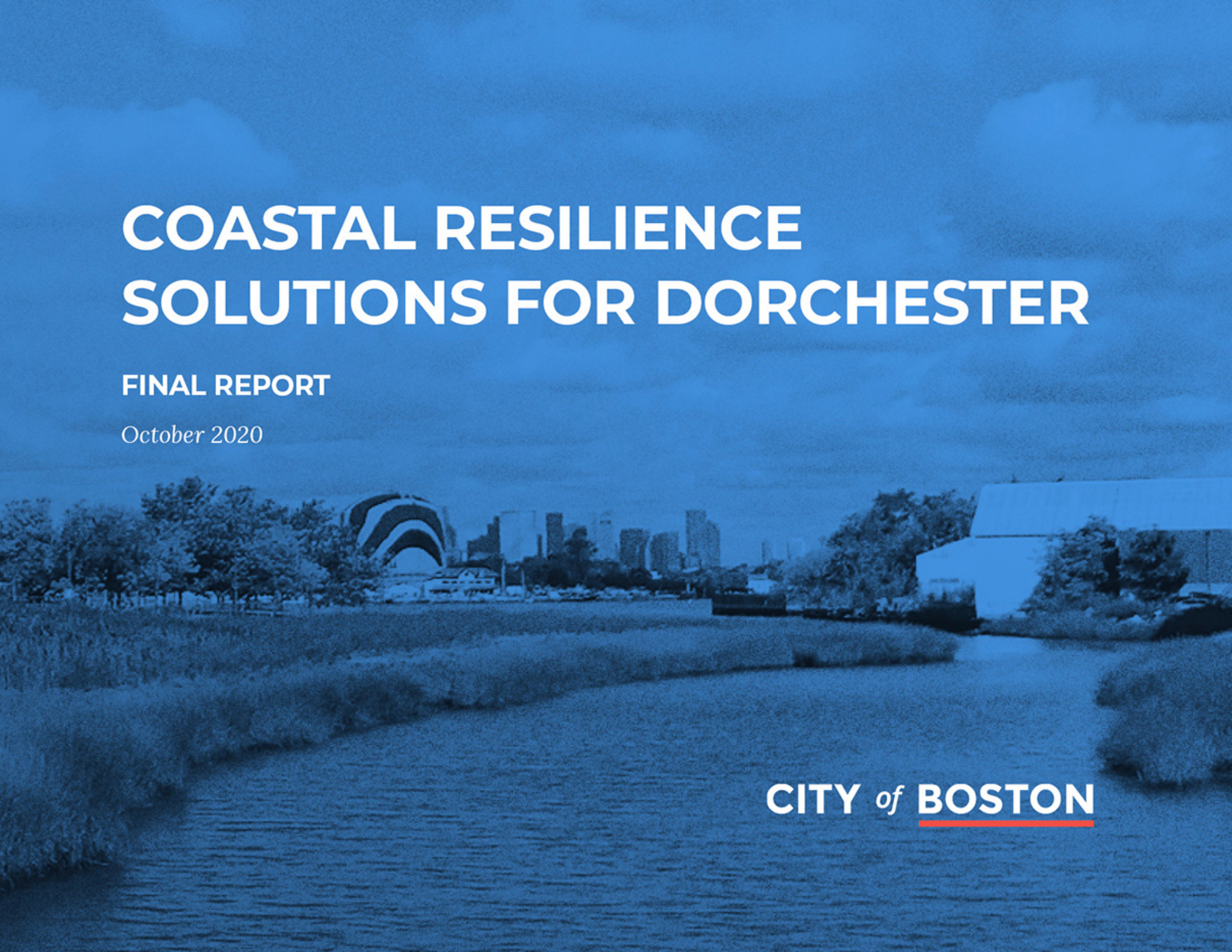
COASTAL RESILIENCE SOLUTIONS FOR DORCHESTER

FINAL REPORT

October 2020



CITY of BOSTON

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Coastal Resilience Solutions for Dorchester is part of Climate Ready Boston, the City's ongoing initiative to help prepare for the impacts of climate change and build a resilient future. We continue to work with local communities and other partners to advance our vision for a Climate Ready Boston.

Mayor Martin J. Walsh

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OCTOBER 2020

Dear Neighbors,

As our city and our world continue to battle the COVID-19 pandemic, it's never been more clear how important it is to listen to the science and plan for the future. The same goes for climate change. It is the defining challenge of our time. Boston is a coastal city, so we understand what's at stake. And that's why we've been taking bold action to prepare for and mitigate the effects of climate change over the last several years.

As a society, we talk about wanting life to "go back to normal" after the pandemic ends. But this pandemic has shined a light on the enduring challenges and inequities we have to face as a society. We must work together to create a new and better normal–one that prioritizes sustainability, public health, and protects the most vulnerable members of our community.

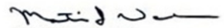
Climate Ready Boston is a crucial part of this work. It's our roadmap for preparing Boston's neighborhoods for the impacts of climate change, and keeping our communities strong and resilient. Working with the community, we are developing comprehensive plans for each of the Boston neighborhoods that the science predicts will experience the biggest climate impacts, including Dorchester.

The Climate Ready Dorchester report outlines our strategies for protecting Dorchester's diverse residents, community spaces, and local businesses from the impacts of climate change, including coastal flooding and sea-level rise. From Morrissey Boulevard and Tenean Beach, to Lower Mills, Codman Square, and Upham's Corner, this report provides an in-depth look at our efforts. It includes near-term and long-term strategies to help make Dorchester more resilient for many years to come.

Throughout the Climate Ready Dorchester planning process, we have worked closely with Dorchester residents to hear their concerns and develop a variety of solutions. We look forward to continuing to work with the community as we further develop and implement these plans. This report works hand-in-hand with our ongoing vision for an entire city coastline built for recreation and resilience, which we call Resilient Boston Harbor.

As the son of immigrants who was born and raised in Dorchester, I've seen how climate change has already impacted this part of the city, and I am committed to protecting the homes of our families, friends, neighbors, and our parks and local businesses, too. This plan will help Dorchester, and the entire City of Boston, stay strong for years to come.

Sincerely,



Mayor Martin J. Walsh

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1 VISION

"We envision a resilient, accessible, and connected shoreline in Dorchester. We want to expand beaches and create better access to the waterfront."
– Resilient Boston Harbor

Source: Resilient Boston Harbor Vision (2018)

"The Dorchester Waterfront can become a more accessible and appealing destination with a pedestrian-friendly waterfront, a naturalized shoreline landscape, and flood protection for inland areas." – Imagine Boston 2030

THE DORCHESTER SHOREWAY

From the iconic Moakley Park to the beloved Neponset River Reservation and Greenway, the Dorchester shoreline stretches 9.5 miles along Boston Harbor and the Neponset River. Open spaces, marshes, and parks line the waterfront, but these spaces are not connected to each other or to adjacent inland communities. The Southeast Expressway (I-93) runs parallel to the shoreline, severing the connection between neighborhoods and the waterfront. Today, only limited points of access remain, and these align with the major inundation pathways of future flood events. **Coastal Resilience Solutions for Dorchester** expands the vision for the future of the Dorchester shoreline, offering strategies to ***adapt*** to coastal flood risk while also establishing a framework to ***connect*** the waterfront parks, beaches, and marshes in Dorchester, transforming them into one accessible, continuous waterfront – ***The Dorchester Shoreway.***

> *"It's important to create a vision that is thinking about climate adaptation in coordination with transportation, ecology, and cultural issues!"*
> *– ONLINE SURVEY 2 RESPONDENT*

PROJECT PURPOSE AND GOALS

The purpose of this plan is to develop near-term and long-term risk reduction solutions for coastal flooding and sea-level rise specific to Dorchester's diverse shoreline and population.

PROJECT GOALS

Four goals articulate the planning and design aspirations for the solutions presented in the *Coastal Resilience Design Solutions* chapter of this report. The primary goal and major focus of the plan is to **develop solutions to equitably reduce coastal flood risk** in Dorchester. These solutions also **enhance access and mobility**, **promote the health of valuable ecosystems**, and **reinforce a connected, cohesive sense of place**.

DEVELOP SOLUTIONS TO EQUITABLY REDUCE COASTAL RISK

The primary and critical goal of the plan is to identify near- and long-term solutions to reduce and manage the risk of future coastal flooding and sea-level rise. All solutions plan for a 1% annual chance flood with 40 inches of sea-level rise (2070s). In order to equitably reduce coastal risk, the plan considers the entire neighborhood, including the inland communities, to ensure that all Dorchester residents benefit from proposed solutions.

ENHANCE ACCESS AND MOBILITY

The solutions proposed in the plan ensure or enhance the mobility of Dorchester residents in the face of rising sea-levels and increased risk of coastal flooding, now and into the future. More resilient infrastructure will preserve and increase access and connectivity of Dorchester residents to the region and other neighborhoods in the city. This will impact the opportunities residents have to build and maintain community and improve health and wellbeing. The plan also improves access to the Dorchester waterfront from inland neighborhoods and connects the waterfront spaces through an accessible, continuous waterfront circulation network.

PROMOTE THE HEALTH OF VALUABLE ECOSYSTEMS

Much of the project area, from Victory Park to the Neponset River Dam, is an estuary and within a state-designated Area of Critical Environmental Concern (ACEC). Estuarine habitats, particularly tidal wetlands, exist in small and large patches along the shoreline; the plan seeks to preserve or enhance these existing habitats within the context of the regulations and value of the ACEC. In addition, the Plan's proposals, where appropriate, provide opportunities and support for existing habitat and ecosystems to migrate and adapt to sea-level rise.

REINFORCE A CONNECTED, COHESIVE SENSE OF PLACE

When connected, the waterfront can transform from a series of discrete, disconnected spaces into one coherent, linked community destination for all Dorchester residents and other residents of the City of Boston. An established, connected destination waterfront draws more people to the water's edge and creates a shoreline for future generations through placemaking, education, and stewardship, aligning with the goals and aspirations of *Imagine Boston 2030*.

A VISION GROUNDED IN COMMUNITY PRIORITIES

A series of activities, including open houses, neighborhood meetings, and online surveys, enabled residents and other stakeholders to convey their priorities, identify and describe the impacts of existing coastal flooding, express their hopes and aspirations, and co-craft a vision for the Dorchester Shoreway.

PLAN PRIORITIES

Open house and online survey participants engaged in a series of activities to inform and provide feedback, including prioritizing six evaluation criteria. **Effectiveness**, **Social Equity & Quality of Life**, and **Environmental & Public Health Benefits** emerged as top priorities. These specific evaluation criteria coupled with more detailed feedback from other activities generated three core principles that contributed to the development of the plan.

REDUCE COASTAL FLOOD IMPACTS

Residents' comments about effectiveness centered on the need to ensure that all future improvements provide risk reduction and flood protection benefits under the current projections for sea-level rise and can be adapted to potential changes in those climate projections in the future. In addition, residents who have already experienced flooding emphasized the need for clear evacuation routes and preventing

> *"There's now an immense opportunity to redesign coastal areas to be more public, more bike and pedestrian friendly, and less car dependent."*
> – ONLINE SURVEY 2 RESPONDENT

> *"Important transportation corridors like Morrissey Boulevard, the MBTA Red Line, the Mattapan Trolley, and the Southeast Expressway need to become resilient and more efficient!"*
> – OPEN HOUSE 1 PARTICIPANT

streets from being blocked by floodwaters. Residents highlighted the social equity implications, especially for people of color, low-income residents, people with disabilities, older adults, and people living with medical illness who are all disproportionately burdened by flooding. Addressing their specific situations and risks will benefit all residents.
Many residents expressed concerns regarding stormwater flooding in areas within and outside of the floodplain and highlighted the desire that, where possible, solutions for coastal flooding should also help address stormwater issues. In all cases, solutions should not make stormwater flooding worse.

