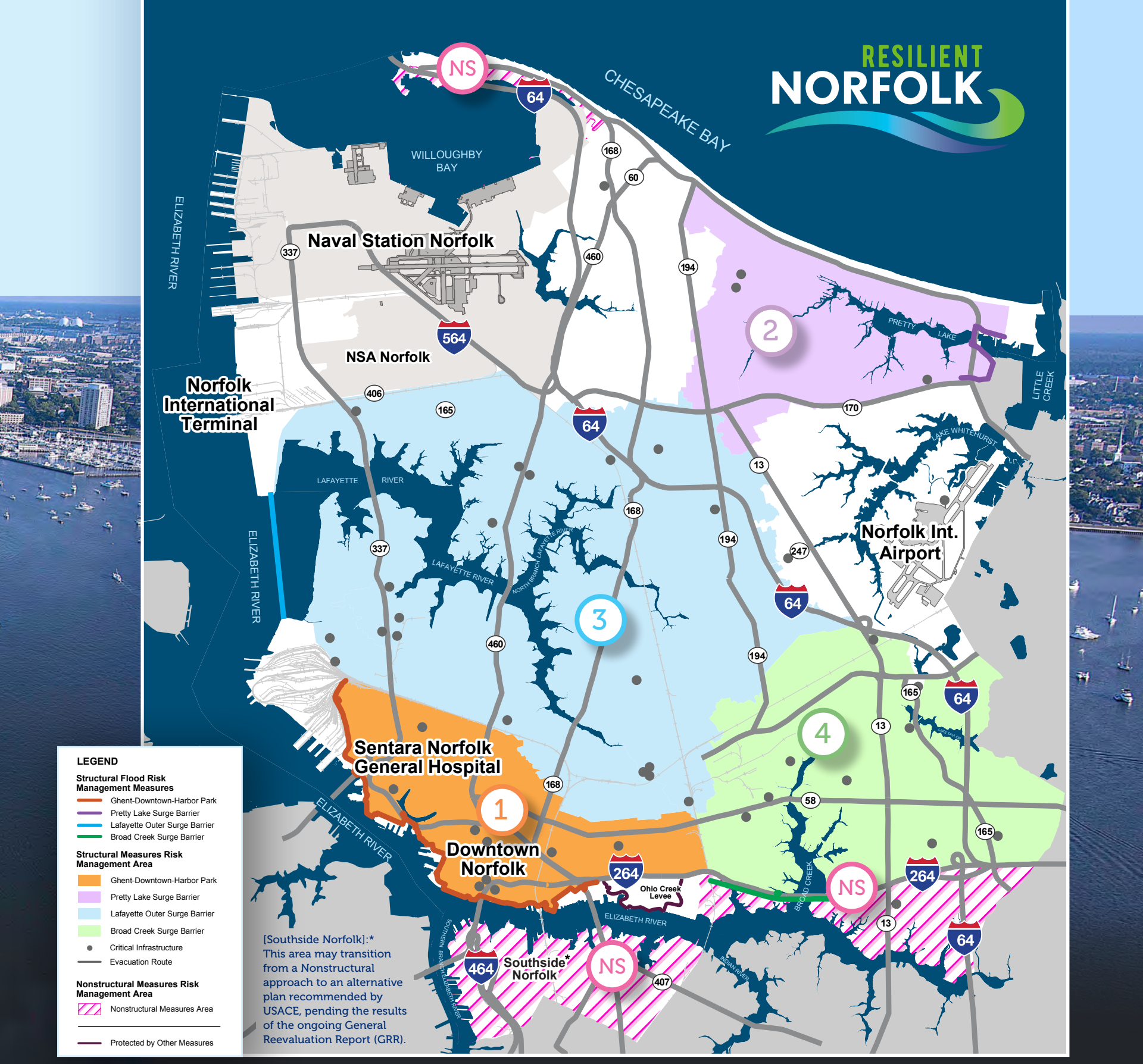
NS Nonstructural

A series of property-specific flood mitigation projects: home elevations, basement fills, floodproofing, etc. Work would take place in multiple areas of the City including Berkley, Campostella, Elizabeth Park, Ingleside, Willoughby Spit, Woodbine, and River Forest Shores.

The $6.1 billion project

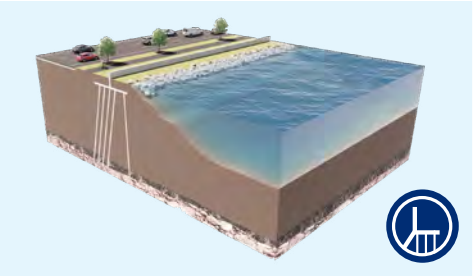
features storm-surge barriers, nearly 9 miles of floodwalls and levees, 11 tide gates, and 13 pump stations, along with nonstructural projects such as home elevations, basement fills, and commercial floodproofing, and various natural and hybrid infrastructure such as oyster reefs and wetland mitigation living shorelines.

[Above]: Nauticus and the Half Moone Cruise and Celebration Center in the Freemason District on the Elizabeth River.

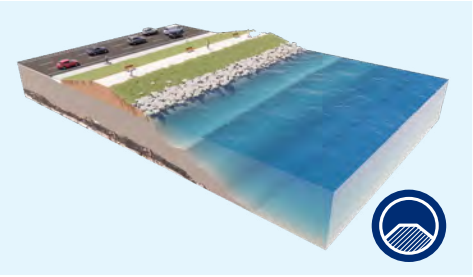

RESILIENT
NORFOLK
CHESAPEAKE BAY
WILLOUGHBY BAY
ELIZABETH RIVER
Naval Station Norfolk
NS
NSA Norfolk
Norfolk International Terminal
LAFAYETTE RIVER
NORTH BRANCH LAFAYETTE RIVER
PRETTY LAKE
LITTLE CREEK
LAKE WHITEHURST
Norfolk Int. Airport
Sentara Norfolk General Hospital
Downtown Norfolk
Ohio Creek Levee
BROAD CREEK
INDIAN RIVER
SOUTHERN BRANCH ELIZABETH RIVER
Southside* Norfolk
1
2
3
4
64
264
564
464
168
60
337
460
194
406
165
170
13
247
58
407
LEGEND
Structural Flood Risk Management Measures
Ghent-Downtown-Harbor Park
Pretty Lake Surge Barrier
Lafayette Outer Surge Barrier
Broad Creek Surge Barrier
Structural Measures Risk Management Area
Ghent-Downtown-Harbor Park
Pretty Lake Surge Barrier
Lafayette Outer Surge Barrier
Broad Creek Surge Barrier
Critical Infrastructure
Evacuation Route
Nonstructural Measures Risk Management Area
Nonstructural Measures Area
Protected by Other Measures
[Southside Norfolk]:* This area may transition from a Nonstructural approach to an alternative plan recommended by USACE, pending the results of the ongoing General Reevaluation Report (GRR).

TYPES OF RISK REDUCTION MEASURES

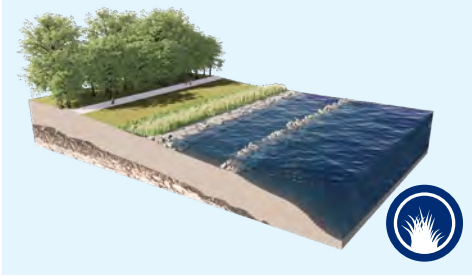
This project combines structural, property-specific, and natural and hybrid infrastructure features to reduce coastal flooding across Norfolk.



T-wall – A sturdy concrete wall, shaped like an upside-down T. It consists of a concrete base with tall floodwall panels extending upward.



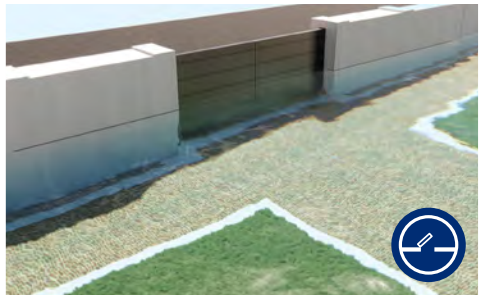
Levee – Man-made structures, such as an earthen embankment, designed and constructed to contain, control, or divert the flow of water.



Natural and hybrid infrastructure – These are flood mitigation solutions that mimic natural processes and include varied practices that can be applied at many different scales.

Levee/T-wall – This combination is a T-wall with compacted, heightened material on one side to provide additional support.

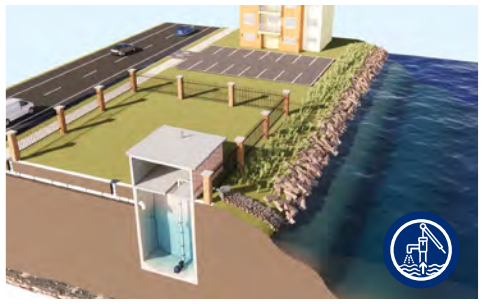
Property-specific, nonstructural – These measures focus on reducing the damages caused by flooding to homes and businesses.



Gate – Adjustable gates are used to control water flow in flood barriers, reservoirs, rivers, streams, or levee systems.

Bin-wall – A gravity retaining wall system made from adjoining closed-faced bins, then backfilled with soil.

Critical infrastructure – These flood mitigation solutions will protect the assets, systems, and networks that are essential to the City's function.



Pump station – These measures help protect areas by pumping away large volumes of water, preventing the occurrence of flooding.

PROPOSED RISK REDUCTION MEASURES PER IMPLEMENTATION PHASE

The CSRM project will utilize several types of flood improvement structures, within each of the five implementation phases, which are specifically designed for reducing coastal flood impacts.

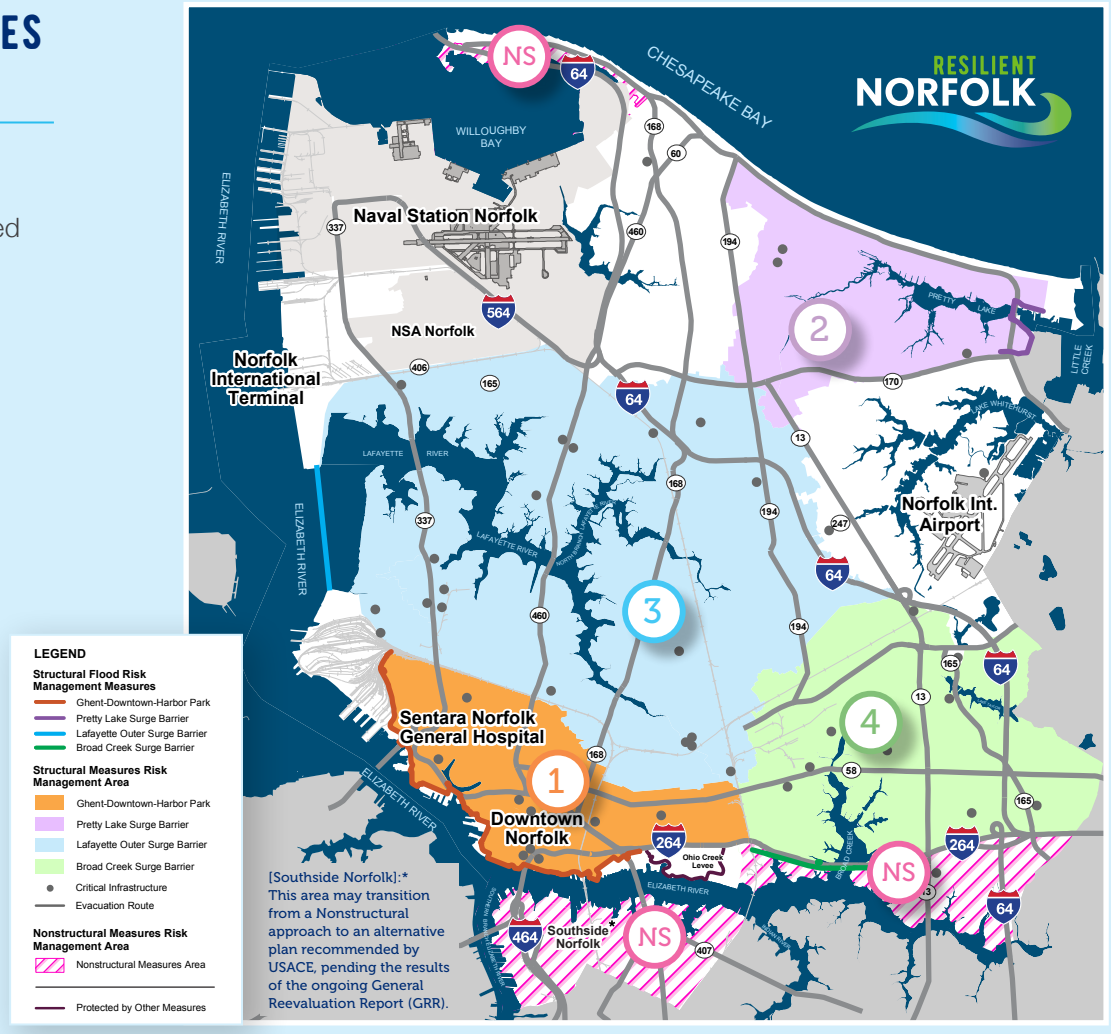
1 Downtown

2 Pretty Lake

3 Lafayette

4 Broad Creek

NS Nonstructural



NATIONAL ECONOMIC IMPACTS BY THE NUMBERS

For the Commonwealth of Virginia as a whole, the construction stimulus would generate 29,700 worker-years of labor, $1.9 billion in labor income, $3.7 billion in output, and $2.2 million in Gross Regional Product.

The CSRM project will generate enormous benefits for Virginia.

- **29,700** Worker-years of labor
- **$1.9B** Labor Income
- **$3.7B** Output
- **$2.2M** Gross Regional Product

COMMUNITY ENGAGEMENT

Outreach is a cornerstone of the Resilient Norfolk Project's strategic plan. By meeting people where they are out in the community and during dedicated office hours, the project team continues to build awareness and strengthen climate resilience across the City. Through a multifaceted approach that includes public workshops, community engagement sessions, and partnerships with local organizations, the team actively involves residents in identifying vulnerabilities and shaping solutions.

These initiatives tap into local knowledge and empower participants through education on sustainability, disaster preparedness, and resource navigation. By fostering strong partnerships, the Resilient Norfolk Project's outreach efforts go beyond raising awareness.

Here are a few examples:

- **Flood Strategy Open Houses**
- **Community Corners**
- **Civic League Meetings**
- **Pop Up Events**
- **Walking Tours**
- **Industry Conferences**

RESILIENT NORFOLK

Since the Feasibility Study was completed, the City and USACE have worked to move the Resilient Norfolk CSRM project forward. The project has experienced several key milestones over the past few years moving from study to design to construction.

MILESTONES

FEBRUARY 2019

Feasiblity Study

The study evaluated structural, nonstructural, and natural and hybrid infrastructure solutions to reduce coastal storm surge risk. Its findings, endorsed with the USACE Chief's Report, which laid the foundation for congressional authorization and the project's phased construction.

FEBRUARY 2023

Phase 1C

USACE held a workshop to discuss the Phase 1C alignment from the Feasibility Study.

JUNE 2023

PPA Signing

USACE signed a PPA with the City of Norfolk, unlocking $399 million in funding from the Infrastructure Investment and Jobs Act.

JANUARY 2025

Phase 1B
Design Contract Awarded

Engineering and design consultant Jacobs was awarded the contract to advance this phase to final 100% design.

JUNE 2025

Phase 1A
Approval of Design

Norfolk Planning Commission unanimously voted to approve Phase 1A design.