PROTECT OR ENHANCE MODES OF SAFE MULTI-MODAL TRANSPORTATION

Residents were concerned about the vulnerability of key infrastructural corridors and prioritized solutions that will reduce flood impact to infrastructure, such as Morrissey Boulevard and the Red Line. This will ensure that the day-to-day life of the community is not disrupted, and that the solutions align with the goals outlined in GoBoston 2030, the City's comprehensive transportation plan. Community members also felt coastal resilience solutions should enhance the safety, comfort, and ease of walking, biking, and taking public transit in addition to driving.

VALUE WATERFRONT PUBLIC SPACE, CONNECTIVITY, AND SAFETY

Many community members shared their love of the greenways and parks along the Neponset Trail and in South Dorchester, praising the recreational opportunities currently available and suggesting these opportunities be expanded to include more water-based activities, such as swimming and boating, and to serve a larger area of the neighborhood.

> *"Natural and nature-based solutions I think harness the connection to the power of natural systems. There is wide spread erosion of natural habitats that have dire consequences to all forms of life locally and globally. We need to rebuild that connection and reintroduce respect for those systems."*
>
> – ONLINE SURVEY 2 RESPONDENT

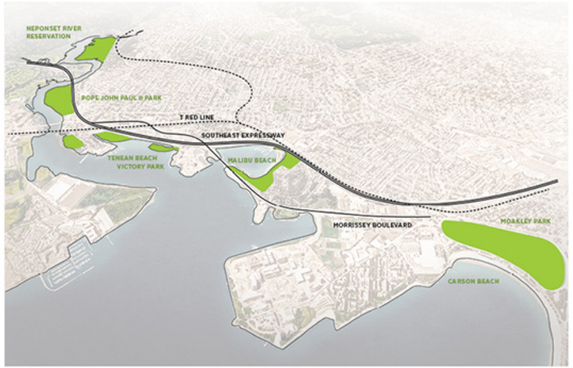
> *"We need to be preparing for larger and less frequent storm events, not just 100-year storms. We need to be creating flexible and adaptable solutions."*
>
> – ONLINE SURVEY 1 RESPONDENT

Many people flock to this area for the respite from city life and to connect with natural systems, and residents emphasized the need for care and preservation of some of the existing valuable ecosystems, such as the Neponset River Estuary. In other areas like Clam Point, Port Norfolk, and Malibu Beach, community members expressed discontent with the quality of access to the waterfront, commenting on the lack of safe or comfortable pedestrian access and the automobile-dominated character of the few connecting roadways. Many felt future interventions should improve the community's ability to safely access the waterfront, particularly on foot and by bike.

Lastly, residents felt that future interventions should both provide access for inland communities into other areas of the city. and a safe connection to public waterfront spaces. In doing so, the City will facilitate an approach that addresses the lack of access, especially for communities of color that have been historically excluded. Better connectivity ensures that all of Dorchester belongs to all Dorchester residents.

> *"We can not only avoid future damages, but also create employment opportunities, and new open space through the creation of wetlands."*
>
> – OPEN HOUSE 1 PARTICIPANT

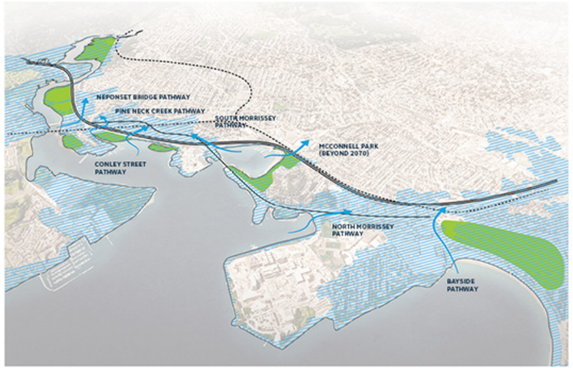
THE CURRENT CONDITION



A DISCONNECTED WATERFRONT

Currently, the Dorchester waterfront is home to a series of beaches, parks, preserves, and other open spaces. These include Malibu Beach, Victory Park, Tenean Beach, Joe Finnegan Park, Pope John Paul II Park, and the Neponset River Reservation. These open spaces are not all continuously connected, and many are disconnected from the inland neighborhoods due to the historical context of redlining and inequitable distribution of valued resources, including usable open and green spaces. Neighborhood access to these parks and ecological preserves is limited to only a few points where the local road network crosses under the Southeast Expressway. For more information, see ***Chapter 2: Context***, on p. 21.

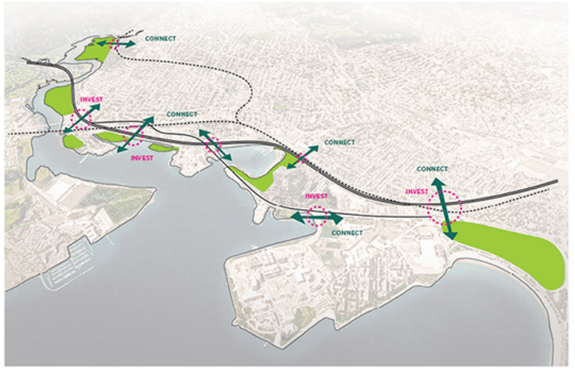
FUTURE COASTAL FLOOD RISK



INUNDATION PATHWAYS ALIGN WITH POINTS OF ACCESS TO THE WATERFRONT

The few locations where access to the waterfront from inland neighborhoods is possible are also major inundation pathways for coastal flooding. For more information on the nature of coastal risk in the neighborhood, see ***Chapter 3: Coastal Flood Risk***, on p. 47.

COASTAL RESILIENCE DESIGN SOLUTIONS



INVEST IN KEY LOCATIONS TO ENHANCE RESILIENCE & ACCESS AND CREATE MORE SHORE FOR OPEN SPACE, ECOSYSTEMS, AND COASTAL RISK REDUCTION

The Plan proposes strategic investments at points where inundation pathways put neighborhoods at risk. These improvements will simultaneously address coastal flood risk and enhance access from the neighborhood to the waterfront. For residents of Dorchester, investments in these key locations will mean reduced coastal flood risk to homes, businesses, and transit infrastructure, as well as improved, more accessible waterfront amenities and open spaces.

The Plan aims to expand and improve existing waterfront resources, connect them from north to south, and help waterfront communities adapt to climate change while maintaining their relationship with the water. A series of marshes, beaches, and parks will combine continuous public access and coastal flood adaptation strategies to create a more engaging, resilient waterfront for the Dorchester neighborhood. For more information, see ***Chapter 4: Coastal Resilience Design Solutions***, on p. 75.

2 CONTEXT

"Boston is at a unique point in our history. Our population is growing and becoming more diverse. Our economy is robust and dynamic [...] The responsibilities of our city are expanding as we strengthen our role as a safe harbor for immigrants and a national leader in preparing for climate change." – Martin J. Walsh, Mayor

Imagine Boston 2030

A step toward a more, equitable, connected, and resilient future.

Climate change is real for Bostonians. As the climate changes, the likelihood of coastal and riverine flooding–as well as other hazards, such as stormwater flooding and extreme heat–will increase. The challenges are substantial and complex but can be addressed through bold and creative actions that support Boston's vitality and livability. The City is paying attention to the evidence and preparing for the impacts of climate change. Boston is taking comprehensive action to help its people, its neighborhoods, and its economic and cultural assets adapt, ensuring that they will continue to thrive in the coming decades. Climate adaptation is an opportunity to create a resilient, climate-ready Boston, and improve the quality of life for all.

Coastal Resilience Solutions for Dorchester builds upon the ongoing Climate Ready Boston planning efforts to increase Boston's ability to thrive in the face of intensifying climate hazards, leading to improved quality of life for all residents as Boston continues to grow.

Through Imagine Boston 2030, the City's first masterplan in 50 years, the City identified areas that have capacity to accommodate Boston's growing population and dynamic economy. Many of the areas where Boston is expected to grow will be exposed to increasing flood risk as sea-levels rise. As these areas grow, Boston is committing to protecting them. As part of the City's effort to invest in developing local climate resilience plans for vulnerable areas, this plan is the fourth neighborhood plan that identifies near-term and long-term actions and multilayered investments needed to enable climate-ready growth.

Climate adaptation presents Boston with opportunities for carefully managed equitable growth and investment that ensure neighborhoods can thrive, communities are ready for the changing climate, jobs are created, and expertise is developed for long-term growth and adaptation.

PROJECT PLANNING CONTEXT

Coastal Resilience Solutions for Dorchester is a neighborhood-specific plan to identify coastal resilience solutions to address the impacts of climate change, specifically coastal flooding and sea-level rise.

The coastal resilience solutions developed as part of this initiative aim to enhance the physical and social resilience of Dorchester while also addressing existing issues of neighborhood connectivity, waterfront accessibility, and equity. Coastal Resilience Solutions for Dorchester builds on and complements many recent and ongoing planning efforts and Mayor Martin J. Walsh's Resilient Boston Harbor Vision, released in 2018.

The framework for making Boston resilient was established in the *Imagine Boston 2030* city-wide plan and has been reinforced through half a decade of planning. The plan advocated for the creation of "A Waterfront for Future Generations," prioritizing equitable access to and along the shoreline and for the environmental stewardship needed for the waterfront to thrive in a rapidly changing climate. Climate Ready Boston (see p. 24) and Resilient Boston (see p. 35) also expand and reinforce these ideas. Each of these city-wide plans has spun off a range of other area-specific efforts that rely on the same frameworks and take them a step further toward implementation. For instance, Coastal Resilience plans in the North End, South Boston, Charlestown, East Boston, and Downtown, and the Moakley Park Vision Plan dovetail with one another to advance planning simultaneously along the entire Boston Harbor.

In parallel with the neighborhood-level plans, the City is advancing several city-wide initiatives that complement them and will ensure that the city, its neighborhoods, and residents have the tools to implement climate adaptation. The Coastal Flood Resilience Design Guidelines and future Zoning Overlay address regulatory changes needed to enable resilience in the private realm. The Climate Resilient Design Standards and Guidelines from Boston Public Works Department provide the design process for evaluating flood barriers to protect Boston's public right-of-way. Resilient Boston outlines strategies within four long-term vision areas crafted to build the resilience of the City of Boston with particular consideration given to its history of racism, segregation, and racial inequities. The City's layered approach to resilience will be essential for effective implementation over the coming decades.

CLIMATE READY BOSTON

Boston can thrive in the coming decades if it takes action to adapt its people, its neighborhoods, and its economic and cultural assets, starting now.

Climate Ready Boston is the City's initiative to prepare Boston for the long-term impacts of climate change. The 2016 Climate Ready Boston report assessed Boston's vulnerabilities to climate impacts and recommended initiatives to build resilience across neighborhoods, infrastructure, buildings, and resident populations—particularly the most vulnerable. Climate Ready Boston was a major step in integrating climate preparedness into all aspects of city planning, review, and regulation and included:

- Updated climate projections;
- Comprehensive evaluation of current and potential future risks through a vulnerability assessment study;
- Eight focus areas with spatially concentrated flood risk, including Dorchester; and
- Climate Resilience Initiatives in policy, planning, programmatic, and financial initiatives to address the identified risks.

SITE CONTEXT

The largest neighborhood in Boston is also the most diverse. Long-time Dorchester residents are neighbors with new immigrants from Vietnam, Cape Verde, Ireland, and many other countries.

DORCHESTER NEIGHBORHOODS & NEW DEVELOPMENT

Dorchester is bounded by South Boston to the north, Dorchester Bay to the east, the Neponset River to the south, and Mattapan and Roxbury to the west. Dorchester consists of a number of distinct residential sub-neighborhoods, anchored by commercial districts, where residents and local businesses depend on a resilient waterfront to thrive. The neighborhood covers areas along Dorchester Bay, Morrissey Boulevard, and the Neponset River, including Adams Village, Ashmont, Bowdoin/Geneva, Cedar Grove, Clam Point, Codman Square, Columbia Point, Grove Hall, Jones Hill, Lower Mills, Neponset Circle, Port Norfolk, Savin Hill, and Uphams Corner. Dorchester has benefited from the recent expansion of the Fairmount MBTA Line, which runs from Downtown to Readville, with three new stations in Dorchester (Newmarket, Four Corners/Geneva Avenue, and Talbot Avenue). The City is planning transit-oriented development along the Fairmount Line.

CLIMATE READY BOSTON NEIGHBORHOOD PLANS

Coastal Resilience Solutions for Dorchester is the next in a series of recent plans for Downtown and North End, South Boston, and East Boston and Charlestown. Following this plan, the City will be looking at the second phase of East Boston and Charlestown. After this, the City will have a comprehensive look at risks, options for resilient solutions, and timelines for implementation along the Boston waterfront. These will be utilized to build a city-wide set of priorities and implementation processes for future action.

ADJACENT COMMUNITIES

The long-term success of the Coastal Resilience Solutions for Dorchester Plan will depend upon coordination with adjacent Boston neighborhoods and north shore and south shore communities, and with recent and ongoing resilience efforts. This plan aims to be an asset for future coordination with areas, including:

- South Boston
- Mattapan
- Town of Milton
- City of Quincy, and
- other communities along the Neponset River.

ONGOING PLANNING AND DEVELOPMENT

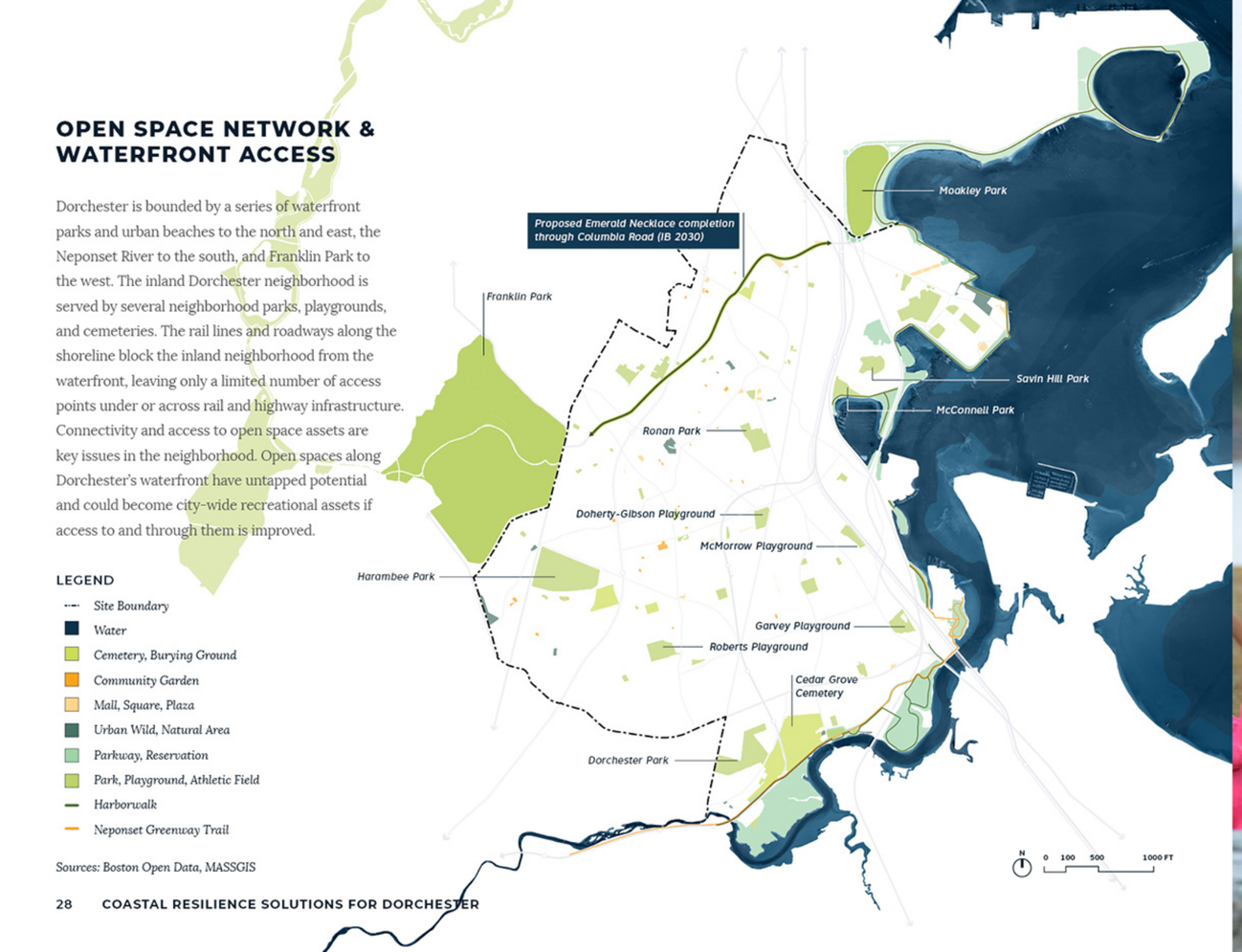
It is important to view Dorchester both in its present and potential future character, by looking closely at recent and ongoing planning efforts and proposed development. A series of sites across Dorchester is targeted for mixed-use and residential development. The majority of development is concentrated in Columbia Point, including the 20-acre Bayside site that will integrate flood protection in its mixed-use development.

- Bayside Redevelopment – 20 *acres*
- 135 Morrissey Boulevard (Boston Globe) – 16.6 *acres*
- 35-75 Morrissey Boulevard – 2.2 *acres*
- 24 Ericsson St (Neponset Wharf) – 7.6 *acres*
- UMass Calf Pasture site – 10 *acres*
- Moakley Park Vision Plan – 60 *acres*

> *"Climate change is already happening and impacting our community. We need a plan that will work and we need it now."*
> – OPEN HOUSE 1 PARTICIPANT

OPEN SPACE NETWORK & WATERFRONT ACCESS

Dorchester is bounded by a series of waterfront parks and urban beaches to the north and east, the Neponset River to the south, and Franklin Park to the west. The inland Dorchester neighborhood is served by several neighborhood parks, playgrounds, and cemeteries. The rail lines and roadways along the shoreline block the inland neighborhood from the waterfront, leaving only a limited number of access points under or across rail and highway infrastructure. Connectivity and access to open space assets are key issues in the neighborhood. Open spaces along Dorchester's waterfront have untapped potential and could become city-wide recreational assets if access to and through them is improved.

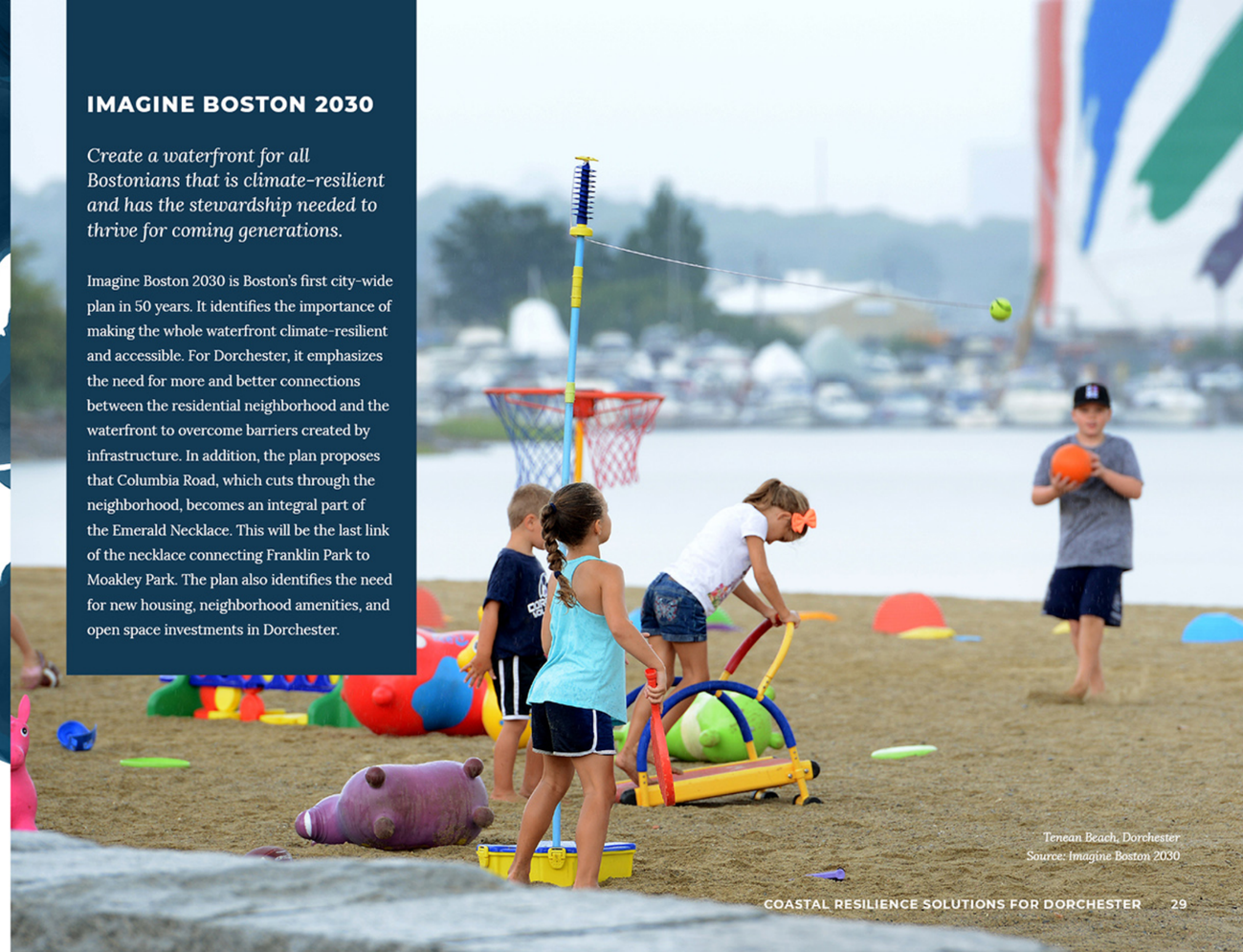


Sources: Boston Open Data, MASSGIS

IMAGINE BOSTON 2030

Create a waterfront for all Bostonians that is climate-resilient and has the stewardship needed to thrive for coming generations.

Imagine Boston 2030 is Boston's first city-wide plan in 50 years. It identifies the importance of making the whole waterfront climate-resilient and accessible. For Dorchester, it emphasizes the need for more and better connections between the residential neighborhood and the waterfront to overcome barriers created by infrastructure. In addition, the plan proposes that Columbia Road, which cuts through the neighborhood, becomes an integral part of the Emerald Necklace. This will be the last link of the necklace connecting Franklin Park to Moakley Park. The plan also identifies the need for new housing, neighborhood amenities, and open space investments in Dorchester.



Tenean Beach, Dorchester
Source: Imagine Boston 2030

LOCAL & REGIONAL TRANSPORTATION

Dorchester's transportation infrastructure includes city and state roads as well as the Massachusetts Bay Transportation Authority (MBTA) Red Line and regional commuter rail lines. The roads and rail run along the Dorchester coast, connecting neighborhoods, towns, and cities and towns south of Boston to Downtown. Though they are vital local and regional transportation corridors, they also constitute a barrier between local communities and the water. There are a limited number of rail stops in Dorchester itself, and no stops along the waterfront south of Savin Hill. The neighborhood is served by a number of bus routes including the 14-19, 21-23, 26-29, 45, 201, 202, 210, 215, and 217. The Ashmont and Fields Corner T stations are the main transfer hubs. Of the major commuter roadways running along the Dorchester coastline, the Southeast Expressway (I-93) is elevated, but the low-lying Morrissey Boulevard is subject to frequent flooding.