Phase 1B
Design Charrette

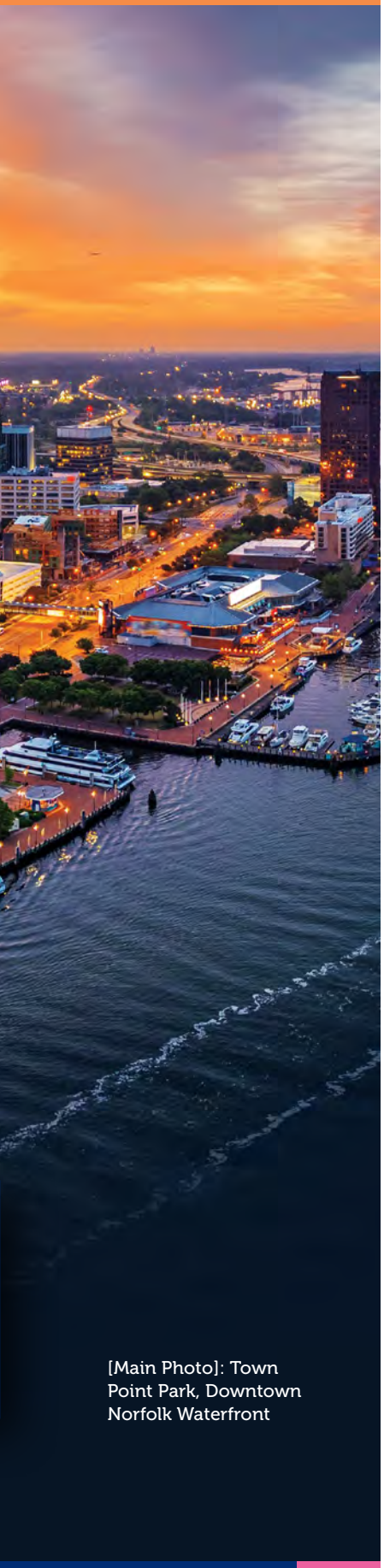
USACE held a design charrette led by Jacobs.

1 Downtown

RISK REDUCTION MEASURES:

2026 STATUS:	FUNDING SOURCE:	2026 EXPENDITURE:	ESTIMATED COST:
50% Design <5% Construction	Federal, State and City	$13.7 Million	$2.65 Billion

GROUNDBREAKING IN 2026



[Main Photo]: Town Point Park, Downtown Norfolk Waterfront

1 PHASE 1 OVERVIEW

Phase 1 of the Resilient Norfolk Project focuses on Downtown Norfolk, one of the City's most flood-prone and economically vital areas. Now nearing final design, Phase 1A includes new floodwalls and levees along Water Street from the Berkley Bridge to the ferry landing), around Harbor Park and the future casino site, and in the South Brambleton area near Lyons Shipyard.

The floodwalls will stand about 16.5 feet high, providing protection against a major storm projected for 2076, with added height to account for wave action. A series of movable gates will allow normal vehicle, boat, and pedestrian access but can be closed when a storm surge is forecast to exceed safe levels.

While sea level rise will continue to shape Norfolk's future, the system is designed to adapt over time. If built today, the floodwall alignment would provide protection exceeding a 70-year storm event, and even by 2076, it will continue to offer significant risk reduction despite higher projected water levels. As daily tides rise, potentially reaching about 4 feet within the next 50 to 100 years, the floodgates will operate more frequently, ensuring consistent protection for downtown's residents, businesses, and infrastructure as conditions evolve.

PHASE 1 OVERVIEW

Downtown

Phase 1 is divided into four subphases, each targeting specific sections of Norfolk's waterfront and designed to deliver flood protection in carefully planned stages.

Phase 1A strengthens flood protection along the downtown waterfront, extending from the Berkley Bridge to the ferry landing. It includes new floodwalls and levees near Harbor Park, the future casino site, and Lyons Shipyard, and is supported by a living shoreline, a pump station, and a swing gate to enhance overall resilience.

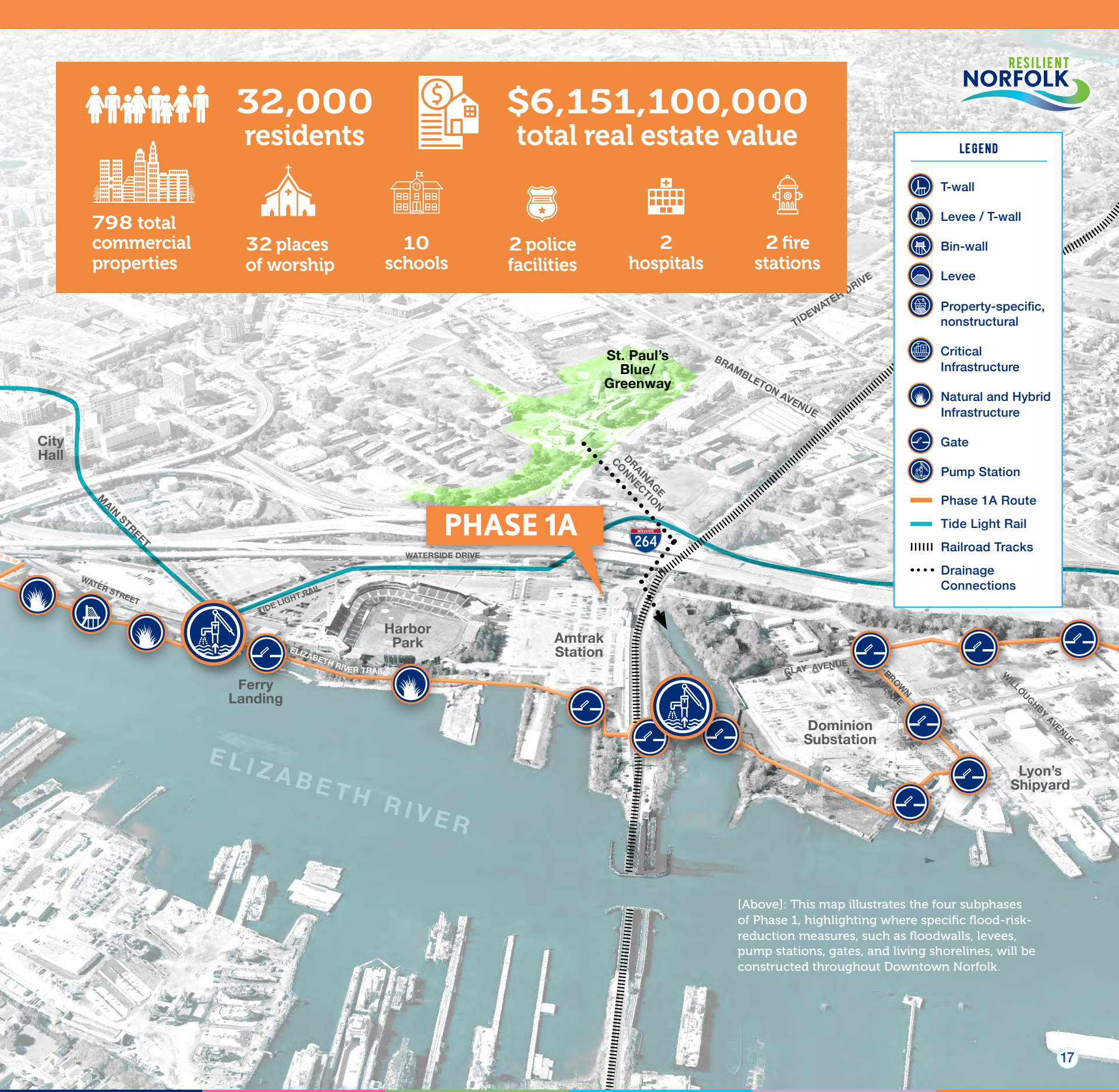
Phase 1B extends flood protection east from the existing downtown floodwall. It adds a levee along Town Point Park, T-walls around Fountain Park, and bin walls that continue past the Sheraton and Dominion Tower and beneath the Berkley Bridge. This phase is supported by a pump station designed to manage stormwater.

Phase 1C extends protection from the Boush Street Pump Station to Historic Fort Norfolk. It evaluates three possible floodwall alignment alternatives, including a proposed storm-surge barrier at The Hague, to determine the most effective combination of structural measures connecting West Ghent to Harbor Park. The final design will be selected based on a comparative analysis of performance, cost, and community impact.

Phase 1D focuses on redesigning and upgrading the city's existing downtown floodwall. It integrates the current structure into the broader protection system to ensure continuous and reliable flood defense as the new sub-phases progress.

WHY DOES DOWNTOWN PHASE 1 MATTER?

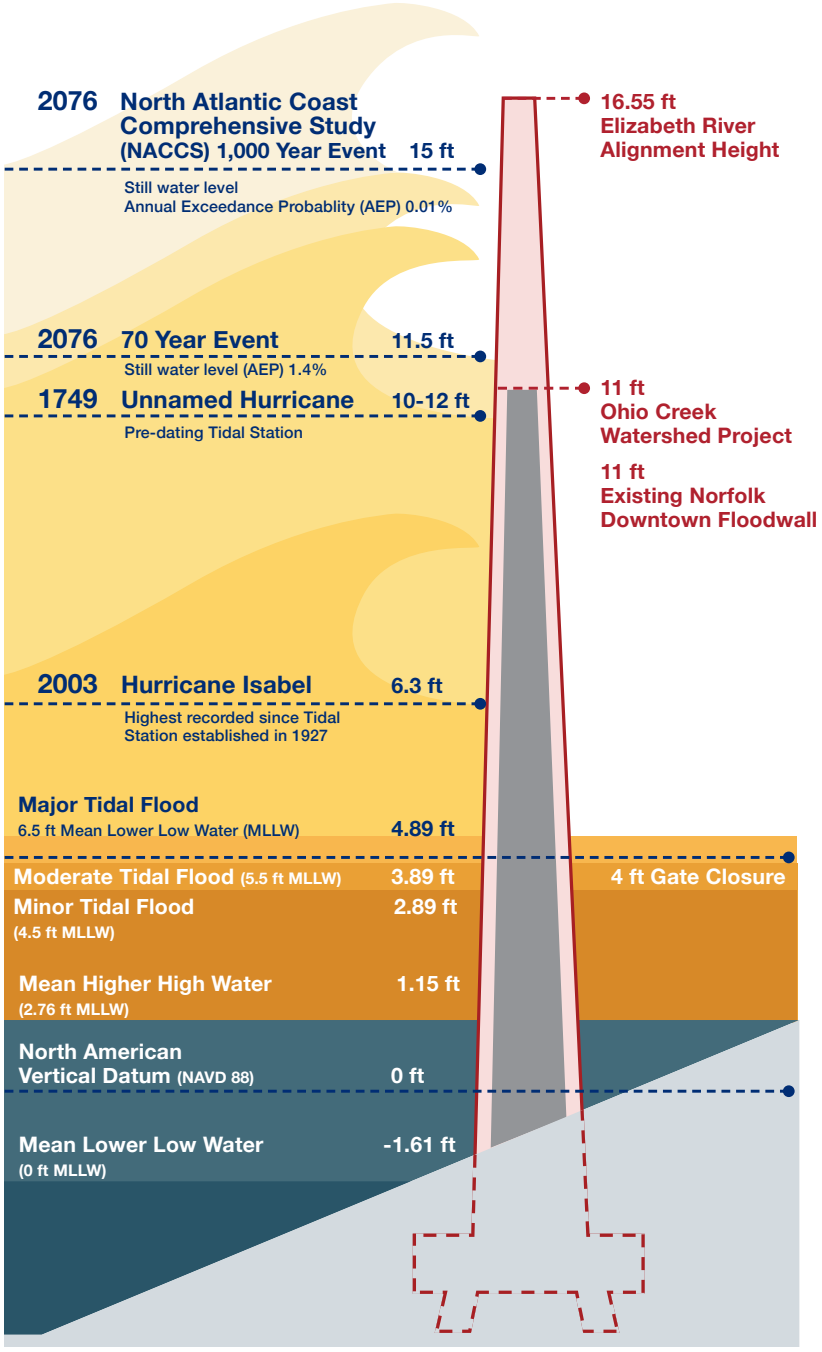
- Downtown sits directly on the Elizabeth River, where even moderate storm surges can push water over bulkheads and flood key streets such as Waterside Drive, Main Street, and Boush Street.
- The Downtown, Freemason, and Fort Norfolk areas experience frequent nuisance (sunny-day) flooding during high tides and heavy rainfall.
- NOAA tide gauge data at Sewells Point shows a steady rise in sea level, contributing to more frequent and severe flooding downtown.
- Critical infrastructure and economic assets, including City Hall, government offices, entertainment venues, and major employers, are concentrated in this area, making protection vital to citywide resilience.
- Phase 1 investments safeguard not only property but also the City's economic core, preserving access, mobility, and business continuity during storm events.



[Above]: This map illustrates the four subphases of Phase 1, highlighting where specific flood-risk-reduction measures, such as floodwalls, levees, pump stations, gates, and living shorelines, will be constructed throughout Downtown Norfolk.

FLOODWALL HEIGHT

The height of the floodwall will vary based on the elevation along the Elizabeth River alignment for Phase 1. The left side of the graphic shows past and potential storm surge levels.



Tidal flooding May 2020 at the Hague in Ghent

STORM SURGE AND FLOOD RISK

Downtown Norfolk faces some of the City's highest risks from storm surge, powerful waves, and rising waters pushed inland by hurricanes, nor'easters, and tropical storms. Even moderate events can flood major corridors such as Brambleton Avenue, Tidewater Drive, and areas near Harbor Park and St. Paul's Blue/Greenway.

The Phase 1 floodwalls and gates are designed to block these surges and keep downtown accessible during major storms. Standing at 16.5 feet above sea level, the system will reduce the risk of flooding from storms projected for the year 2076, helping protect homes, businesses, and vital infrastructure. During normal conditions, the gates remain open to allow cars, boats, and pedestrians to move freely, balancing daily life with long-term safety.

[Left]: Section diagrams illustrate the key datums, or stormwater levels, used to determine the floodwall height. The Phase 1 floodwall along the Elizabeth River is designed to 16.5 feet North American Vertical Datum of 1988 (NAVD 88) to reduce storm surge risk and includes gates for tidal flow and traffic, which remain open under normal conditions.

The diagrams compare the floodwall height to critical water levels, including tidal floods and historical hurricane events. The wall is designed to protect all levels shown, addressing a 70-year storm surge scenario projected for 2076, with an additional 5 feet of freeboard to accommodate wave action.

This map illustrates the USACE Phase 1A floodwall alignment behind Harbor Park along the Elizabeth River. It highlights protection against a 70-year storm surge and shows the locations of proposed pump stations and tide gates, which remain open under normal conditions to maintain tidal flow and vehicle, marine, and pedestrian access.

RESILIENT NORFOLK


Hurricane Erin 2025, The Hague

A STORM SURGE can increase the **normal high tide by 11 feet or more** and is the main reason why evacuations of the coast are ordered.

Downtown

PHASE 1A

AREA PROJECTS PLANNED WITHIN 1A

Within Phase 1A, several coordinated projects will work together to strengthen flood protection and enhance the downtown waterfront. These efforts combine engineered infrastructure with natural solutions to manage stormwater, reduce flood risk, and protect key assets around Harbor Park and the surrounding area from Berkley Bridge to Chesterfield Heights.