LEGEND

- Site Boundary
- Water
- Red Line
- Fairmount Indigo Line
- Rail Stop
- Major Roadways

Sources: Boston Open Data, MASSGIS

GO BOSTON 2030

The 2017 Transportation and Mobility Plan identified a series of actions for Dorchester to improve mobility and access to transit infrastructure. Projects included:

- Walking- and bicycle-friendly main street districts, such as Dorchester Avenue Complete Streets
- Fairmount Indigo line service improvements
- Columbia Road greenway (linking Moakley to Franklin Park)
- Mattapan to Longwood corridor
- Neighborhood mobility microHUBS
- Smart signal corridor along Gallivan Boulevard
- Vision Zero plan to improve road safety

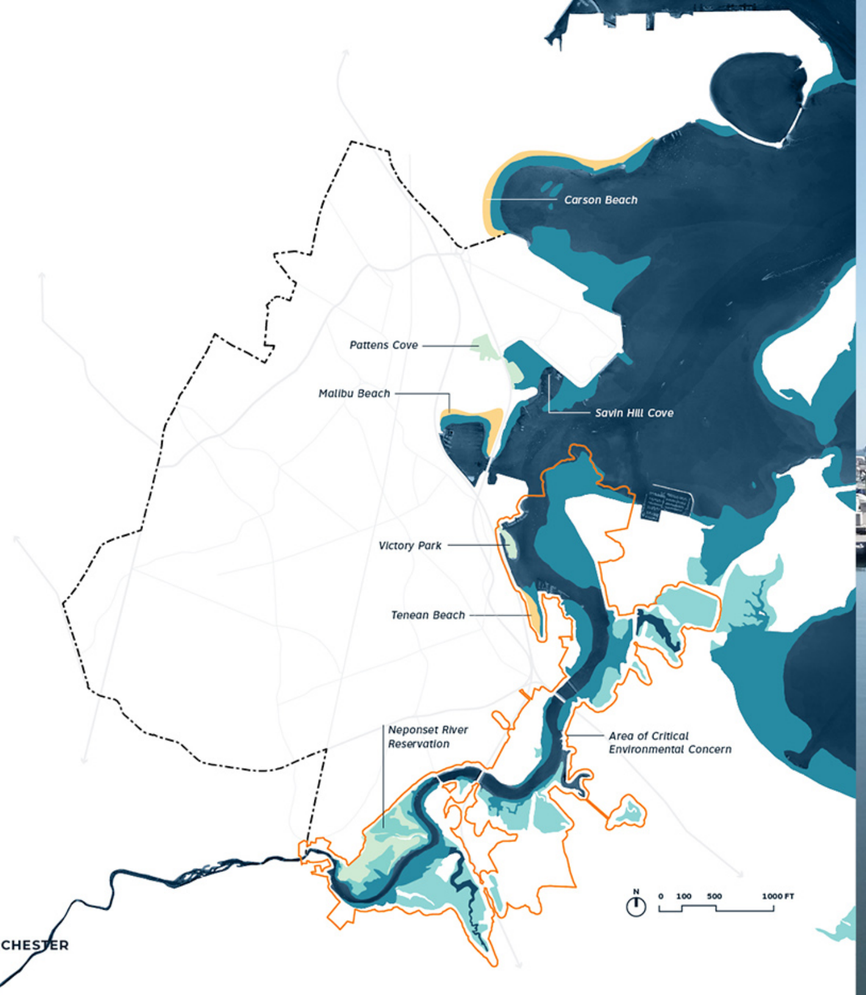
MORRISSEY BOULEVARD

The Massachusetts State Department of Conservation and Recreation (DCR) is currently working on a plan to improve Morrissey Boulevard to reduce flooding and improve bicycle and pedestrian safety and access.

Image Source: Alex Maclean for Boston Planning & Development Agency (BPDA)

COASTAL ECOLOGY

The Dorchester shoreline is a necklace of tidal mudflats, wetlands, non-tidal swamps, parks and beaches. The Neponset River Estuary Area of Critical Environmental Concern (ACEC) spans the south side of the neighborhood from Lower Mills to Victory Park. An ACEC is a state-designated area that receives special recognition because of the quality, uniqueness and significance of its natural and cultural resources. The Neponset River is a natural estuary with extensive tidal marshlands at its mouth and significant freshwater wetlands along much of its upstream length. It provides an unusually rich and diverse habitat for both plants and animals including a number of threatened and endangered species. The State Department of Conservation and Recreation (DCR) owns over 500 acres within the ACEC, providing a wide variety of public open space and recreational opportunities.



LEGEND

- *Site Boundary*
- *Water*
- *Tidal Mudflat*
- *Wetland*
- *Nontidal Swamp*
- *Beach*
- *Area of Critical Environmental Concern (ACEC)*

Sources: Boston Open Data, MassGIS, MassDEP

> *"The Vietnamese community sees the waterfront as part of their daily life and goes there frequently for fishing and clamming."*
>
> – OPEN HOUSE 1 PARTICIPANT

LOCAL WETLANDS ORDINANCE

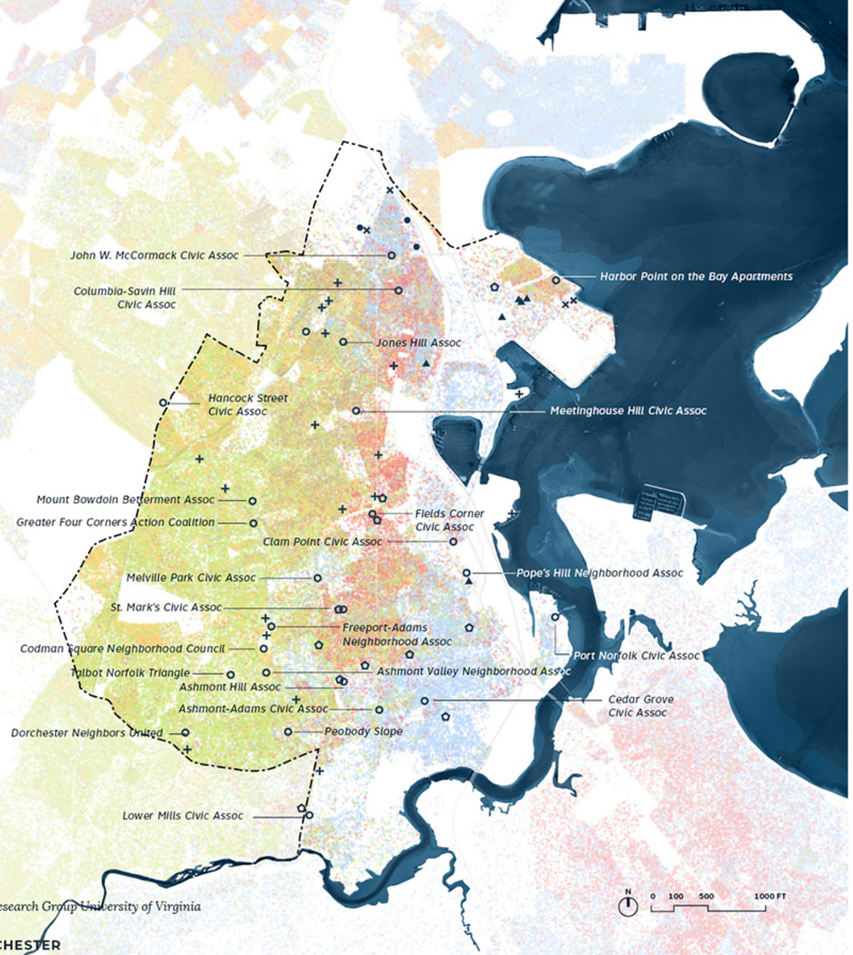
In December 2019, the City of Boston enacted an *Ordinance Protecting Local Wetlands and Promoting Climate Change Adaptation* in the City of Boston.

The Local Wetlands Ordinance gives the City greater authority to protect its wetlands, which are crucial to controlling flooding and protecting Boston's neighborhoods and green space. The ordinance directs the Boston Conservation Commission to consider future climate impacts like rising sea-levels in applications for new developments, construction, or special events. These local ordinance standards are stricter than the statewide standards, and will help Boston protect its natural areas for decades to come.

Victory Park and Old Colony Yacht Club at the northern edge of the Area of Critical Environmental Concern.

DIVERSITY & EQUITY

Dorchester is Boston's most populous and diverse neighborhood. It has a higher percentage of foreign-born individuals and members of racial and ethnic minorities than the city as a whole. Dorchester has 126,000 residents, about 18% of Boston's population. People of color make up 78% of the neighborhood, compared to 55% city-wide. Social, educational, and cultural resources play a critical role in the fabric of the neighborhood. While it is the services that these organizations provide and the people who run them that are the lifeblood of the neighborhood, their physical spaces are also important loci of activities and community. In terms of waterfront access, there are two distinct kinds of residential neighborhoods in Dorchester: ones that identify as "waterfront" neighborhoods, such as Port Norfolk, Savin Hill, and Harbor Point; and inland areas that are cut off from accessing the shoreline.



LEGEND

- Site Boundary
- White
- Black
- Asian
- Hispanic
- Other
- Community Centers
- Community-Based Organization
- Cultural Non-Profit Organization
- School
- Labor Union
- Religious Center

Sources: Boston Open Data, MASSGIS, 2010 Census, Demographics Research Group University of Virginia

RESILIENT BOSTON

Released in 2017, Resilient Boston is the result of a collaboration with the 100 Resilient Cities program and the City of Boston. It outlines strategies within four long-term vision areas that are crafted to build the overall resilience of Boston with particular consideration given to addressing its history of racism, segregation, and racial inequities. Its components are:

1. A Reflective City and Stronger People
2. Collaborative, Proactive Governance
3. Equitable Economic Opportunity
4. A Connected, Adaptive City

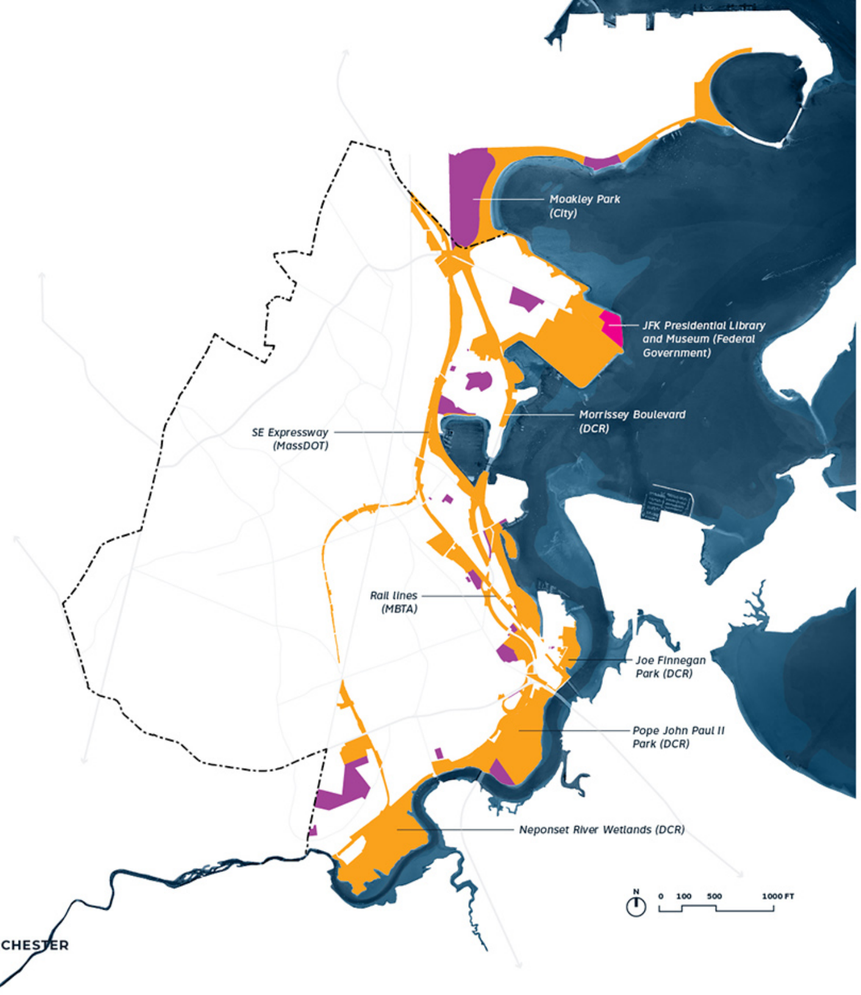
> "People of color, low income, and immigrants are the most vulnerable to the effects of climate change. No other mechanism will get us to an equitable city. Climate adaptation as a catalyst, not a problem!"
>
> – OPEN HOUSE 1 PARTICIPANT

Image Source: Alex Maclean for Boston Planning & Development Agency (BPDA)

OWNERSHIP

9.2 miles *out of* **9.5 miles** *of shoreline are not owned by the City of Boston.*

The majority of the Dorchester shoreline is owned by the State, not the City. Thus, close coordination with the State and other relevant public and private stakeholders will be essential for continued planning and implementation of the coastal resilience strategies. Much of the southern waterfront is part of the Neponset River Reservation and owned by Massachusetts Department of Conservation and Recreation (Mass DCR). Between the reservation and Columbia Point, the majority of the shoreline is owned by Mass DOT (the Southeast Expressway) and Mass DCR (open spaces), with pockets of privately-owned residential areas such as Port Norfolk. In addition, National Grid, the energy utility, owns and operates a large parcel at the mouth of the river. Along Columbia Point, a significant portion of the edge is owned and occupied by UMass Boston and is undergoing planning for new development.



LEGEND

- *Site Boundary*
- *Water*
- *City owned (0.3 miles)*
- *State owned (7.2 miles)*
- *Federally owned (0.3 miles)*
- *Privately owned (1.7 miles)*

Sources: Boston Open Data, MASSGIS

Neponset River Reservation (DCR)

> "I would like to see more programming on the waterfront, more events, activities: a celebration of the fact that we're a waterfront community!"
> – ONLINE SURVEY 1 RESPONDENT

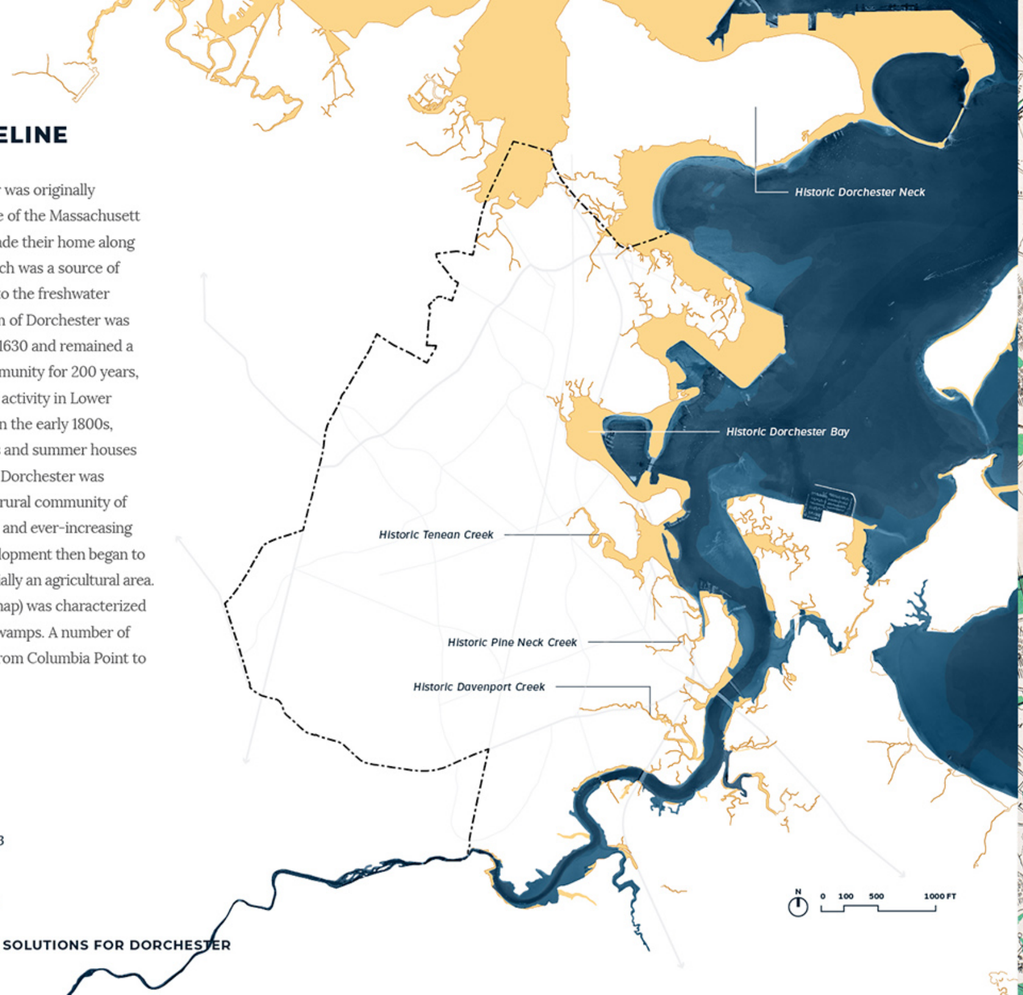
Kayak launch in the Neponset River (DCR), Source: Dorchester Reporter, July 2018

Tenean Beach and Pine Neck Creek (DCR)

Malibu Beach (DCR)

HISTORIC SHORELINE

The area that is now Dorchester was originally inhabited by the Neponsett tribe of the Massachusett nation. For generations, they made their home along the Neponset River estuary, which was a source of plentiful and diverse foods due to the freshwater meeting the salt water. The town of Dorchester was founded by English colonists in 1630 and remained a predominantly agricultural community for 200 years, with some waterfront industrial activity in Lower Mills and at Commercial Point. In the early 1800s, wealthy Bostonians built estates and summer houses as second homes. In 1870, when Dorchester was annexed to Boston, it was still a rural community of 12,000 residents. Railroad access and ever-increasing residential and commercial development then began to transform what had been essentially an agricultural area. The historic shoreline in 1603 (map) was characterized by swaths of salt marshes and swamps. A number of creeks flowed to the shoreline from Columbia Point to the Neponset River.



LEGEND

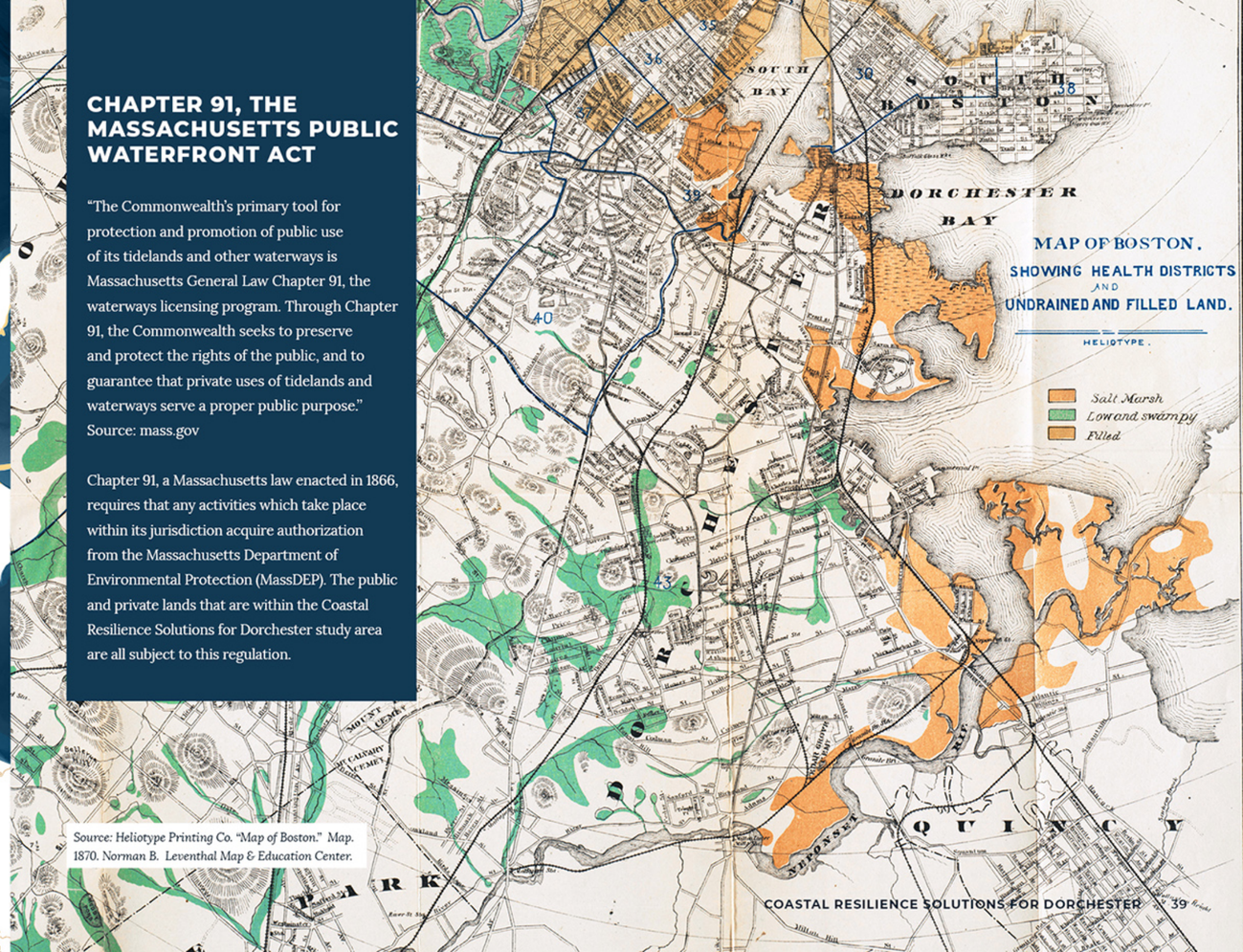
- Site Boundary
- Water
- Historic Shoreline 1603
- Inferred Historic Shoreline 1603
- Fill over time

Sources: Boston Open Data, MASSGIS

CHAPTER 91, THE MASSACHUSETTS PUBLIC WATERFRONT ACT

"The Commonwealth's primary tool for protection and promotion of public use of its tidelands and other waterways is Massachusetts General Law Chapter 91, the waterways licensing program. Through Chapter 91, the Commonwealth seeks to preserve and protect the rights of the public, and to guarantee that private uses of tidelands and waterways serve a proper public purpose." Source: mass.gov

Chapter 91, a Massachusetts law enacted in 1866, requires that any activities which take place within its jurisdiction acquire authorization from the Massachusetts Department of Environmental Protection (MassDEP). The public and private lands that are within the Coastal Resilience Solutions for Dorchester study area are all subject to this regulation.



Source: Heliotype Printing Co. "Map of Boston." Map. 1870. Norman B. Leventhal Map & Education Center.

PLANNING PROCESS

The planning process spanned nine months and consisted of three phases: analysis and technical review of the project area and current plans and efforts; the definition of key evaluation criteria and development of planning and design strategies; and the development of final proposals and a roadmap towards implementation.