Planned improvements include the following:

Harbor Park Living Shoreline

Harbor Park Pump Station

Water Street and Harbor Park Floodwall

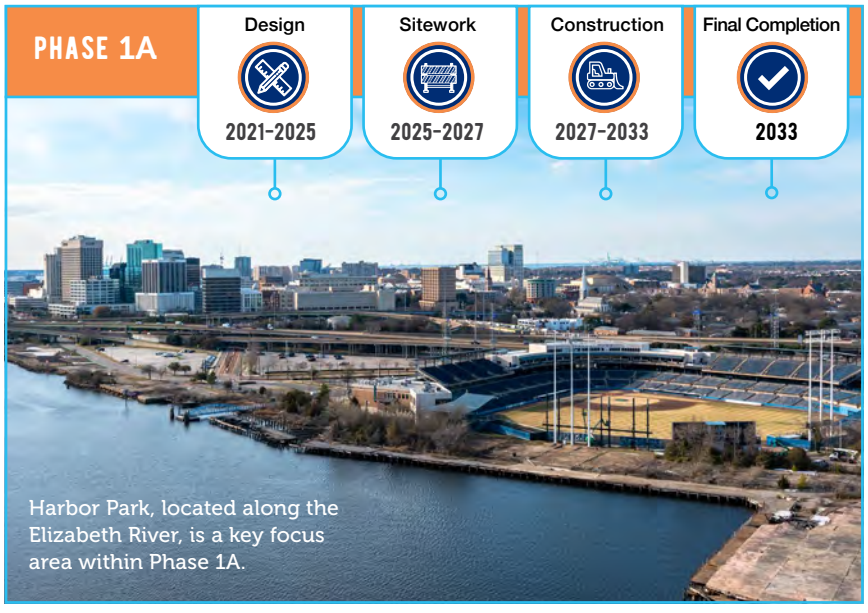
Norfolk Southern Railroad Crossing

Newton Creek Pump Station

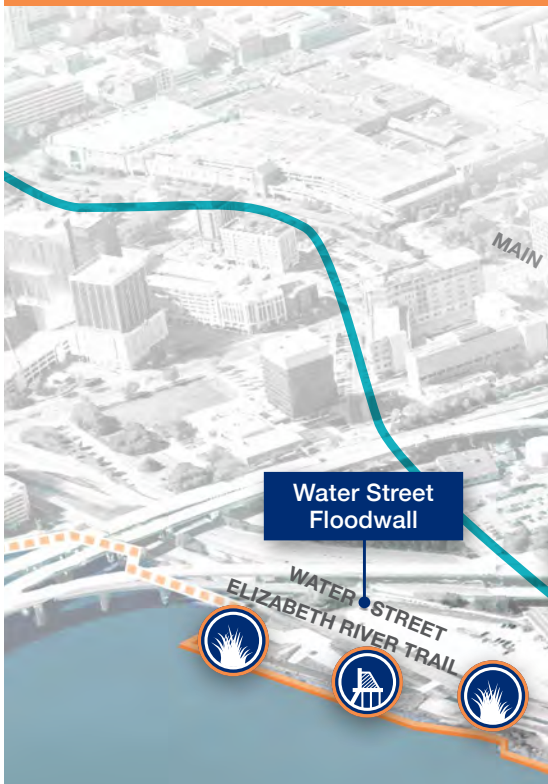
24-Inch Horizontal Directional Drill (HDD) - *COMPLETE*

Dominion Substation

Clay Avenue Bridge Project



Harbor Park, located along the Elizabeth River, is a key focus area within Phase 1A.



[Above]: This map illustrates a key portion of the Phase 1A floodwall alignment, which follows the downtown Norfolk waterfront near Harbor Park. The alignment is designed to protect this high-risk area from coastal flooding while maintaining access to nearby recreational and transportation amenities.

The map highlights how the floodwall will coexist with critical features such as the Elizabeth River Trail and the Tide Light Rail and shows the planned locations of flood gates and pump stations. Each element of the design was planned to balance flood protection with mobility, ensuring pedestrians, cyclists, and commuters can continue to enjoy and navigate the downtown waterfront safely.

RESILIENT NORFOLK

St. Paul's Blue/ Greenway

BRAMBLETON AVENUE

RAIL ROAD TRACK

STREET

DRAINAGE CONNECTION

COMPLETE

24-Inch HDD

Harbor Park Pump Station

WATERSIDE DRIVE

INTERSTATE 264

TIDE LIGHT RAIL

Amtrak Station

Harbor Park

Clay Avenue Bridge

CLAY AVENUE

BROWN AVENUE

WILLOUGHBY AVENUE

Ferry Landing

Ferry Landing Plaza

Living Shoreline Harbor Park

Dominion Substation

Lyon's Shipyard

Norfolk Southern Railroad Crossing

Newton Creek Pump Station

ELIZABETH RIVER

LEGEND

- Gate
- Pump Station
- Levee / T-wall
- Natural and Hybrid Infrastructure
- Phase 1A Route
- Tide Light Rail
- Railroad Tracks
- Drainage Connections

The $6.1 billion USACE Coastal Storm Risk Management (CSRM) Project in Norfolk includes storm-surge barriers, floodwalls, levees, tide gates, pump stations, and natural and hybrid infrastructure. This map highlights the project area for **Phase 1A**, which is nearing 100% design and has been approved by Norfolk City Council.

Natural and hybrid infrastructure oyster reef living shoreline.

HARBOR PARK LIVING SHORELINE

ESTIMATED COST: $1.8 Million

STATUS: Working toward 65% design;
USACE will review prior to moving to 100%

EXPECTED CONSTRUCTION START: 2030

The Living Shoreline at Harbor Park is an innovative ecological restoration initiative designed to enhance coastal resilience while fostering biodiversity. This project combines natural materials such as native vegetation and oyster reefs to create a sustainable shoreline that mitigates erosion and improves water quality. By integrating habitat for marine life and promoting the growth of indigenous plant species, the living shoreline not only protects against storm surges but also supports local wildlife populations.

View from the elevated Elizabeth River Trail along the Phase 1A floodwall, looking toward downtown Norfolk. The trail features seating, lighting, and trash receptacles, supporting connectivity and recreational use. A future pump station is visible in the background, while the adjacent living shoreline buffers waves and provides habitat for marine life.

PHASE 1A

Downtown

This section illustrates a portion of the Phase 1A floodwall alignment options in relation to Harbor Park, the Elizabeth River Trail, and the living shoreline. In these areas, the trail remains at grade before gradually sloping upward, supporting recreational use and connectivity.

The living shoreline in both illustrations reduces wave action, stabilizes the bank, and enhances coastal habitat.

Pump stations and floodwalls are essential infrastructure elements that work in tandem to control floodwaters. Use the QR code here to view an illustrated video on how pump stations divert water away from protected areas, while floodwalls serve as barriers to prevent flooding.

HARBOR PARK PUMP STATION

TOTAL COST: $35 Million (estimated)

STATUS: 15% design underway;
RFP for Design-Build Contract being developed

EXPECTED CONSTRUCTION START: Late 2027

Next to Harbor Park, a future pump station will play a key role in protecting downtown Norfolk from flooding during heavy rain and coastal storms. Designed to work in coordination with the new floodwall system, the pump station will move stormwater safely away from low-lying areas and back into the river when gates are closed during high-water events. Located beside a living shoreline that helps reduce wave energy and stabilize the riverbank, this site combines engineered infrastructure with natural resilience, supporting both flood protection and the health of Norfolk's waterfront ecosystem.

Rendering displays onlookers viewing downtown Norfolk and the Elizabeth River from Harbor Park and the Elizabeth River Trail.

PHASE 1A

Downtown

WATER STREET AND HARBOR PARK FLOODWALL

TOTAL COST: $354 Million

STATUS: 100% design is currently under review by USACE

EXPECTED CONSTRUCTION START: 2026 site work, 2027 floodwall construction

The Phase 1A floodwall alignment between Harbor Park and the Elizabeth River (as illustrated above) will reduce storm surge risk while also supporting an extension of the Elizabeth River Trail, enhancing recreational opportunities and river views. The floodwall starts at Water Street and continues past Harbor Park to the Norfolk Southern Railroad Crossing. A living shoreline and breakwaters along the river-facing side of the wall will help reduce wave action, stabilize the shoreline, and improve the coastal habitat.

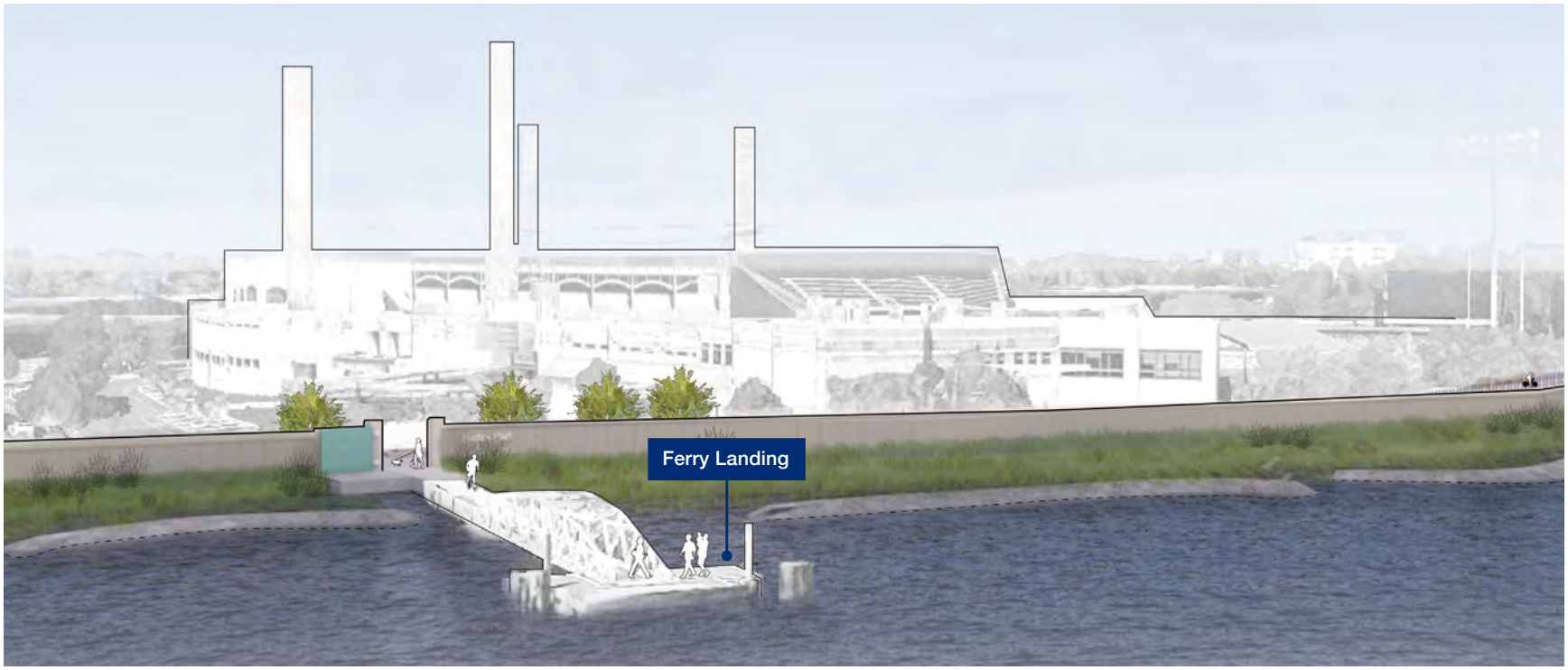
This gate in the floodwall will maintain pedestrian access to the waterfront and close when needed to block storm surge and high tides.

A swing gate at Ferry Landing and the Elizabeth River Trail at Harbor Park Stadium will provide pedestrian access to the ferry terminal. Additionally, the plaza at the Ferry Gate incorporates seating, lighting, and a bike rack to support comfort, safety, and multimodal access.

The Elizabeth River Trail gradually ramping upward along the alignment will offer continuous connectivity, opportunities for recreation, and enhanced access to the waterfront. Together with the adjacent living shoreline, these features create a resilient and active public space that reduces storm surge risk, provides a public recreation amenity, and supports the shoreline.

The illustration below demonstrates the view from the Ferry Landing along the Phase 1A floodwall, looking toward Harbor Park Stadium.

[Above]: Illustrated view at Ferry Gate



NORFOLK SOUTHERN RAILROAD CROSSING

TOTAL COST: $60 Million (estimated; shoofly, gate, wall)

STATUS: 65% design has been submitted; working with Norfolk Southern to get their input before proceeding to 100%

EXPECTED CONSTRUCTION START: 2029

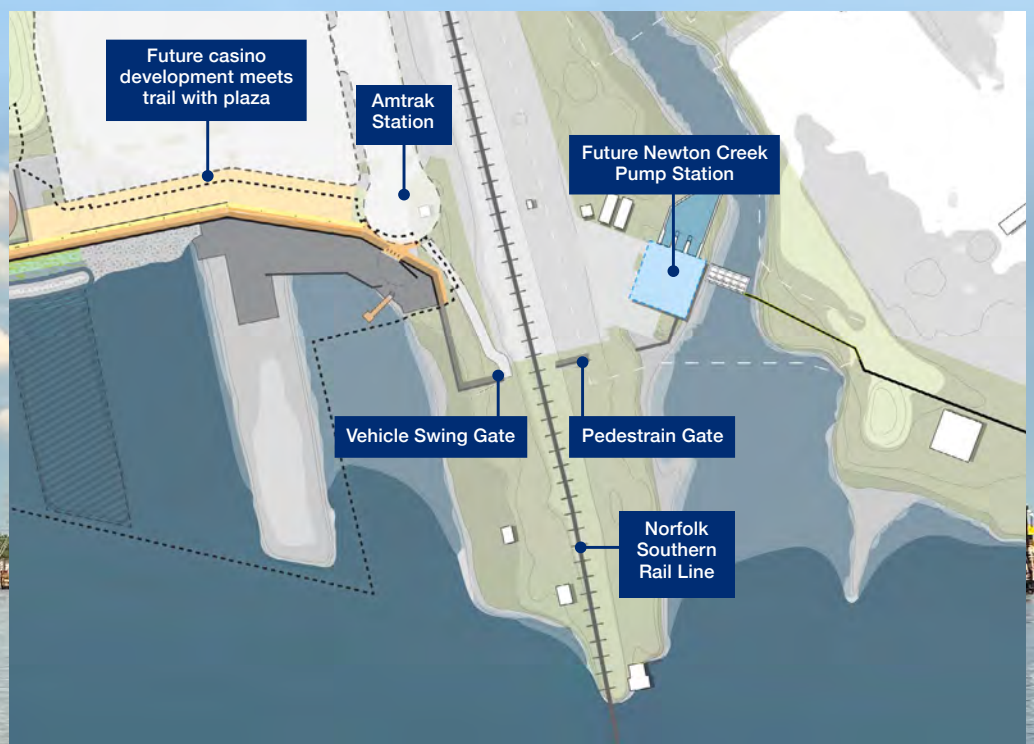
Norfolk Southern Railroad Crossing is a subphase of the Phase 1A floodwall that crosses Norfolk Southern Railroad's tracks near the Norfolk Amtrak station. The USACE Norfolk District is designing the floodwall and gates in-house as part of the larger Phase 1A project. Currently at 65% design, it is anticipated to be the last subphase of Phase 1A to be constructed in the early 2030s.

A large gate will allow for continued use of the railroad tracks except during gate closures. Access will also need to be maintained for vehicles operating and maintaining Norfolk Southern's movable bridge over the Elizabeth River. The railroad gate will be designed to automatically alert Norfolk Southern of any movement as a backup to existing gate closure protocols.

To construct the gate foundations, temporary detour "shoofly" tracks are proposed between Park Avenue and the Elizabeth River to keep train service running during construction. These tracks are at 65% design by the City of Norfolk's consultant and under review by the City of Norfolk's Resilience Partners.

PHASE 1A

Downtown



The map highlights where the Phase 1A floodwall intersects the Norfolk Southern rail line near the Amtrak station. This section includes the design and placement of the flood gate that will protect critical rail and transportation infrastructure during storm events.

NEWTON CREEK PUMP STATION AND TIDE GATE

TOTAL COST: $121 Million (estimated)

STATUS: USACE soliciting for 100% design contract

EXPECTED CONSTRUCTION START: 2032

When Norfolk was established as a borough around 1680, Newton Creek was as a boundary for the town's limits. Throughout the 1700s, the creek was used to support the City's local enterprises. Throughout the 1800s, as the town developed, the creek was progressively filled in, with complete infill by 1905. By the mid-20th century, neighborhoods were built directly on top of the creek bed, leading to chronic flooding issues.

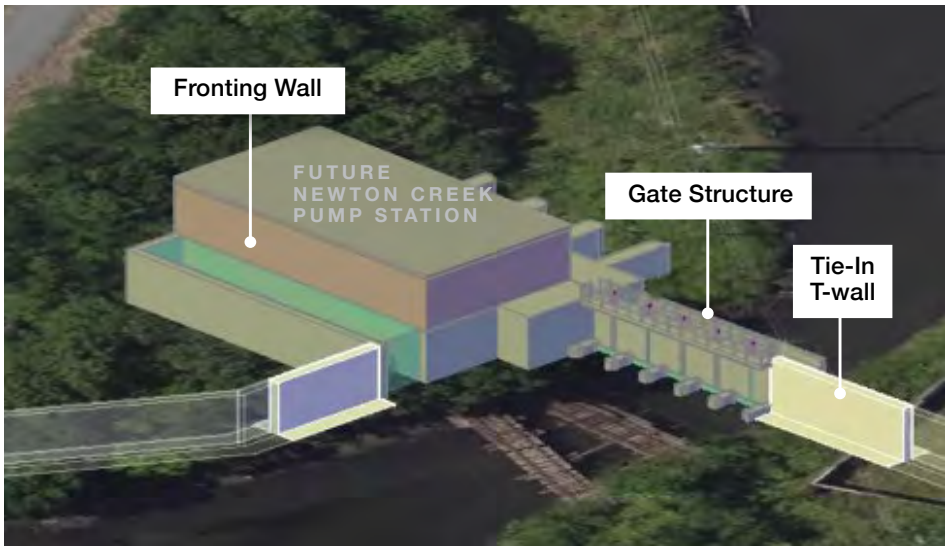
To address flooding issues, the proposed pump station will sit on a site adjacent to a canal (Mahone Canal/ Newton Canal) that was created to accommodate drainage from the railroad tracks in the area, near where the canal empties into the Elizabeth River.

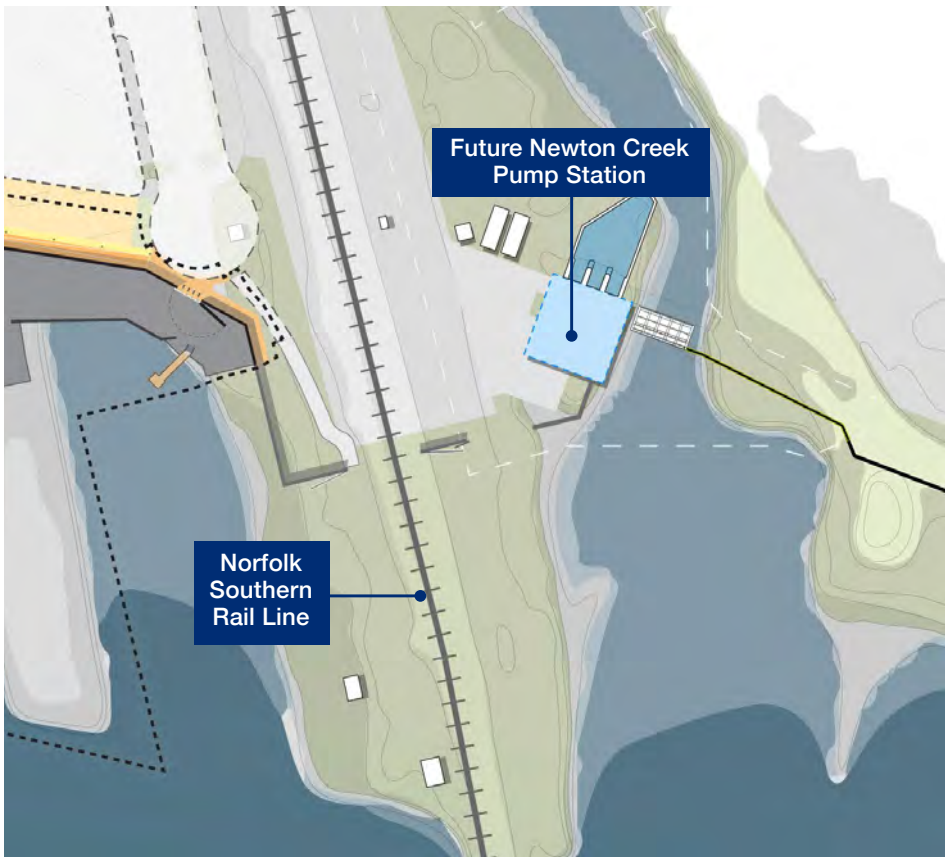
In December 2023, the USACE contracted AECOM to start the design of both the Harbor Park Pump Station and Newton Creek Pump Station. In January 2024, the 15% design was reviewed by USACE and the City and went through a Value Engineering (VE) Study. The Newton Creek Pump Station is currently at 15% design level and will continue to progress through 2026.

When the design is completed, it is expected that the pump station will be incorporated into the floodwall, have a tide gate in the canal, and have approximately five 150cfs pumps to keep up with drainage requirements.

The Newton Creek Pump Station is estimated to take approximately 31 months to build and cost approximately $121M for design and construction.

The illustration and map below show how the Newton Creek Pump Station will be incorporated directly into the floodwall system to control water levels during heavy rain and storm surge.





24-INCH HORIZONTAL DIRECTIONAL DRILL (HDD)

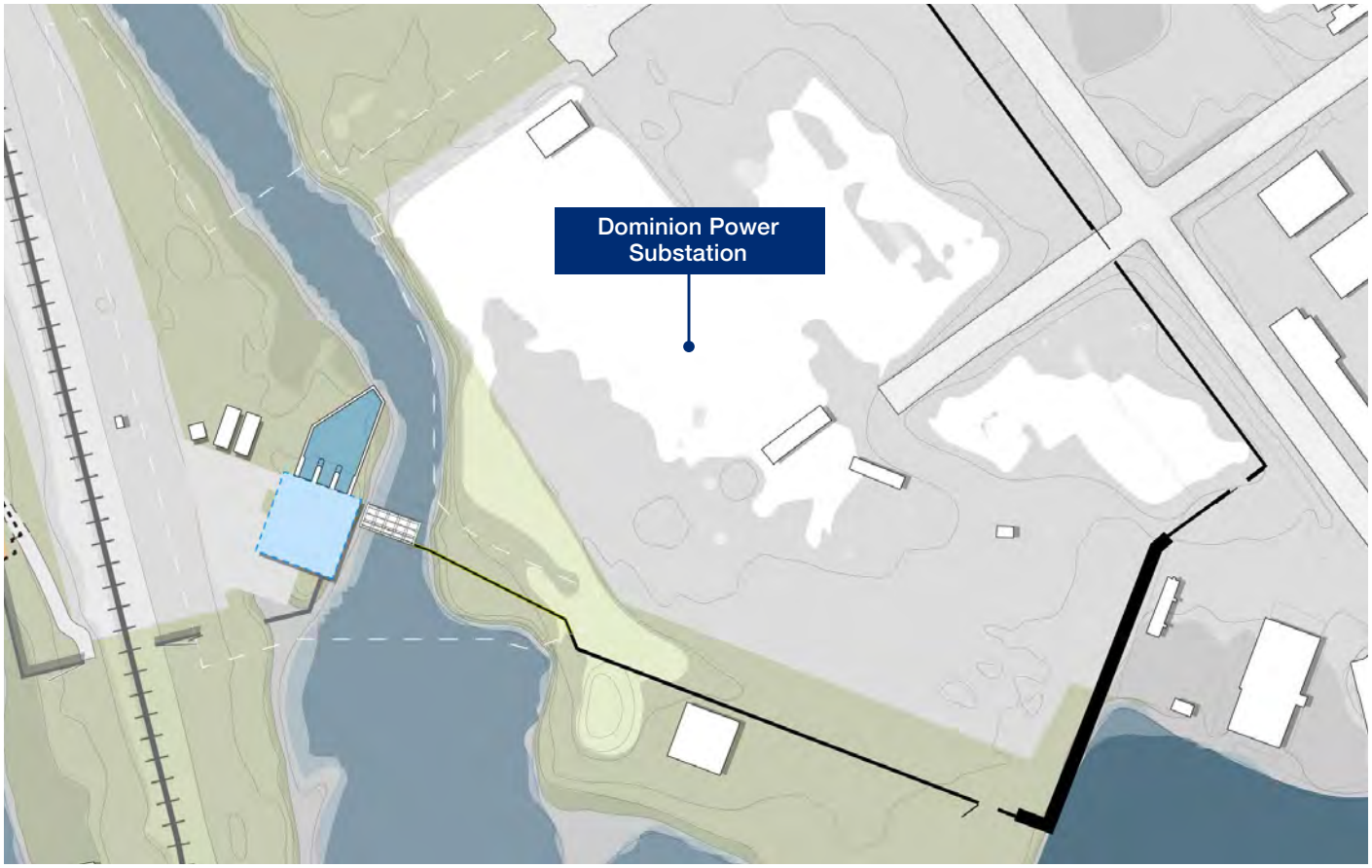
TOTAL COST: $11 Million

STATUS: Construction completed March 2024

A 24-inch water main and a Verizon line crossed under the Elizabeth River near Harbor Park. Those utilities were in conflict with the planned floodwall, so new lines were installed deeper than the originals using the Horizontal Directional Drill (HDD) method. Once the new lines were installed, the old lines were taken out of service and the previously conflicting conduits were removed for the floodwall construction.

PHASE 1A

Downtown



The Dominion Power Substation, located east of Newton Creek, is critical infrastructure that is essential to the power grid for the region.

DOMINION POWER SUBSTATION

TOTAL COST: $75 Million

STATUS: USACE completed 35% plans and working toward 65%

EXPECTED CONSTRUCTION START: 2031

The Dominion Power Substation in Downtown Norfolk is a key utility site included in Phase 1A of the Resilient Norfolk CSRM Project. This facility provides critical electrical service to surrounding neighborhoods and businesses, making its protection essential to maintaining power reliability during major storm events. Planned improvements will integrate flood protection measures to prevent service interruptions and safeguard the regional power supply.

CLAY AVENUE BRIDGE PROJECT

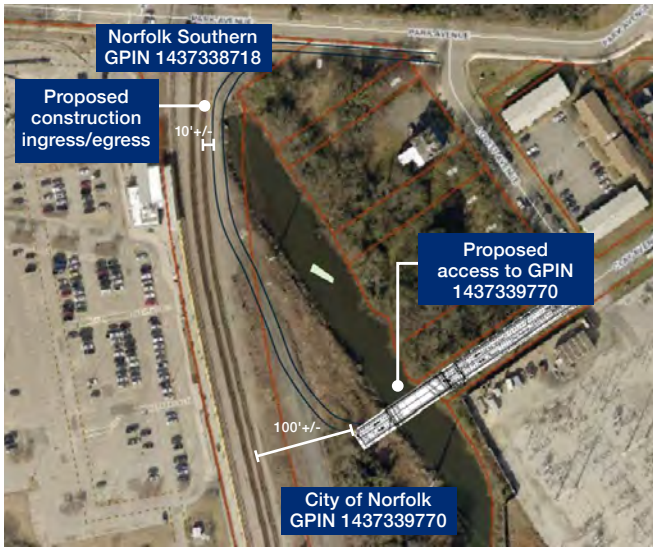
TOTAL COST: $7 Million

STATUS: 65% design under review, and Safety Assurance Review (SAR) and District Review comments were received

EXPECTED CONSTRUCTION START: 2027

The Clay Avenue Bridge will provide a dedicated land access to the future site of the Newton Creek Pump Station for construction, operations, and maintenance. Currently, the only land access is through Norfolk Southern's right-of-way. It is constrained between the railroad tracks and creek and does not provide sufficient clearance to the tracks. A new access road and bridge will extend Clay Avenue across Newton Creek.

The City of Norfolk's consultants are designing the bridge and the City will procure the construction contract. Design is at 65% and is anticipated to be completed in 2026. The proposed bridge is a single span of prestressed concrete box girders on concrete abutments supported by micropiles. The micropiles can be installed with low headroom, which is necessary due to overhead electrical transmission lines running along the west side of the creek.



This aerial map shows where the proposed Clay Avenue Bridge will extend across Newton Creek to provide direct access to the future pump station site.

The proposed bridge will create new land access to the Newton Creek Pump Station site, replacing the limited route along the Norfolk Southern right-of-way.

PHASE 1A

Downtown

Downtown

PHASE 1B

AREA PROJECTS PLANNED WITHIN 1B

In Phase 1B, several projects are planned to strengthen flood protection along the downtown waterfront from the Berkley Bridge to Town Point Park. Included in Phase 1B is engineered infrastructure that works with the waterfront, including a floodwall barrier system and bin walls along the marinas, as well as natural and hybrid infrastructure solutions to manage stormwater, reduce flood risk, and protect Norfolk's vibrant downtown business district.

Planned improvements include the following:

Norfolk Ohio Creek Watershed Project Tie-In

Norfolk State University

Waterside Drive Alignment & Bin Wall

Town Point Park & Waterside Drive Floodwall

Fountain Park to Berkley Bridge

[Left]: Waterside fronts the Downtown Norfolk skyline along the Elizabeth River

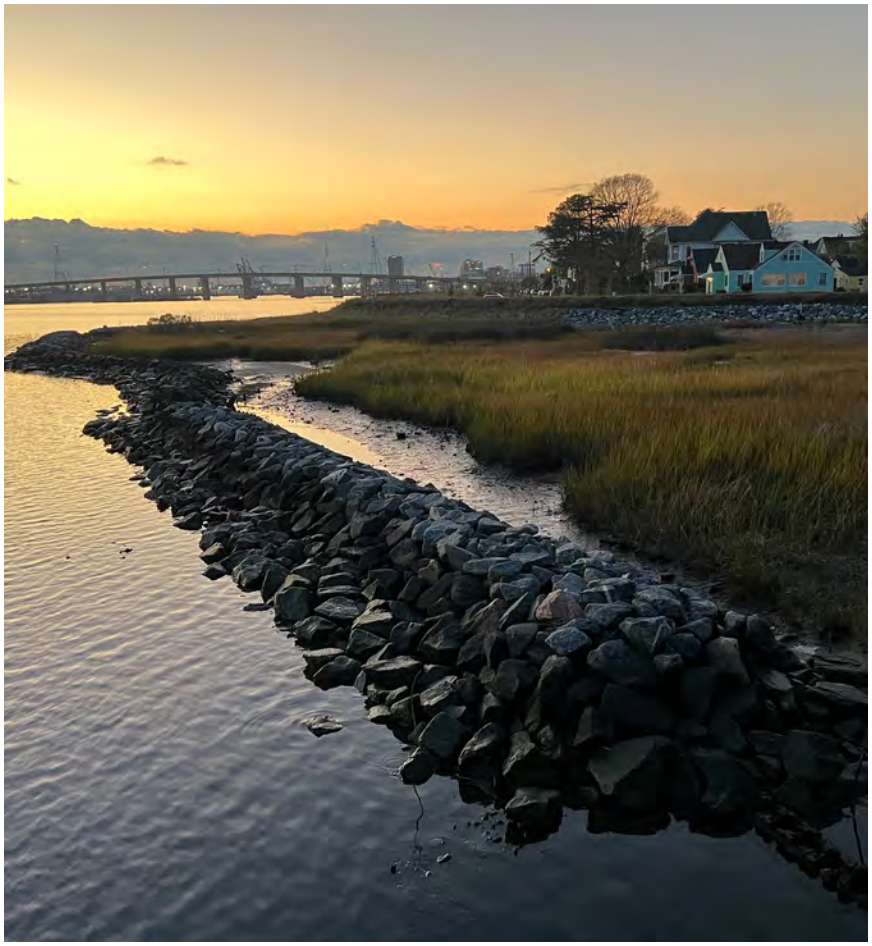
PHASE 1B

Downtown

NORFOLK OHIO CREEK WATERSHED PROJECT TIE-IN

The Norfolk Ohio Creek Watershed Project was funded as part of the U.S. Department of Housing and Urban Development—initiated National Disaster Resilience Competition (NDRC). This project, completed in 2023, aims to reduce the risk from nuisance flooding and coastal inundation for two neighborhoods along the Elizabeth River. A coastal protection alignment, designed as a continuous berm or floodwall, encircles the edge of the historic Chesterfield Heights neighborhood to reduce risks posed by increasing storm surge due to sea level rise, reduce coastal erosion, and expand tidal exosystems through the integration of a living shoreline.

As part of the Norfolk Ohio Creek Watershed Project, a pump station, permeable road surfaces, pipe network upgrades, and green infrastructure were installed to manage stormwater.