A robust stakeholder engagement process was critical through all phases of the project. The complex geography of the Dorchester shoreline, the numerous state-owned areas, and the diversity of the local residents required an extensive engagement process. This included over 20 interviews with key stakeholders, including neighborhood groups, civic organizations, and project teams of adjacent ongoing projects such as the Moakley Park Vision Plan, that are key to the successful reduction of coastal flood risk. The team was able to speak with city and state agencies, private and institutional stakeholders, non-profit organizations, community-based organizations, residents, neighborhood associations, and students, as well as the broader public through the open houses.

INVOLVED STAKEHOLDERS

CITY AGENCIES

- Boston Environment Department
- Boston Planning and Development Agency
- Boston Parks and Recreation Department
- Office of Neighborhood Services (ONS)
- Boston Water and Sewer Commission (BWSC)
- Boston Conservation Commission (BCC)
- Office of Emergency Management (OEM)
- Boston Public Works Department (PWD)
- Boston Transportation Department (BTD)

STATE AGENCIES

- Massachusetts Department of Conservation and Recreation (DCR)
- Massachusetts Bay Transportation Authority (MBTA)
- Massachusetts Department of Transportation (MassDOT)

NON-PROFIT ORGANIZATIONS / COMMUNITY-BASED ORGANIZATIONS / RESIDENT GROUPS

- Neponset River Watershed Association
- Boston Harbor Now
- Rounding the Bases
- Melville Park Association
- Ashmont Hill Association
- Ashmont Adams Association
- Woodrow Ave Neighborhood Association
- Codman Square Neighborhood Council
- Port Norfolk Neighborhood Association
- Columbia Savin Hill Civic Association
- TNT Neighbors United

PRIVATE / INSTITUTIONAL STAKEHOLDERS

- University of Massachusetts-Boston
- National Grid
- Eversource
- Boston College High School students
- Massachusetts College of Art and Design students
- Savin Hill Yacht Club
- Accordia Partners
- John F. Kennedy Presidential Library and Museum

RELEVANT PROJECT TEAMS

- Moakley Park Vision Plan Team
- Bayside Redevelopment Team

During Open House 1, participants identified assets in the floodplain they care the most about.

During Open House 2, participants flagged on a physical model how they feel about the waterfront.

During Open House 1, participants where able to view in 360 VR videos the projected flood levels in three key flood pathway locations.

During Open House 2, participants provided input on the Plan's vision, goals and design alternatives.

STAKEHOLDER ENGAGEMENT

Four types of stakeholder engagement were used during the planning process, ranging from one-on-one meetings to large public events.

◆ **STEERING COMMITTEE**

The Committee met for in-person presentations and worksessions every five to six weeks to define goals and desired outcomes, share updates on engagement activities, and frame guidance on design proposals and next steps.

○ **STAKEHOLDER INTERVIEWS**

One-on-one interviews were held with diverse stakeholders (agencies, organizations, institutions, residents) at key points in the schedule. These were both in-person meetings and conference calls.

▲ **EXISTING NEIGHBORHOOD MEETINGS**

Presentations were given at existing neighborhood meetings in communities reflecting the geographic and demographic breadth of Dorchester.

✱ **OPEN HOUSE / ACTIVITIES**

The broader public was invited to the open houses to bring the community's concerns, desires, and priorities to the team, and to give input on preferred elements between preliminary design alternatives.

**Resilience in Columbia Point group included representatives from Coastal Resilience Solutions for Dorchester, Moakley Park Vision Plan, Bayside Redevelopment Team, JFK Library, and UMass-Boston.*















EVALUATION CRITERIA

In accordance with Climate Ready Boston's Initiative 5.2, "Determine a consistent framework for flood defense prioritization," this plan uses a set of evaluation criteria consistent with the previous plans for East Boston and Charlestown, South Boston, and Downtown and the North End. The criteria guided the proposals in the plan, focusing efforts towards feasible, effective, equitable, and adaptable solutions that achieve multiple benefits in both the near- and long-term. The evaluation criteria for this plan include some small adjustments to some categories to reflect the conditions, risks, and neighborhood context of Dorchester. The complete set of evaluation criteria is listed here.

As with the previous planning initiatives, community members and other stakeholders indicated which evaluation criteria were most important to them. During the community open houses, participants expressed preferences for **effectiveness of solutions**, **environmental and public health benefits**, and **social equity and quality of life**.

> *"First of all, solutions must be effective in reducing floods, but they should also consider public health, quality of life and how they improve the neighborhood for the people."*
>
> *– OPEN HOUSE 1 PARTICIPANT*

EFFECTIVENESS

Is the design alternative effective at reducing coastal flood risk to residents, other stakeholders, and the assets on which they rely?

- *Target level of coastal flood protection*
- *Reduction in flood extent*
- *Avoided damage and loss*
- *Flood risk to residents reduced*
- *Critical assets protected*

FEASIBILITY

Can the design alternative be reasonably implemented and easily maintained and operated over time?

- *Stakeholder acceptance*
- *Constructability*
- *Permitting requirements and regulatory considerations*
- *Affordability: Cost of construction and cost of maintenance*
- *Replicability*

DESIGN LIFE & ADAPTABILITY

Will the design alternative be adaptable to coastal flooding levels over time once it is implemented?

- *Design life*
- *Performance horizon*
- *Adaptability / flexibility*
- *Maintenance requirements*
- *Phase-ability and time to implementation*
- *Impacts to Infrastructure*

ENVIRONMENTAL & PUBLIC HEALTH BENEFITS

Does the design alternative provide health and environmental benefits and minimize impacts on the natural environment?

- *Water and air quality*
- *Habitat value*
- *Habitat adaptability*
- *Human health benefits*

SOCIAL EQUITY & QUALITY OF LIFE

Does the design alternative benefit the quality of life of people who live or work in Dorchester? Are those benefits shared fairly by all?

- *Recreational, cultural, aesthetic improvements*
- *New and equitable access to water*
- *Neighborhood walkability*
- *Educational opportunities & workforce development*
- *Job creation & improvement*
- *Community partnerships*
- *Preservation / addition of affordable housing & business properties*

VALUE CREATION

Does the design alternative increase the value of the land around it and provide opportunities for funding future resilience projects?

- *Capacity to catalyze future funding and investment*
- *Quality of the neighborhood's urban design and public realm*
- *Neighborhood desirability*

3 COASTAL FLOOD RISK

"The challenge of climate change is here, in Boston, now. We've seen more frequent flooding on Morrissey Boulevard. We endured the record-setting snowstorms of 2015 [...] Climate change has influenced all these events. I've felt these changes from my home in Dorchester, and I know you've felt them in your neighborhoods, too." - Martin J. Walsh, Mayor, Climate Ready Boston

Morrissey Boulevard, March 2018.
Source: Boston Harbor Now

In the second half of the twenty-first century, large areas of Dorchester will be exposed to frequent flooding affecting community and ecological resources, infrastructure, and buildings.

Dorchester is already exposed to climate change impacts including heat, increased precipitation and stormwater flooding, sea-level rise, and coastal and riverine flooding. The focus of this plan is understanding coastal flood risk and developing near-and long-term solutions to address the identified risk.

Coastal flooding occurs when the land is inundated by coastal processes that force seawater to higher elevations than the normal tidal fluctuations of the present day. As the climate changes, the risk of two primary types of coastal flood along Boston's coastline increases: (1) flooding that is caused by rising tide levels (future chronic flooding), and (2) flooding that is caused by the increasing intensity and frequency of storm events (e.g. hurricanes, nor'easters, etc.), which produce elevational surges and increased wave energy in coastal waters. Shorelines are also threatened by erosion forces, especially during coastal storm events.

Rising sea-levels mean that daily tides will reach increasingly higher levels, and any given storm will cause higher water levels and greater flood extents than it would today. According to the findings of the 2016 Climate Ready Boston report, severely damaging floods will shift from being a rare occurrence to a monthly reality. In the near-term, a flood event inundating 5 percent of the city will have a 1 percent chance of occurring in any given year. By mid-century, such a flood will be ten times more likely each year, and by the late century, that magnitude of flooding will likely occur at least once a month.

In Dorchester, coastal flooding can impact the local communities and resources through physical damage, stress (anxiety, trauma, and lost productivity), displacement costs, and losses due to business interruption. In addition, coastal flooding can disrupt the critical infrastructure systems–including transportation, stormwater infrastructure, and essential facilities–on which residents of Dorchester rely.

NATURE OF COASTAL RISK

TYPES OF COASTAL RISK

SEA-LEVEL RISE
chronic flooding

Sea-level rise (SLR) is one of the most certain and potentially destructive impacts of climate change. Sea-level rise will impact harbors, bays, estuaries, and tidal rivers across Massachusetts. As mean tide levels rise, lower points along the shoreline that once were above the intertidal zone will be inundated more frequently. Initially, flooding may happen a few times a year, but eventually it will likely occur monthly or daily. In some cases, current low points along the shoreline may be fully and constantly submerged. Higher downstream water levels will impede the ability of water to flow from lakes, ponds, rivers, streams, and pipes that drain into coastal water bodies. This can result in increases in inland flooding during rain events and even "sunny day flooding" in particularly low-lying areas.

STORM SURGE
episodic flooding

Coastal storms typically produce winds that push ocean water towards the land, creating a storm surge—an increase in the water elevation above the normal tide. The maximum water level reached during a storm event, which is the combination of the surge and tide, is called a storm tide. Different types of storms can generate different types of storm-induced flooding; in the Northeast the most common storm types are extratropical cyclones (nor'easters) and tropical cyclones (hurricanes). Currently, these storms can result in significant flooding in Dorchester. Coupled with sea-level rise, this risk and the resulting damage increase. A less powerful storm in the future will produce the same amount of flooding as a more powerful storm of today, and a future storm will produce higher surge and a larger flood extent than it would today. In addition, the intensity of storm surge flooding can depend on the relative height of the tide at the time of a storm.

WAVE ACTION & EROSION
ongoing and episodic

The Dorchester project area is relatively protected from the Atlantic Ocean waves by the Boston Harbor Islands, Hull, and Winthrop. However, during significant storm events, energy from the Atlantic Ocean, along with locally generated wind waves, can erode the shoreline and impact coastal structures in the area. Additionally, as the sea-level rises, deeper water may allow for the generation of higher and more powerful waves, particularly during storm events. Flood risk models can provide details on these evolving wave conditions and can be used to assess both ongoing day-to-day erosional processes and the more significant erosion that can occur during storm events.

ASSUMPTIONS

This plan uses the same flood modeling results as all previous Climate Ready Boston neighborhood plans. The results are based on the Boston Harbor Flood Risk Model (BH-FRM) that was developed by Woods Hole Group and UMass Boston for MassDOT and the Federal Highway Administration (FHWA) to assess the vulnerability of the Central Artery Tunnel Project to climate change, specifically SLR and storm surge. The model employs a physics-based approach to predict future flood risks and generates results to inform adaptation planning and design. In this plan, the model is also used to test the performance of the proposed solutions.

We expect these projections to change as we learn more from evolving climate science. An updated Massachusetts Coast Flood Risk Model (MC-FRM) for the entire State of Massachusetts is expected to be released in 2020. The MC-FRM will be the next generation flood model and will provide the latest information on coastal flood risk vulnerability using the same technology as the BH-FRM and updated climate projections.

Recognizing that climate science is evolving, this plan proposes flexible and adaptable solutions. The proposed solutions are designed to the identified "Design Flood Elevations" (see p. 62) and will not be undermined by the anticipated updated results.

SEA-LEVEL RISE

The sea-level rise projections used in this plan are the same as those used for all Climate Ready Boston projects to date. In particular, we looked at a sea-level rise of approximately 9 inches (reference to a 2030s condition) and 36 inches + 4 inches subsidence (referred to as 40 inches) (reference to a 2070s condition).

STORM SURGE

The results utilized in Climate Ready Dorchester are taken from the BH-FRM, which includes both extratropical and tropical cyclones that occur under changing climate and ocean conditions. The BH-FRM uses a probabilistic modeling which evaluates a statistically robust set of viable storm conditions that produce both spatial and temporal probabilities of flooding. Hundreds to thousands of storms are dynamically simulated to produce flood exceedance probabilities at high resolution.