NORFOLK STATE UNIVERSITY

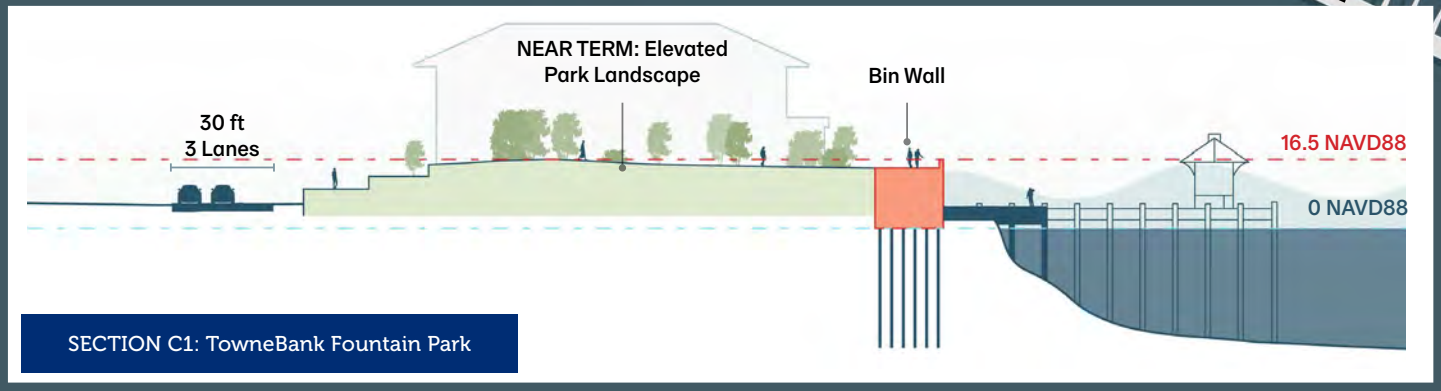
The sluice gate and pump station planned at the mouth of Ohio Creek will reduce tidal inundation of the drainage network through Norfolk State University (NSU) and the surrounding neighborhoods. This will allow pipes to hold more water during large rain events, reducing frequency of flooding on the streets around campus.

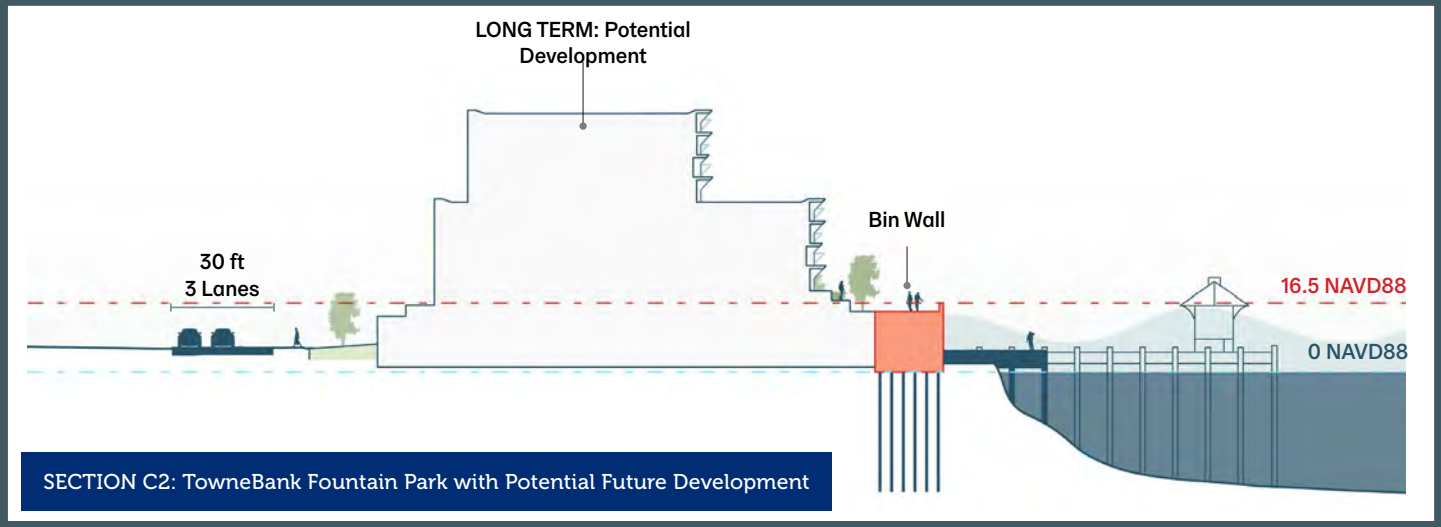
WATERSIDE DRIVE ALIGNMENT AND BIN WALL

The original Feasibility Study recommended a levee through Town Point Park. However, due to its substantial footprint and real estate requirements, the levee posed significant challenges to the functionality and accessibility of this iconic city park.

USACE consultants are currently designing Phase 1B and the levee may be reconfigured into a floodwall. While a traditional T-wall offers structural benefits, it presents usability and safety concerns.

The City of Norfolk is exploring the use of deployable flip-up barriers to preserve the park's character and public access. These barriers remain hidden during normal conditions but can be raised ahead of a storm, ensuring reliable flood protection while maintaining the park's scenic views and open layout year-round.





[Left]: Illustrated view of Town Point Park Bin Wall in near- and long-term development

TOWN POINT PARK AND WATERSIDE DRIVE FLOODWALL

Norfolk's Town Point Park is vulnerable to flooding and damage to downtown businesses, residences, and major roadways caused by coastal storms, hurricanes, and rising sea levels.

Two options are being considered for the Waterside Drive Floodwall to address this vulnerability: the T-wall and Flip-up Barrier designs seen here as street level and birds-eye views in an open and closed depiction of Waterside Drive.

PHASE 1B

Downtown

T-WALL

Street-level view of open T-wall

Street-level view of closed T-wall

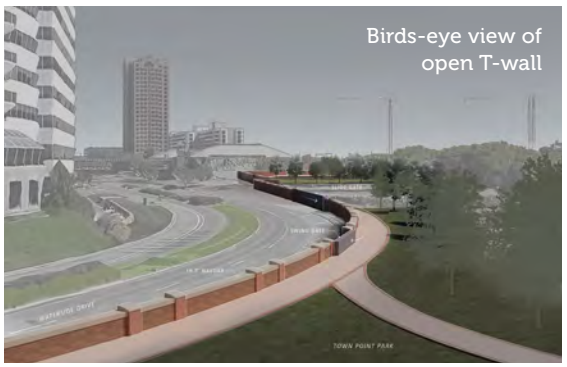
FLIP-UP BARRIER

Street-level view of open Flip-up Barrier

Street-level view of closed Flip-up Barrier

T-WALL

Birds-eye view of open T-wall

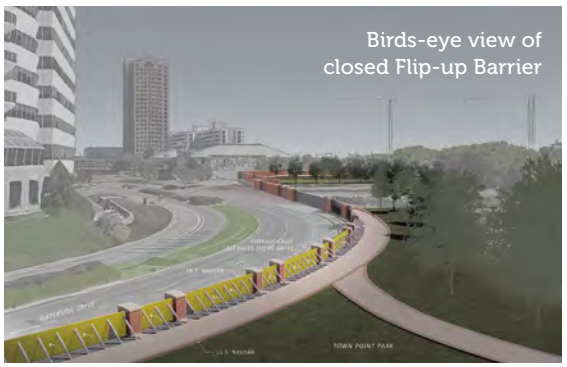


Birds-eye view of open T-wall

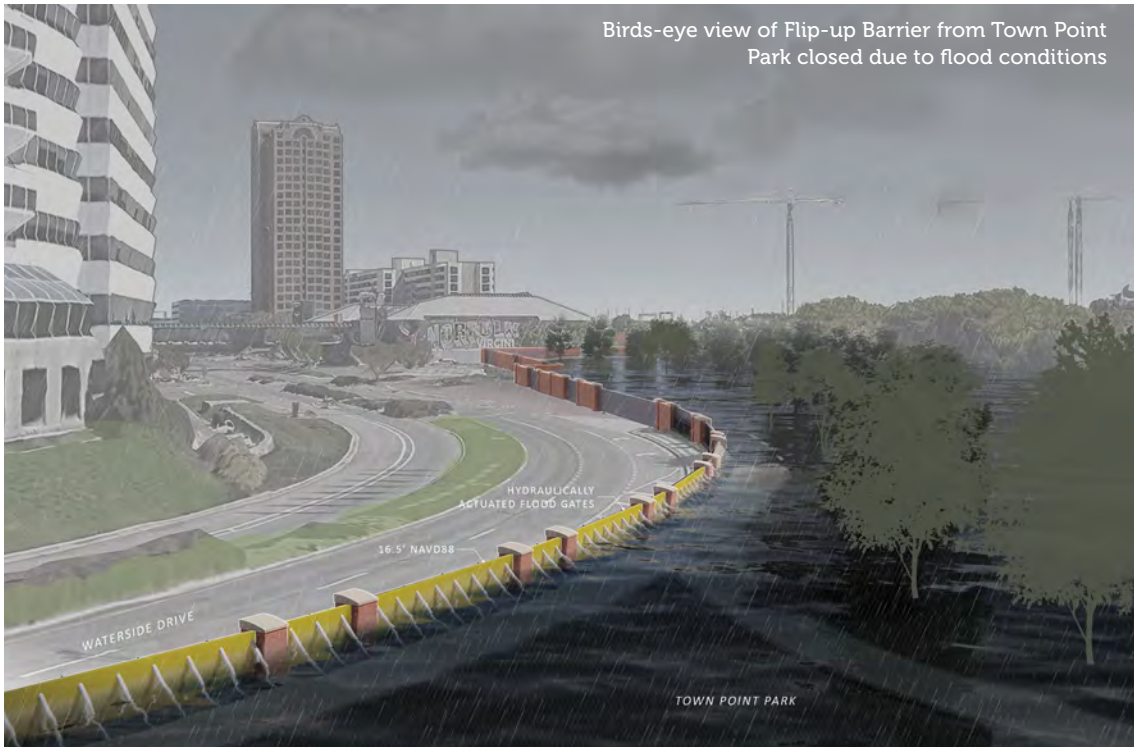
Birds-eye view of T-wall from Town Point Park closed due to flood conditions

FLIP-UP BARRIER

Birds-eye view of open Flip-up Barrier



Birds-eye view of closed Flip-up Barrier



Birds-eye view of Flip-up Barrier from Town Point Park closed due to flood conditions

TOWN POINT PARK TO BERKLEY BRIDGE

Phase 1B starts at the end of the existing downtown floodwall, with a levee planned along the north edge of Town Point Park. The levee will transition into a T-wall at the east end of Town Point Park, briefly into a bin wall along Otter Berth, then back into a T-wall at Fountain Park. A T-wall continues around the north and east sides of Fountain Park, with several gates through the floodwall for vehicular access and pedestrian ingress and emergency egress during large events. The T-wall from Fountain Park will turn east and transition into a bin wall along the remainder of Phase 1B. In addition to the bin wall along the waterfront, a raised plaza is proposed south of Waterside District in the same footprint of the existing plaza.

Sheraton/Dominion Tower Pump Station

Fountain Park

Waterside District

Dominion Tower to the Sheraton

PHASE 1B

Downtown

Downtown

PHASE 1C

AREAS PLANNED WITHIN PHASE 1C

Phase 1C extends from the Downtown Pump Station at Boush Street to the Norfolk Southern Lambert's Point Rail Yard in West Ghent. Plans for Phase 1C currently consist of three floodwall alignment alternatives for the Phase 1C East portion of Phase 1C. The structural measures will form an alignment extending from West Ghent to the Town Point Park area. Floodwalls will tie into the existing downtown floodwall.

A storm surge barrier is proposed at the entrance to The Hague.

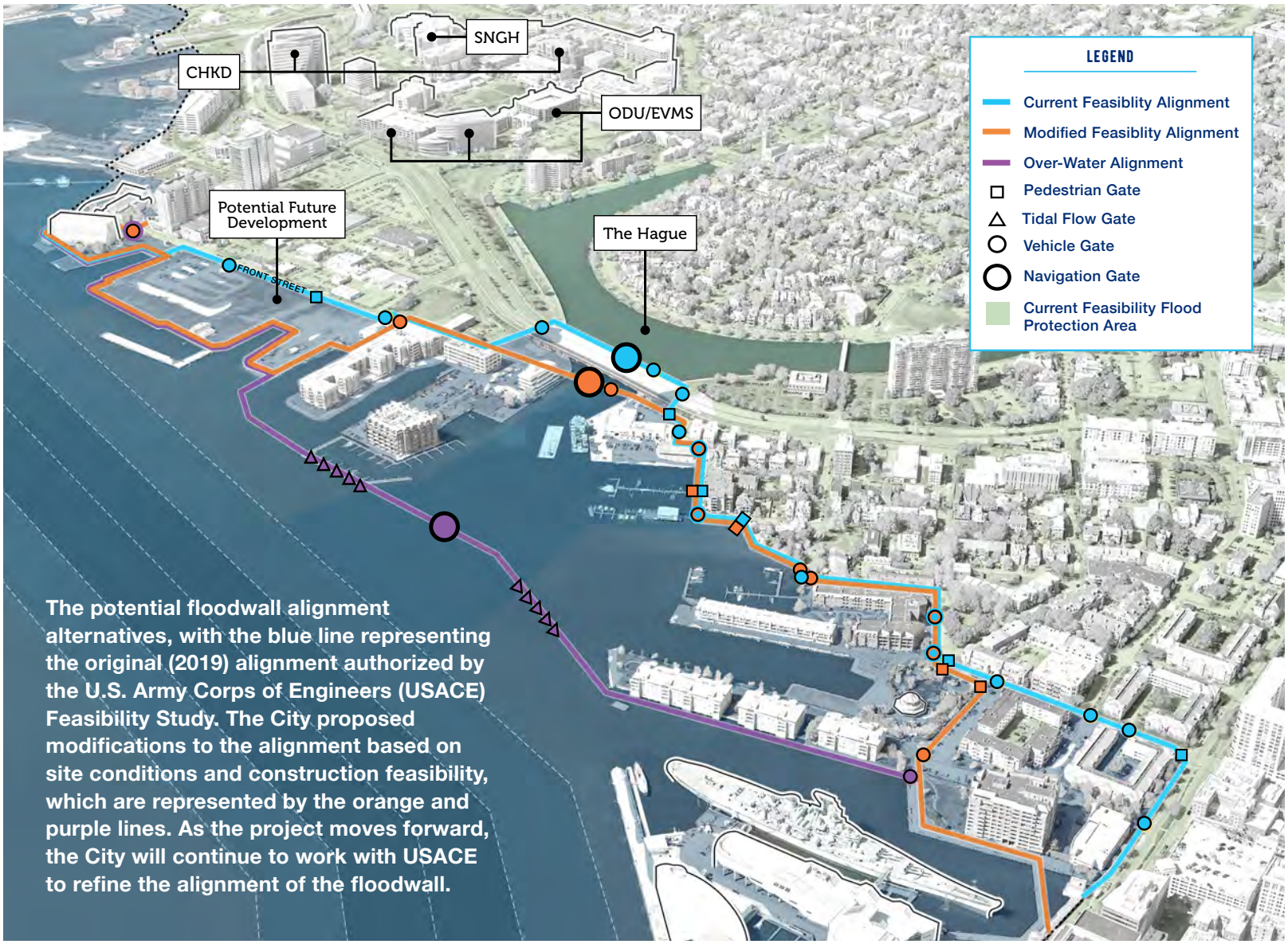
[Left]: View from West Ghent to Freemason District in Downtown

PHASE 1C EAST ALIGNMENT

The USACE Feasibility Study originally identified a floodwall alignment for the Phase 1C East area. However, following additional stakeholder engagement, data collection, and field evaluation, several concerns were identified with that Feasibility Study Alignment.

To assess the challenges, USACE and the City of Norfolk held a Phase 1C workshop in February 2023 to discuss concerns and explore alternative alignment options. Building on those discussions, the City presented an Alternatives Synthesis to USACE in February 2025, analyzing multiple scenarios for consideration including Current Feasibility Alignment, Modified Feasibility Alignment, and Over-water Alignment.

The map below illustrates these potential alignment alternatives, developed based on site conditions, construction feasibility, and how well each option meets the City's long-term flood protection goals.



The potential floodwall alignment alternatives, with the blue line representing the original (2019) alignment authorized by the U.S. Army Corps of Engineers (USACE) Feasibility Study. The City proposed modifications to the alignment based on site conditions and construction feasibility, which are represented by the orange and purple lines. As the project moves forward, the City will continue to work with USACE to refine the alignment of the floodwall.

PHASE 1C
Downtown

The three floodwall alignment alternatives evaluated in the Phase 1C East study include:

RESILIENT NORFOLK

A. Current Feasibility Alignment

- Outlined in the USACE Feasibility Study
- Consists of T-walls and a shorter in-water portion (marine gate) on the north side of the West Avenue Brambleton Bridge
- +/- 23 gate structures: 17 vehicle, 4 pedestrian, 1 tidal flow (nonnavigable), and 1 navigation

B. Modified Feasibility Alignment

- Similar to the Current Feasibility Alignment along much of its length, this Modified Feasibility Alignment seeks to reduce the impact on utilities, traffic patterns, and maintenance while improving life safety
- Primary adjustments include limiting floodwall placement on Boush and Tazewell streets, routing towards and around Pagoda Park, shifting the in-water portion to the south side of West Brambleton Avenue Bridge, and moving most of the Front Street alignment to the water's edge
- Consists of T-walls, bin-walls, and an in-water marine gate on the south side of the West Brambleton Avenue Bridge
- +/- 14 gate structures: 9 vehicle, 4 pedestrian, 1 tidal flow, and 1 navigation

C. Over-Water Alignment

- Bypasses much of the Current Feasibility Alignment, reducing utility conflicts, impacts on traffic, historic neighborhood impacts, and challenges with private property real estate
- Primarily Over-Water between Wisconsin Plaza, crossing Smith Creek, and coming ashore at Front Street, continuing along a portion of the Modified Feasibility alignment
- Consists primarily of an in-water storm surge barrier with one large gate for vessel traffic and multiple tide gates to maintain water quality
- +/- 12 gate structures: 6 to 10 for tidal flow, 1 navigation, and 1 vehicular

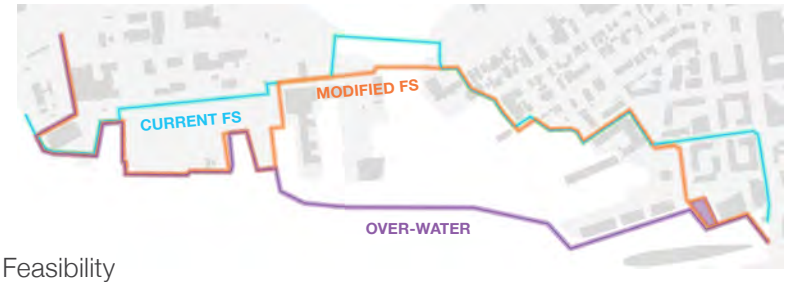
ALIGNMENT EVALUATION CRITERIA

Protection Levels | **Urban Design & Welfare** | **Historic & Cultural Resources** | **Natural Resources** | **Stormwater Management** | **Implementation** | **Schedule**

The alternatives are compared systematically, using the Current Feasibility Alignment as a baseline across many factors. These factors incorporated cost and schedule, utility and stormwater challenges, resident welfare and urban design, protection of people and property, historical and cultural resources, and scheduled risk. Attributes and relative advantages of the alternatives by factor are compiled to compare the alternative features. Significant construction costs are anticipated for utility relocation and stormwater network upgrades, and particular attention is given to these types of conflicts and interactions with existing infrastructure for each of the alternatives. Rough magnitude construction cost estimates for each alternative are one of the factors in the side-by-side comparison.

WISCONSIN SQUARE SECTIONAL STUDY

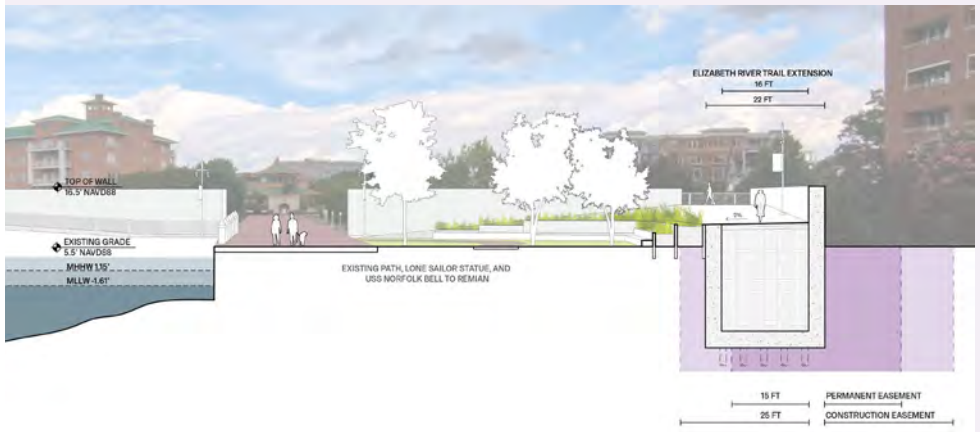
As part of the Phase 1C Alternatives Synthesis, Wisconsin Square is a public waterfront park that honors Norfolk's naval heritage and provides sweeping views of the Elizabeth River. The park features memorials dedicated to Norfolk-based ships and submarines lost since World War II, including eight commemorative plaques, the USS Norfolk (DL-1) ship's bell, and the Lone Sailor statue facing the Battleship Wisconsin.



This sectional study focuses on two alignment concepts: the Modified Feasibility Alignment and the Over-water Alignment, which explore how flood protection can be incorporated near the park without compromising its open space or views.

B. Modified Feasibility Alignment

- Maintains public waterfront access at Wisconsin Square
- Increased number of residential properties within the line of protection
- Reduces utility conflicts by avoiding Boush Street
- Results in restricted views for residential properties adjacent to the square



C. Over-water Alignment

- Potential for raised park and elevated trail that minimizes viewshed impact for Elizabeth River Trail users
- Increased number of residential properties within the line of protection
- Significant reduction in utility conflicts overall
- Results in restricted views for residential properties adjacent to the square

PHASE 1C
Downtown

Downtown

PHASE 1D

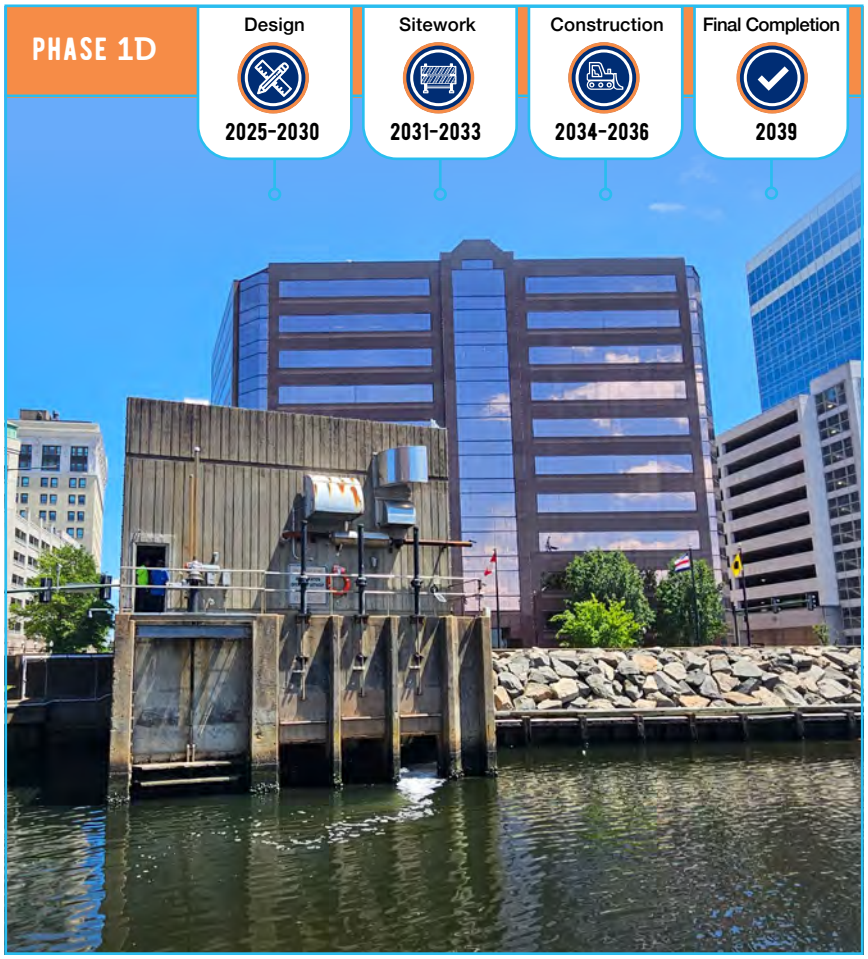
AREA PROJECTS PLANNED WITHIN 1D

Phase 1D covers the existing Downtown Norfolk floodwall built in the 1970s, which extends from Town Point Park to Tazewell Street, as well as the Downtown Pump Station.

Planned improvements include the following:

Floodwall Replacement

Downtown Pump Station Refurbishment



[Left]: The existing Downtown Pump Station pictured here will be refurbished as part of Phase 1D.

DOWNTOWN FLOODWALL AND PUMP STATION

The City of Norfolk's original floodwall, built by USACE in 1971, protects the downtown area from flooding. This system includes permanent floodwalls and a pump station that manage tidal flooding by moving water from low-lying areas into the Elizabeth River. The pump station and adjacent floodwalls protect the low-lying areas of downtown from tidal flooding. Five large steel gates, which typically remain open to allow access to the waterfront, are periodically closed during high tides to keep the water out. Beneath City Hall Avenue, which was once a canal, a large box culvert collects stormwater runoff from the downtown area; trash and debris are removed before the water is pumped into the river.

[Above Left]: A section of Norfolk's existing floodwall system, this steel floodgate can be closed to block storm surge and high tides during major storms.

[Above Right]: Inside a pump station, powerful pumps like these move stormwater back into the river when tides are high and runoff is not able to be expelled through outfall pipes.

[Right]: The downtown pump station discharges stormwater into the Elizabeth River, preventing flooding during high tides and storms.

PHASE 1D

Downtown

[Below]: The Downtown floodwall kept rising waters from flooding Downtown Norfolk during the October 2025 Nor'easter.

The original flood wall includes a swing gate for pedestrian access. When a storm approaches, crews can close the swing gate, keeping high tides and storm surge from inundating Downtown Norfolk.

[Left]: City staff test and maintain the swing gate regularly.

2 Pretty Lake

RISK REDUCTION MEASURES:

2026 STATUS:	FUNDING SOURCE:	2026 EXPENDITURE:	ESTIMATED COST:
< 15% Design 0% Construction	Federal, State and City	$3 Million	$520 Million

[Main Photo]:
Shore Drive Bridge
over Pretty Lake

2 PHASE 2 OVERVIEW

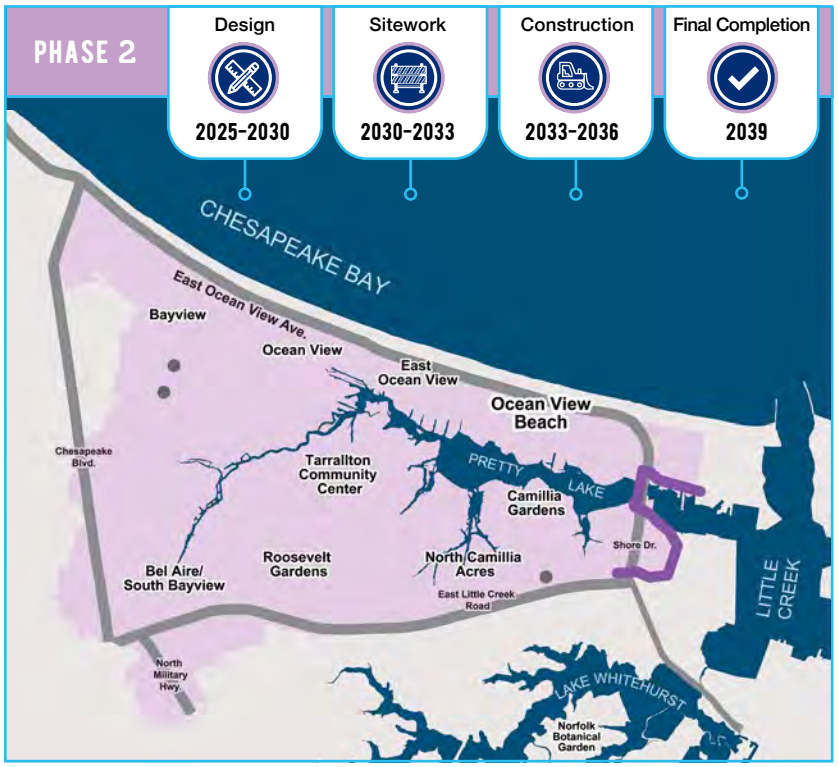
Phase 2 focuses on protecting the East Ocean View area, one of Norfolk's most flood-prone coastal zones. This phase features a system of floodwalls, storm surge barrier, tide gates, and a new pump station designed to keep storm-driven waters from entering Pretty Lake and its surrounding neighborhoods. In addition to these structural defenses, natural and hybrid infrastructure solutions, such as living shorelines and wetland restoration, will help absorb wave energy, stabilize the coast, and provide marine habitat. Together, these measures will strengthen flood protection while preserving the natural character of the area.

AREA PROJECTS PLANNED WITHIN PHASE 2

These planned projects will strengthen coastal protection during major weather events:

Pretty Lake Surge Barrier

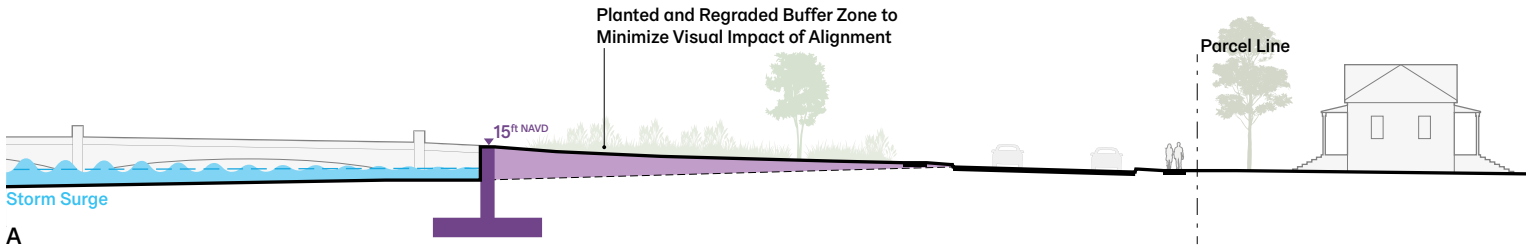
Floodwall & Pump Station

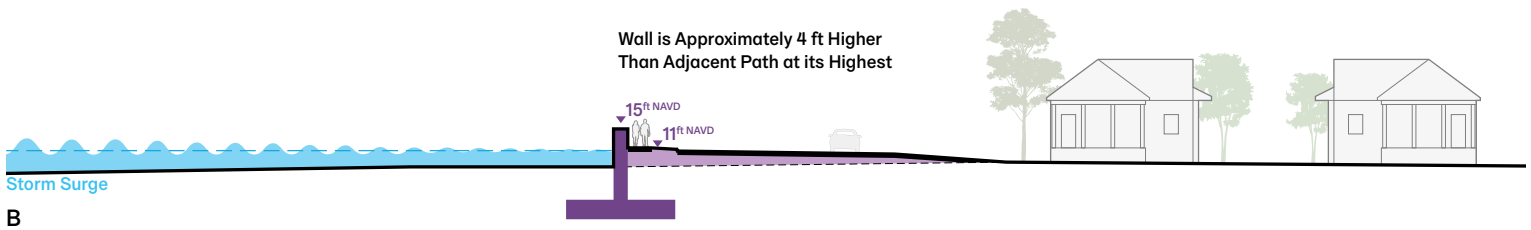


PRETTY LAKE

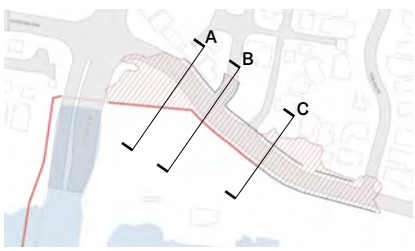
The Pretty Lake watershed is a vital ecological feature characterized by its diverse habitats and biological richness. It encompasses approximately 1,600 acres, primarily serving as a drainage basin for the surrounding urban landscape while playing a crucial role in flood management and water quality enhancement. The watershed acts as a natural filtration system, in which various flora and fauna thrive, contributing to the overall health of the Chesapeake Bay ecosystem.