9 INCHES *of sea-level rise refers to the* **2030**s

40 INCHES *of sea-level rise refers to the* **2070**s

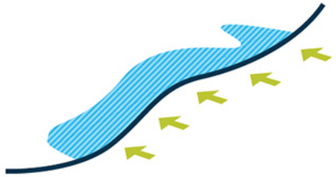
COMPARISON TO FEMA FLOOD MAPS

FEMA flood mapping is an important part of the National Flood Insurance Program (NFIP), as it is the basis of the NFIP regulations and flood insurance requirements. FEMA maintains and updates data through Flood Insurance Rate Maps (FIRMs) and risk assessments. However, these flood maps are intended for a much different purpose (assigning insurance rates) and rely on historic events rather than projecting into the future. Care should be taken when trying to compare mapping at any levels.

HOW DOES COASTAL FLOODING HAPPEN?

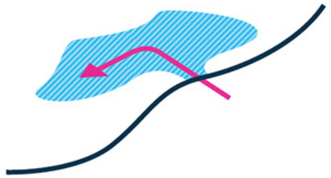
A significant stretch of Boston's coastline was created by land-filling an area that was historically below high tide levels. This man-made land area and its characteristics have changed the landscape of Boston dramatically. In some cases, the construction of transportation infrastructure, such as the Southeast Expressway, creates elevated barriers between inland areas and the water, while in other cases, old waterfront communities remain close to the water and the low shoreline. Depending on these varying physical features of the coastal areas, coastal-based flooding can occur as either ***fringe flooding*** (flooding that occurs along the shoreline but does not penetrate inland) or as flooding through ***flood pathways*** (flooding that enters at the shoreline but penetrates inland and floods much larger areas landward of the entry point).

The flood risk model permits a more granular analysis and allows estimates of street level transport of the flood water. This analysis evaluates the flow of water around buildings and along streets. The analysis can be used to assess flood entry points and pathways in both space and time, and to guide decision making in designing coastal resilience strategies.



FRINGE FLOODING

Impacts low-lying areas along the waterfront as water levels rise above the ground elevation.



FLOOD PATHWAY

Impacts low-lying inland areas when water enters through a discrete low-lying area on the waterfront.

Neponset Circle, March 2018.
Source: Boston Harbor Now

HOW OFTEN DOES COASTAL FLOODING OCCUR?

While it is impossible to predict when the next storm will happen or how severe it will be, engineers and scientists use statistical data from past storm events and projections of future climate conditions to determine the probability or chance that a storm event of a certain size will occur in a defined period in the future. For example, smaller storm events are more common and occur more frequently, while larger superstorms (e.g. Sandy) occur less frequently. The probability that the given storm event will be equaled or exceeded in any given year is typically expressed as a percentage or a recurrence interval (sometimes called the return period).

Large, catastrophic floods (e.g. the 1% or 100 year flood) have a very low probability (1%) of occurring each year, and overall occur less frequently (on average 1 within a 100 year timeframe). Smaller floods (e.g. the 100% or 1 year flood) have a very high probability (100%) of occurring each year, and in fact do occur more often (once per year). However, a 100-year return period event has an increased chance of occurring over time: for example, a 100-year storm event has at least a 22.2% chance of occurring over 25 years.

DAILY TIDAL

Daily tidal flooding is the temporary inundation of low-lying areas during daily high tides. Every day has two high tides; one of these has higher water than the other due to the gravitational pull of the sun and moon.

MONTHLY TIDAL

Monthly tidal flooding is the temporary inundation of low-lying areas during the highest tides (called spring tides) every month.

100% ANNUAL CHANCE FLOOD

A flood with a 100% chance of occurring each year; that is, a flood of this magnitude will likely occur every year. These are relatively common, smaller flood events.

10% ANNUAL CHANCE FLOOD

A flood with a 10% chance of occurring each year.

1% ANNUAL CHANCE FLOOD

A flood with a 1% chance of occurring each year.

> *During the January and March flood events (Grayson & Riley) in 2018, Tenean Beach was washed out. Port Norfolk was completely isolated by flooding because Conley and Neponset Circle were both flooded.*
>
> – OPEN HOUSE 1 PARTICIPANT

Tenean Beach, March 2018. Source: Boston Harbor Now

COASTAL FLOOD RISK

Morrissey Boulevard and the former Bayside Expo Site are already experiencing flooding today.

PRESENT DAY

Today, parts of the Dorchester shoreline—mainly roadways and open spaces—are already regularly affected by high-probability floods (10% annual chance). Parts of Morrissey Boulevard near Savin Hill and the former Bayside Expo Site are experiencing the impacts of low-probability flooding (1% annual chance). Approximately 73 buildings could be impacted during a 1% annual chance flood event today, causing damages estimated around $67 million. Low-lying buildings (mainly commercial) in Port Norfolk are particularly impacted by fringe flooding, and buildings in Columbia Point are impacted by waters entering the Bayside flood pathway.

Morrissey Boulevard, March 2018.
Source: Owen Anastas

Morrissey Boulevard, March 2018.
Source: Boston Harbor Now

Columbia Point Harborwalk, March 2018.
Source: Lee Toma for the Neponset River Greenway Council

LEGEND

- *Monthly Tidal*
- *1% Annual Chance Flood*
- *Flood Pathway with 0 inches of SLR (2013)*
- *Flood Pathway with 9 inches of SLR (2030s)*
- *Flood Pathway with 40 inches of SLR (2070s)*

Sources: Boston Open Data, MASSGIS, BH-FRM

In the near term, more flood pathways are activated, impacting inland areas such as Adams Village, Clam Point, and South Boston.

9 INCHES OF SEA-LEVEL RISE (2030s)

By the 2030s, fringe flooding will expand along the Neponset River and in Port Norfolk. Some areas along the coast, such as Neponset Circle (between the Neponset Bridge and the MBTA Red line Bridge), Conley Street, and Morrissey Boulevard at the intersection with Bianculli Boulevard will become flood pathways, allowing inundation of low-lying inland areas during a 1% annual chance event. This flooding will impact approximately 409 buildings, with estimated damages at around $330 million. Monthly tidal flooding will impact the Neponset River wetlands, parts of Tenean Beach, and stretches of Morrissey Boulevard near Savin Hill.

LEGEND

- *Monthly Tidal*
- *1% Annual Chance Flood*
- *Flood Pathway with 0 inches of SLR (2013)*
- *Flood Pathway with 9 inches of SLR (2030s)*
- *Flood Pathway with 40 inches of SLR (2070s)*

Sources: Boston Open Data, MASSGIS, BH-FRM

Harborwalk at Neponset Circle, March 2018.
Source: Lee Toma for the Neponset River Greenway Council

Harborwalk at Tenean Beach, October 2016.
Source: Boston Harbor Now

Tenean Beach, March 2018.
Source: Lee Toma for the Neponset River Greenway Council

In the long term, a significant portion of low-lying inland neighborhoods such as Adams Village and Clam Point will be severely impacted by numerous flood pathways.

40 INCHES OF SEA-LEVEL RISE (2070s)

When sea-level rise hits 40 inches, approximately 1050 buildings will be impacted by a 1% annual chance flood event, with estimated damages reaching $860 million. Flood pathways from Conley Street, Pine Neck Creek, and Morrissey Boulevard (South) will merge and flood Clam Point. Large areas of South Boston, South End, and Roxbury will be inundated by the merged flood pathways from Morrissey Boulevard and Bayside. Buildings at Harbor Point and along the Neponset will be further impacted by fringe flooding. Monthly tidal flooding will impact large stretches of Morrissey Boulevard, the Neponset wetlands, Port Norfolk, Malibu Beach, and the Bayside Expo Site.

LEGEND

- *Monthly Tidal*
- *1% Annual Chance Flood*
- *Flood Pathway with 0 inches of SLR (2013)*
- *Flood Pathway with 9 inches of SLR (2030s)*
- *Flood Pathway with 40 inches of SLR (2070s)*

Sources: Boston Open Data, MASSGIS, BH-FRM

Pine Neck Creek at Tenean Beach, October 2019.
Source: Boston Harbor Now

Neponset Greenway Trail, March 2018.
Source: Lee Toma for the Neponset River Greenway Council

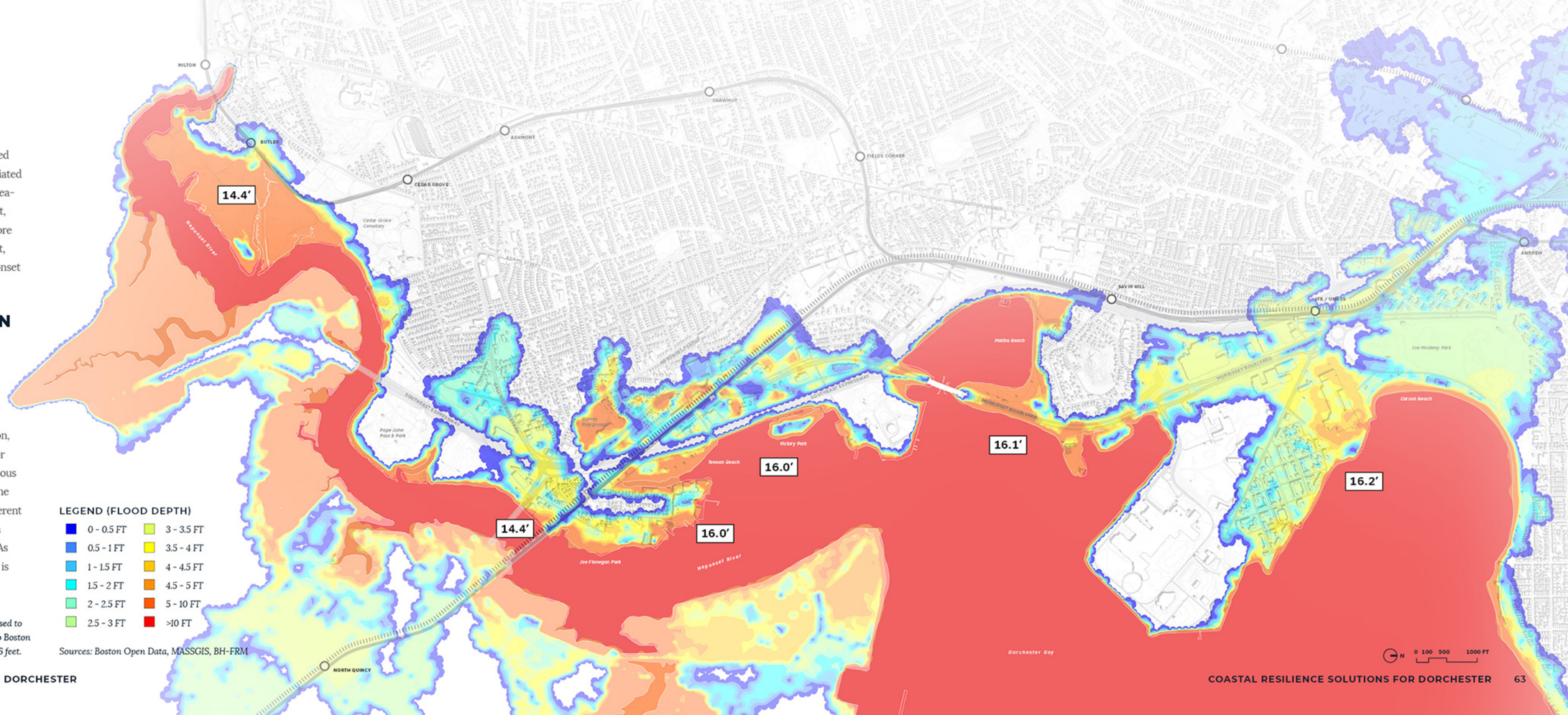
FLOOD DEPTH

Perhaps equally as important as the likelihood of flooding is the magnitude, or depth, of the anticipated flooding. The map shown provides the depths associated with the 1% annual chance event with 40 inches of sea-level rise (2070s). Low-lying areas such as Clam Point, Morrissey Boulevard and Bayside will experience more than 5 feet of water during a 1% annual chance event, while areas along the fringes of flooding in the Neponset River will experience a foot of water or less.