PHASE 2 SECTIONS

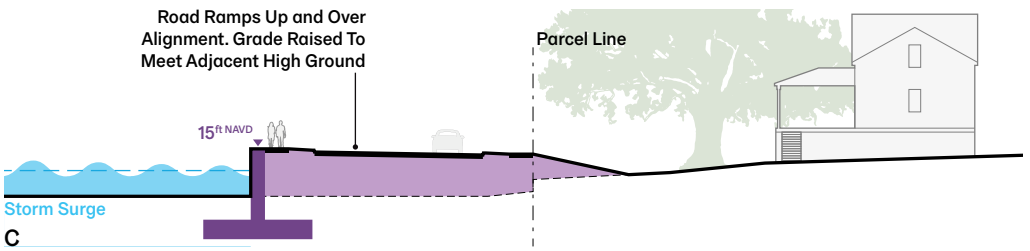




Section Key Drawing



Phase 2

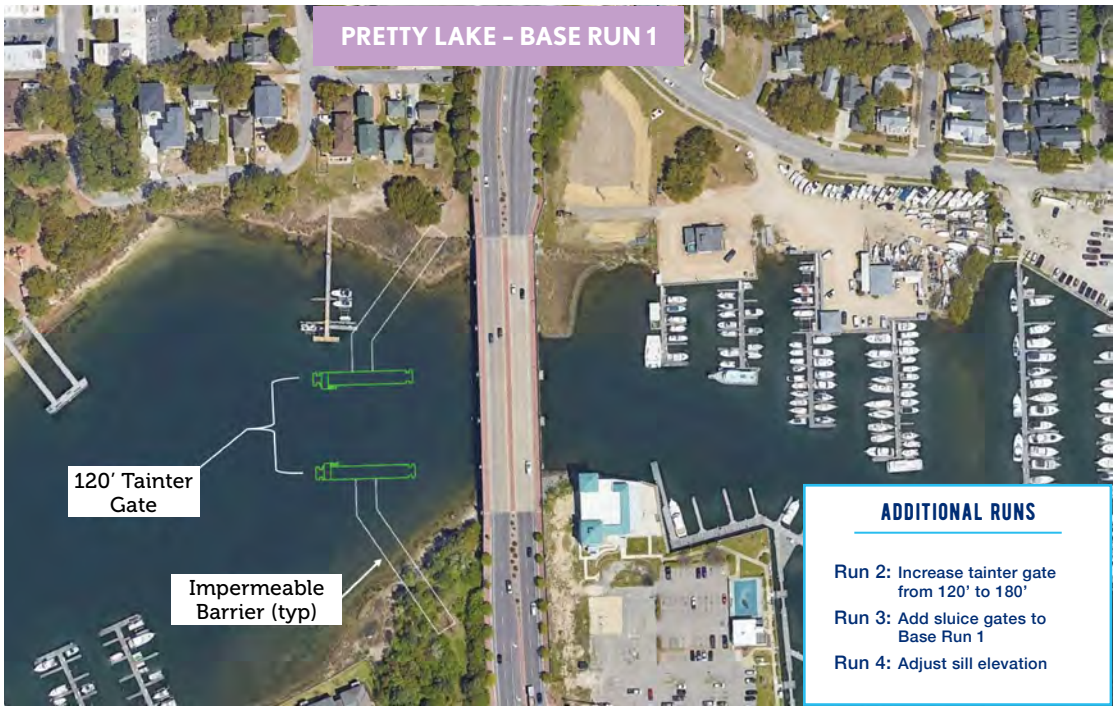


PHASE 2
Pretty Lake

This rendering shows the proposed Phase 2 alignment around Pretty Lake, where a combination of floodwalls, a navigable storm surge gate, and a new pump station will work together to reduce flooding and protect the East Ocean View community while preserving natural coastal features.

The Pretty Lake Surge Barrier will serve as a line of defense against coastal flooding from the Chesapeake Bay. Designed as a permanent structure with a tide gate, it will block storm surge from entering Pretty Lake during major storms, while allowing maritime traffic to navigate when the gate is opened. The barrier's location and elevation are carefully planned to minimize environmental impact while strengthening protection for homes, roadways, and essential infrastructure.

Working in tandem with the surge barrier, the Pretty Lake floodwall and pump station will help manage flooding from both storm surge and heavy rainfall. The floodwall will extend protection along lower elevations, while the pump station will move excess stormwater out of the area during high tides or heavy rain. Together, this system will provide continuous flood protection for the East Ocean View community.



3

Lafayette

RISK REDUCTION MEASURES:

2026 STATUS:	FUNDING SOURCE:	2026 EXPENDITURE:	ESTIMATED COST:
20% Design 0% Construction	Federal, State and City	$12 Million	$1.4 Billion

[Main Photo]: Norfolk Yacht Club on the Lafayette River

3 PHASE 3 OVERVIEW

The Lafayette River watershed is a critical ecological and hydrological system that encompasses approximately 43 square miles. This urban watershed is characterized by its diverse habitats, which include tidal marshes, freshwater wetlands, and subaquatic vegetation beds that support various wildlife species. Phase 3 includes a storm surge barrier and natural and hybrid infrastructure solutions.

AREA PROJECTS PLANNED WITHIN PHASE 3

Planned improvements include the following:

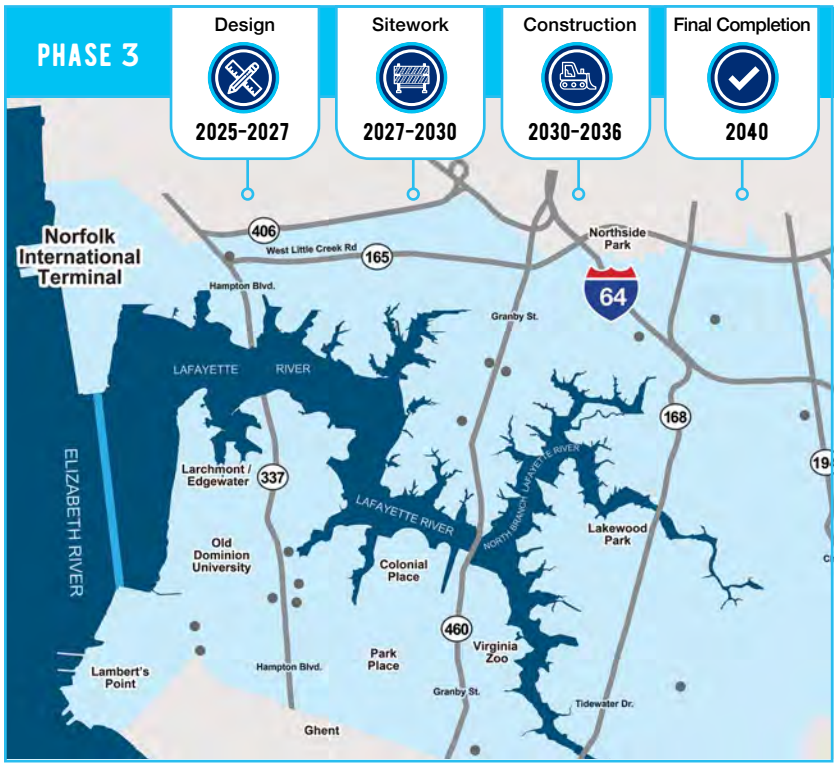
Lafayette Surge Barrier

Tie-in at Port & HRSD/Norfolk Southern

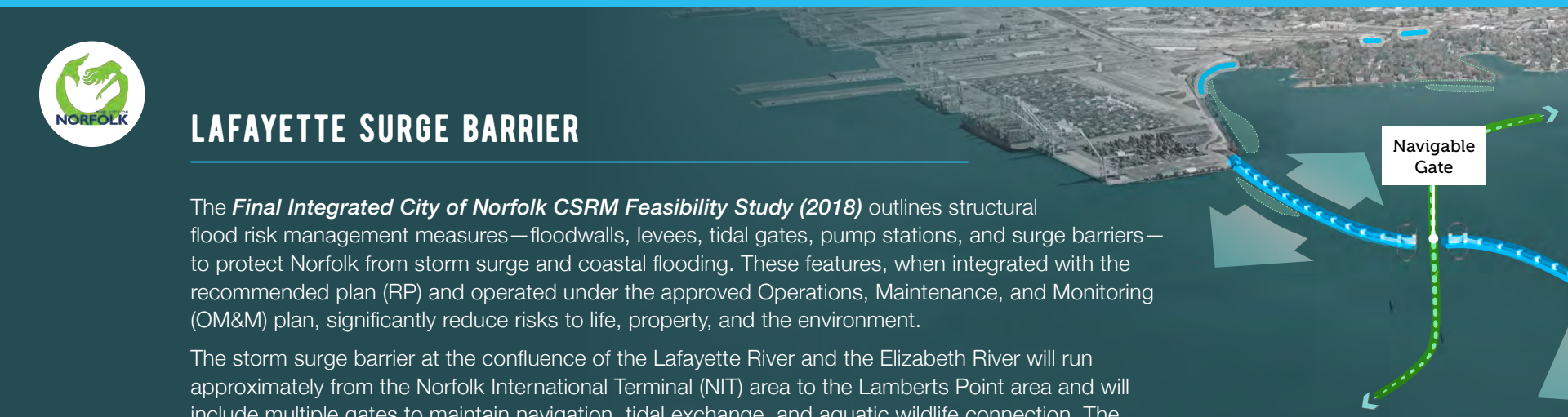
Lochaven

Richmond-Surry Crescent Shoreline Restoration

Lake Borgne



LAFAYETTE SURGE BARRIER



The ***Final Integrated City of Norfolk CSRM Feasibility Study (2018)*** outlines structural flood risk management measures—floodwalls, levees, tidal gates, pump stations, and surge barriers—to protect Norfolk from storm surge and coastal flooding. These features, when integrated with the recommended plan (RP) and operated under the approved Operations, Maintenance, and Monitoring (OM&M) plan, significantly reduce risks to life, property, and the environment.

The storm surge barrier at the confluence of the Lafayette River and the Elizabeth River will run approximately from the Norfolk International Terminal (NIT) area to the Lamberts Point area and will include multiple gates to maintain navigation, tidal exchange, and aquatic wildlife connection. The Phase 3 storm surge barrier system will reduce storm surge risk to the Lafayette River watershed (an area of approximately 18 square miles).

A large navigable gate will be incorporated into the storm surge barrier to maintain access for vessels traveling between the Lafayette and Elizabeth Rivers. During normal conditions, the gate will remain open to support navigation, tidal flow, and aquatic habitat. When major coastal storms are forecast, the gate will close to block storm surge from entering the Lafayette River, protecting nearby communities and critical infrastructure from flooding.

PHASE 3

Lafayette

CONNECTING SHORE TO SHORE

The tie-in at the Port of Virginia will connect the new flood protection system with existing infrastructure along the waterfront, creating a continuous line of defense. This connection point will ensure that floodwalls, levees, and other protective features work together seamlessly to prevent storm surge from entering through low-lying areas near the port. By reinforcing one of Norfolk's most critical economic and transportation hubs, the tie-in will strengthen both coastal resilience and regional stability.

The tie-in at Hampton Roads Sanitation District (HRSD) and Dominion will connect the Phase 3 storm surge barrier to existing flood protection features near key utility and energy facilities. This connection will ensure continuous protection along the Lafayette River corridor while safeguarding critical infrastructure that serves the region. By aligning with HRSD's wastewater systems and Dominion's energy assets, the tie-in will strengthen the overall resilience of Norfolk's coastal defense network and help protect essential public services from storm surge impacts.

Residential coastal flooding from October 2025 Nor'easter

LOCHAVEN

Within Phase 3, the Lochaven area will serve as a key connection point along the Lafayette River. Planned improvements here include levees between the neighborhood and Port that will link to adjacent flood protection features, helping to close gaps in the overall system. The work will focus on reducing localized flooding, improving stormwater management, and strengthening shoreline protection for nearby residential areas.

LAKE BORGNE, LOUISIANA

A key reference point for the City of Norfolk CSRM Recommended Plan is the Inner Harbor Navigation Canal—Lake Borgne Surge Barrier in southeast Louisiana. The CSRM project, includes similar structural components, was implemented in challenging environmental conditions and serves as a model for effective monitoring, operation, and maintenance. Its success demonstrates the importance of coordinated multi-agency efforts and transparent public communication before, during, and after storm events. The operational protocols outlined in its OM&M plan provide a valuable framework for Norfolk's approach to flood risk management.

RICHMOND-SURREY CRESCENT SHORELINE RESTORATION

The Richmond-Surrey Crescent Shoreline Restoration is part of a larger hybrid flood protection project that will reduce the risk of tidal flooding in parts of the Larchmont-Edgewater neighborhood and the adjacent Hampton Boulevard corridor. The overall project, under design in partnership with the Department of Public Works, will utilize low kneewalls and berms to provide an intermediate level of flood protection for small storm events and abnormal high tides that often flood the street at a level that would not trigger the planned Lafayette Surge Barrier for closure, but when the planned Lafayette Surge Barrier would not be triggered for closure. This grey infrastructure solution will be paired with a living shoreline component, part of the Norfolk Coastal Storm Risk Management project's natural and hybrid infrastructure solution program.

The Richmond-Surrey Crescent Shoreline Restoration will include approximately 700 feet of restored marsh and 1800 feet of riprap revetment seeded with oysters to create a reef habitat. These features will be installed to replace an existing concrete bulkhead, which has reached the end of its serviceable life, along the waterfront adjacent to Richmond Crescent and Surrey Crescent. The berm and kneewall structures will be constructed between the road and shoreline features.

The living shoreline will also tie into two nearby green assets: the Myrtle Park wetland between Richmond and Surrey Crescent and the Birdsong wetland at Larchmont Library, one of the earliest living shorelines constructed in Virginia. The project is currently under design and will demonstrate an excellent example of layered resilience using hybrid grey-green approaches.

4

Broad Creek

RISK REDUCTION MEASURES:

2026 STATUS:	FUNDING SOURCE:	2026 EXPENDITURE:	ESTIMATED COST:
<15% Design 0% Construction	Federal, State and City	$3 Million	$658 Million

[Main Photo]:
Residential area
along Broad Creek

4 PHASE 4 OVERVIEW

Phase 4 covers the eastern portion of the City along the eastern branch of the Elizabeth River. It includes a surge barrier across Broad Creek, a pump station, and floodwalls running parallel to I-264 south of the HRT Tide Light Rail tracks tying into surrounding high ground. The measures will prevent floodwaters from the Elizabeth River from entering the Broad Creek watershed. A railroad gate will be needed at the Norfolk Southern railroad tracks in Chesterfield Heights.

The results of the Virginia Beach Coastal Storm Risk Management feasibility study may impact the recommended plan. Design is expected to start in 2028, sitework in 2031, and construction in 2033.

AREA PROJECTS PLANNED WITHIN PHASE 4

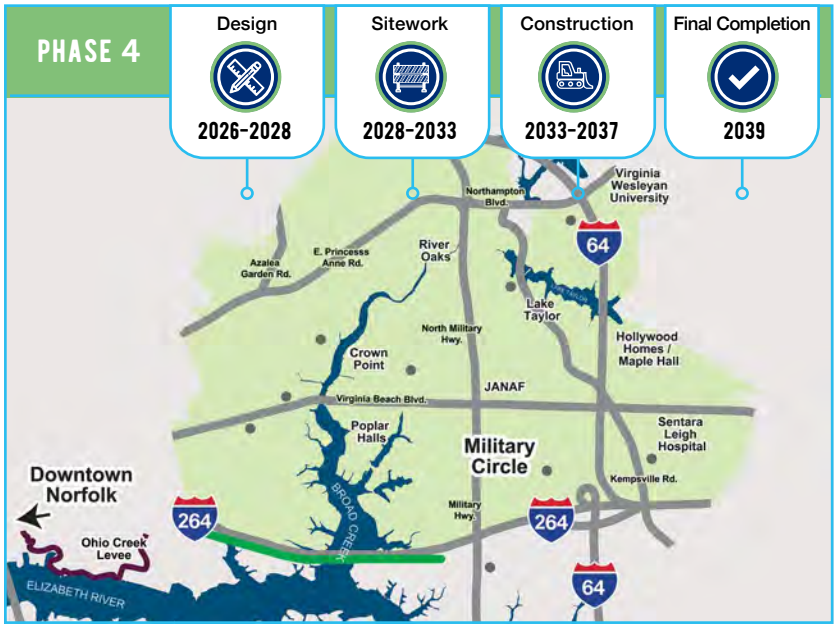
Planned improvements include the following:

Broad Creek

Norfolk Southern Crossing

Tide Gates in Neighborhood

Pump Station



PHASE 4

Broad Creek

BROAD CREEK

This project will include a system of over-land floodwalls and a storm surge barrier near the I-264 crossing of Broad Creek. The storm surge barrier will include one or more gates to maintain navigation, tidal exchange and aquatic wildlife connection. The Phase 4 floodwall and storm surge barrier system will reduce storm surge risk to the Broad Creek watershed (an area of approximately 7 square miles).

NORFOLK SOUTHERN CROSSING

The Norfolk Southern Crossing will integrate a railroad gate into the Phase 4 flood protection system where the alignment meets the Norfolk Southern tracks near Chesterfield Heights. This critical feature will allow train operations to continue under normal conditions while maintaining flood protection during major storm events. When closed, the gate will prevent storm surge from traveling inland along the rail corridor—an area that otherwise provides a direct path for floodwaters from the Elizabeth River. By coordinating with Norfolk Southern and other transportation partners, the project ensures both rail reliability and strengthened coastal resilience for nearby neighborhoods.

TIDE GATES IN NEIGHBORHOOD

Tide gates will be installed in the headwaters of several small creeks winding through neighborhoods such as River Forest Shores and Elizabeth Park. During normal conditions, these gates will remain open to allow water to flow freely; during high-water events, they will be closed to ensure floodwaters cannot bypass flood barriers through creeks, ditches, and stormwater pipes.

PUMP STATION

The pump station will collect stormwater from low-lying streets and properties and pump it into the river when water levels are too high for gravity drainage. By keeping water moving even when the surge barrier is closed, the system helps prevent flooding and protects homes and infrastructure in Neighborhoods along Broad Creek.

NS

Nonstructural

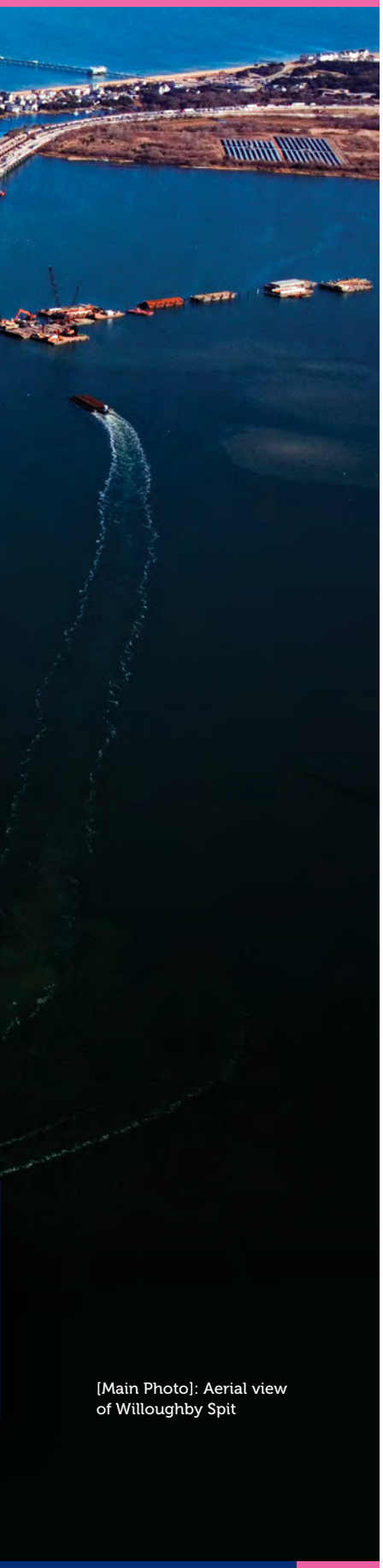
RISK REDUCTION MEASURES:

2026 STATUS:
<5% Design
0% Construction

FUNDING SOURCE:
Federal,
State and City

2026 EXPENDITURE:
$1.2 Million

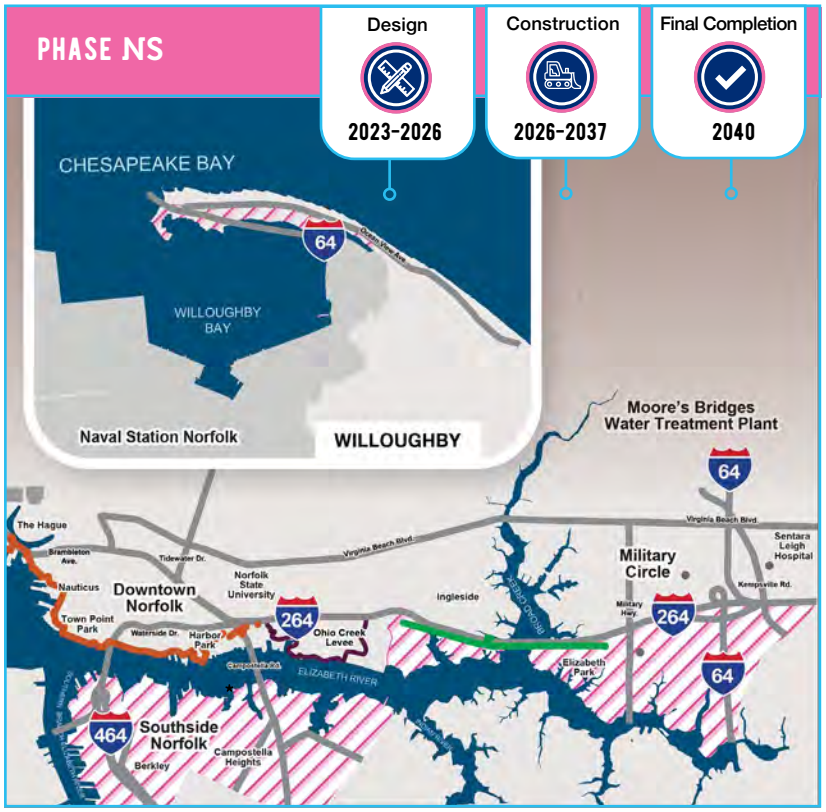
ESTIMATED COST:
$665 Million



[Main Photo]: Aerial view of Willoughby Spit

NS NON-STRUCTURAL OVERVIEW

The project's Nonstructural Program is a voluntary program that includes a series of property-specific flood mitigation projects designed for individual properties most at risk of flooding from coastal storms. These improvements will help reduce damages from flooding and will be located where structural features, such as a floodwall, are not possible. Mitigation measures will be paid for by the CSRM project.



[Southside Norfolk]:* This area may transition from a Nonstructural approach to an alternative plan recommended by USACE, pending the results of the ongoing General Reevaluation Report (GRR).

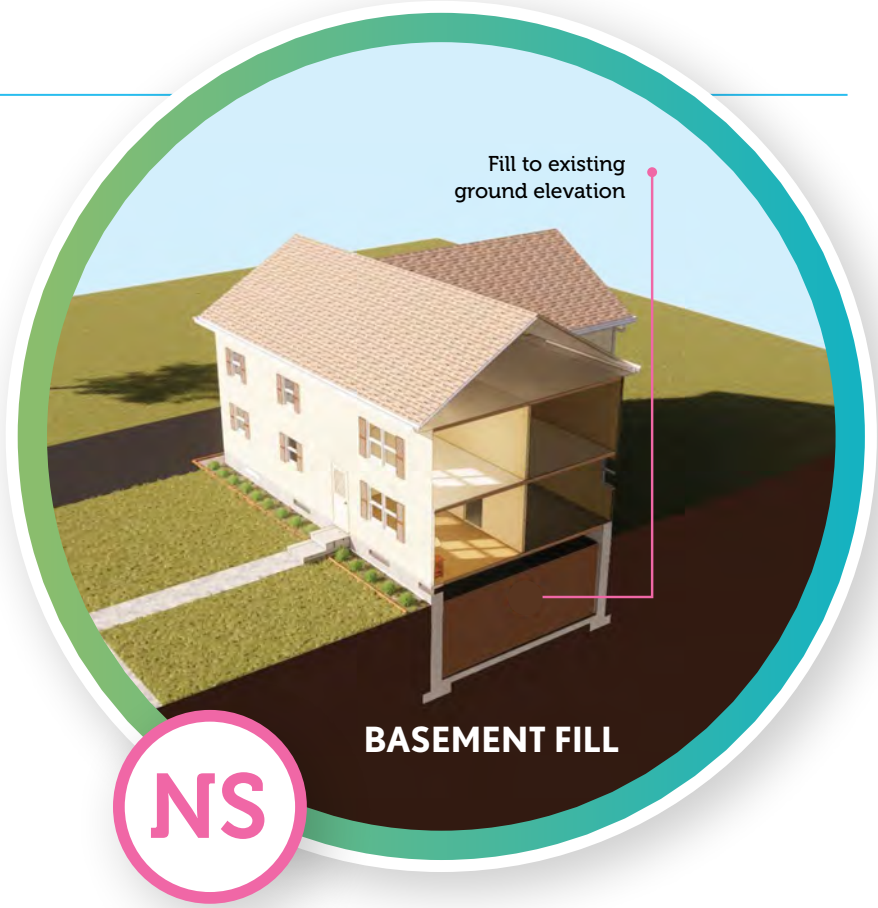
TYPES OF NONSTRUCTURAL MITIGATION MEASURES

Property-specific, nonstructural improvements focus on reducing the damages from flooding, rather than reducing the probability of flooding events. This project includes basement fills, floodproofing of commercial structures, and home elevations.

Basement fills involve backfilling the home's basement with soil, essentially converting the basement into a crawl space, which raises the lowest level of the home above the flood level.

Commercial floodproofing techniques include door barriers, wall barriers, and sealants, which can prevent water from infiltrating buildings. By implementing these solutions, commercial businesses can not only protect their assets but also safeguard their employees by creating more resilient work environments that can quickly bounce back following a flood event.

Home elevations raise the foundation of a house above the flood level. This can be accomplished by reconstructing the foundation to completely lift the house. Home elevations are especially useful in areas where floods are likely to occur often. Raising the home above the flood level prevents floodwater from entering the living space.



COMMERCIAL FLOODPROOFING

NONSTRUCTURAL ELIGIBILITY

Approximately 1,000 properties were identified as pre-eligible for the Nonstructural Program in the CSRM Feasibility Study. Because of the program's scale, outreach will occur in phases, beginning with the properties identified as the most at risk of flooding.

Participation is voluntary, and eligibility will be confirmed before work begins. The City of Norfolk will verify and update property data, develop an application process, and guide property owners through enrollment. This phased approach ensures that resources are prioritized for the most vulnerable properties while building capacity for future participation.

Application: Pre-eligible properties apply for the Nonstructural Program to determine final eligibility and agree to the program.

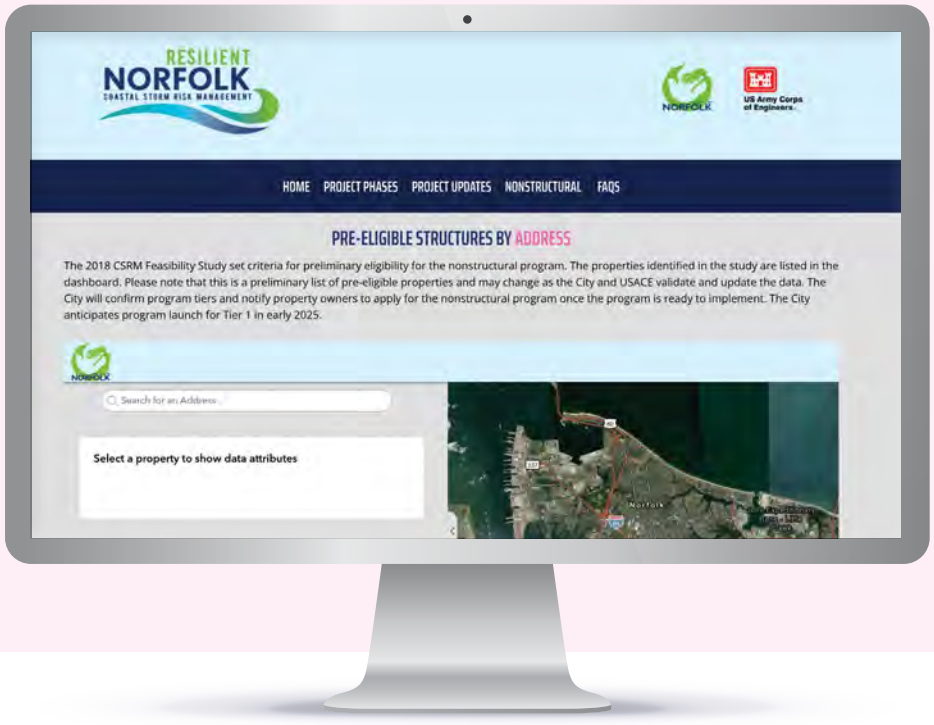
Design/Build Stage: Property owner is assigned a contractor. The contractor works with the City and property owner to complete the work.

Inspection Stage: Property owner must comply with the Operations, Maintenance, Repair, Rehabilitation and Replacement Manual. Compliance must continue for the life of the property and the City may conduct periodic inspections to ensure compliance.

ONLINE TOOL

Norfolk residents are able to check whether their properties are pre-eligible for the Nonstructural Program on the ResilientNorfolk.com website using the online nonstructural eligibility tool. In addition to eligibility, the online tool will also identify the mitigation measure for pre-eligible properties.

NS



CRITICAL INFRASTRUCTURE

As part of the Resilient Norfolk (CSRM) Project, critical facilities in Norfolk were identified to be at risk from coastal storm events. Separate flood mitigation measures are proposed to reduce flooding risk to these critical assets and to ensure the flood resilience of these facilities, which are vital to essential City operations before, during, and after large-scale storm events.

Disruption to operations at the critical infrastructure facilities can have immediate and wide-scale impacts to the local communities, areas of Norfolk, and the greater Hampton Roads Region.

The following examples are flood mitigation measures being evaluated at the various critical infrastructure sites:

- Elevating critical equipment, buildings, or access points
- Internal floodproofing to structures
- Updating existing critical systems to allow operation during storm events
- Constructing small sections of floodwall, or earthen levees and temporary floodwall barriers/defenses
- Improving ground conditions to slow or prevent seepage flow paths
- Installing flood gates and/or deployable flood barriers
- Enhancing pumping systems and backflow valves on utilities/drainage
- Sealing/waterproofing existing walls
- Sealing/removing existing utilities or services that enter exterior walls and foundations

Moore's Bridges
Water Treatment Plant

Critical infrastructure facilities in the City include water treatment plants, waste water treatment plants, pumping stations and highway facilities.

These facilities are crucial to the services provided by the City.

RESILIENT NORFOLK

PRESERVING NORFOLK

The Resilient Norfolk Coastal Storm Risk Management Project offers significant benefits to the Norfolk region by enhancing its resilience against coastal flooding and storm surges. The project reduces the risk to the area's critical infrastructure and community facilities, as well as the City's residents, workers, and visitors.

6 police facilities

102 places of worship

43 schools

4 hospitals

11 fire stations

705 miles of road

152* pump stations

68,080 buildings

181,000 residents

3,362 total commercial properties

$23,162,500,000
total real estate value

* This number encompasses all types of pump stations, including those for water, wastewater, and stormwater.

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