DESIGN FLOOD ELEVATION

The Design Flood Elevation (DFE) is established as the minimum elevation required to protect the neighborhood in a 1% annual chance flood with 40 inches of sea-level rise (2070s). Site-specific wave information is included in the analysis at each location, and 1 foot of freeboard is also included (to account for climate uncertainties and to be consistent with previous Climate Ready Boston Projects). In the map shown, the numbers indicate the Design Flood Elevation for different locations ranging from +16.2 FT NAVD88 at Columbia Point to +14.4 FT NAVD88 along the Neponset River. As such, the planning and design of flexible adaptations is critical in the design development process.

** North American Vertical Datum of 1988 (NAVD88): a base measurement created by the National Geodetic Survey and used to calculate or compare elevations. NAVD88 can be converted to Boston City Base (BCB) by using a conversion factor of NAVD88 +6.46 feet.*



Sources: Boston Open Data, MASSGIS, BH-FRM

WHAT'S AT RISK?

As sea-levels rise, more areas of Dorchester will be impacted, threatening homes, businesses, and open space, and disrupting the local economy, commuter routes, and other day-to-day activities. The next series of maps highlights what's at risk in three key areas: (1) Community and Ecological Assets, (2) Infrastructure, and (3) Buildings.

COMMUNITY & ECOLOGICAL ASSETS

Community and ecological assets are the collective resources (libraries, associations, clinics, open spaces, schools, etc.) available to individuals and communities. These assets can be leveraged to improve the health and well-being of the residents. Although community assets are found throughout the neighborhood, a significant number are located within the floodplain. With 40 inches of sea-level rise expected in the 2070s, vital assets will be damaged or destroyed: the Leahy Holloran Community Center will be exposed to flooding during fairly high-probability events (10% annual chance flood) and the McCormack Middle School will be exposed to flooding during low-probability events (1% annual chance flood). In terms of ecological assets, open spaces such as Malibu Beach, Tenean Beach, and the Neponset River wetlands will be inundated by tidal monthly flooding by the 2070s, causing dramatic changes in their ecosystem functions and risk reduction benefits.

Sources: Boston Open Data, MASSGIS, BH-FRM

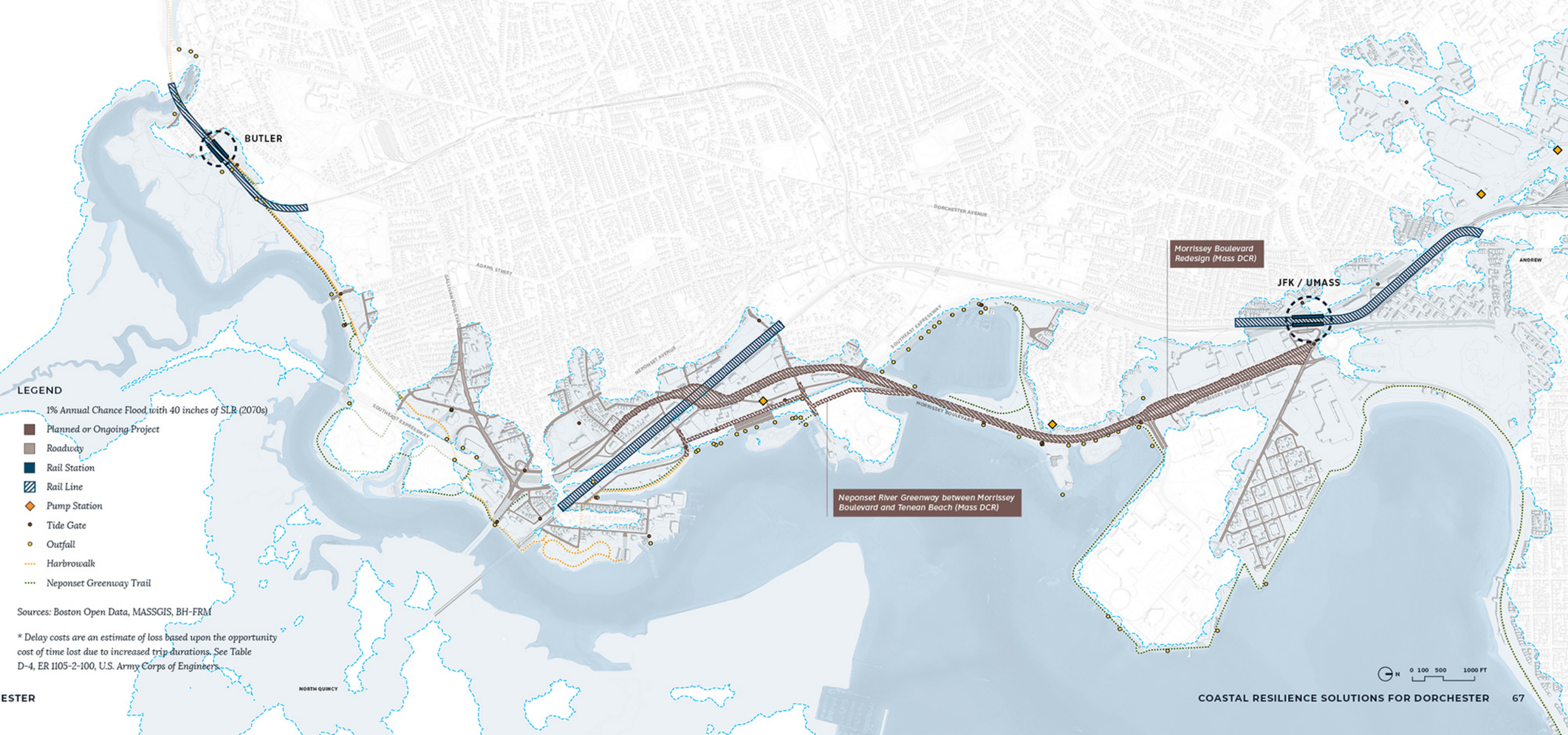
INFRASTRUCTURE

TRANSPORTATION INFRASTRUCTURE

With larger and more frequent floods, much is at risk. Damage to exposed roads and transportation networks—such as near-term risks to the MBTA Red Line, and Morrissey Boulevard—could isolate areas of Dorchester and interrupt its emergency response system. Within this century, all of Dorchester's evacuation routes, including I-93 South, Morrissey Boulevard, Neponset Avenue, and Gallivan Boulevard, will be exposed to coastal flooding and sea-level rise. Hypothetical travel time delays along Morrissey Boulevard (between 5 and 15 minutes) due to flood-related road closures would result in delay costs* of between $2.5M and $5.5M per day when applied to the total annual average daily traffic. Similar travel delays to the daily boardings at the JFK/UMass, North Quincy, and Savin Hill Red Line stations would result in delay costs of between $200K and $400K per day when applied to the total daily ridership.

STORMWATER INFRASTRUCTURE

The current gravity-based stormwater system will be overwhelmed as sea-level rises and storms become more intense and more frequent. Pipes and outfalls at low elevation will be impacted, as well as any stormwater system facilities that are located within the floodplain. Stormwater outlets not protected by tide gates could also become pathways to flooding in lower lying areas connected through the stormwater system itself.



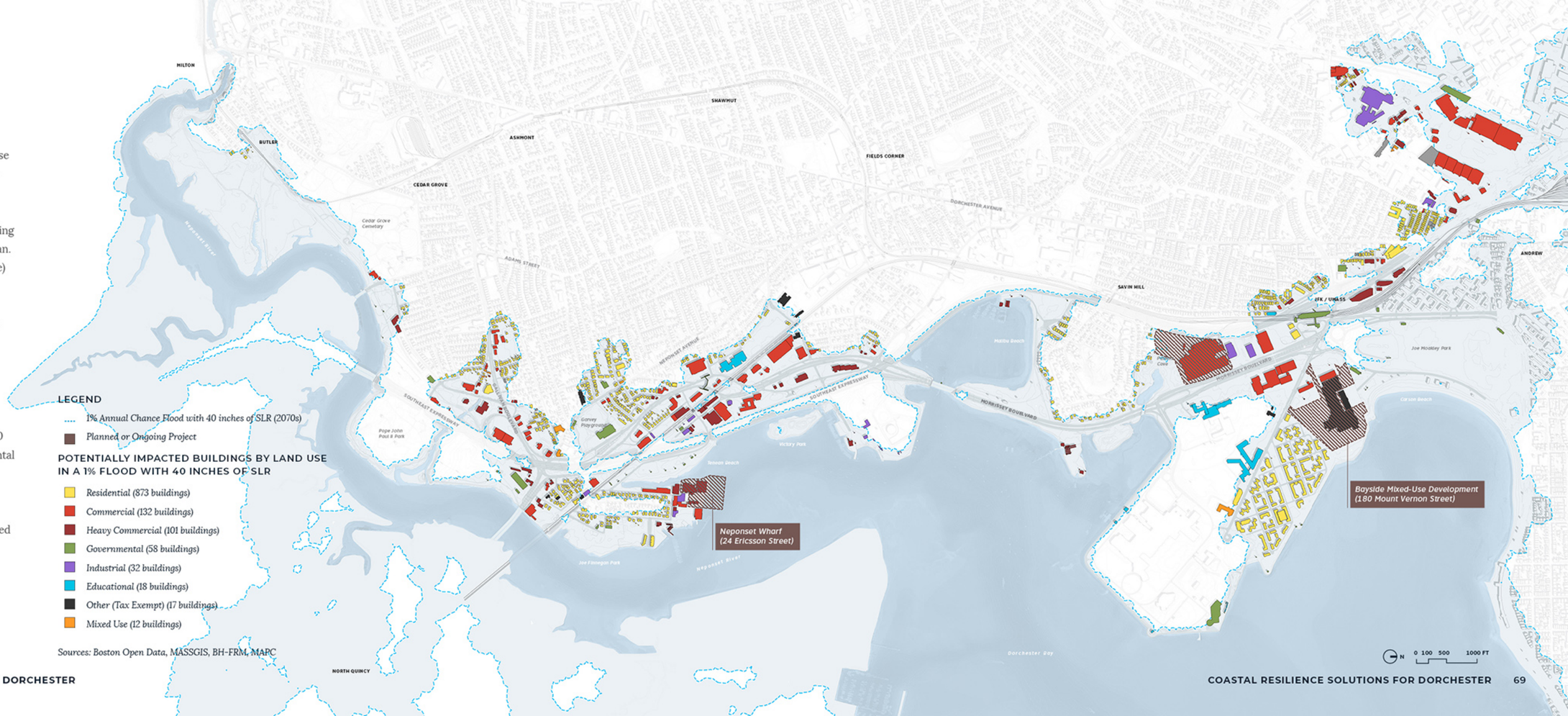
Sources: Boston Open Data, MASSGIS, BH-FRM

** Delay costs are an estimate of loss based upon the opportunity cost of time lost due to increased trip durations. See Table D-4, ER 1105-2-100, U.S. Army Corps of Engineers.*

BUILDINGS

In the near term (at 9 inches of sea-level rise), close to 400 structures in Dorchester can expect some flooding from a low-probability event (1% annual chance flood) leading to $330 million in physical damages to structures and their contents, according to the Benefit Cost Analysis conducted for this plan. As soon as the 2070s (at 40 inches of sea-level rise) and based on the same analysis, close to 1050 of Dorchester's structures can expect some level of flooding from a low-probability event resulting in direct physical damage costs of $860 million.

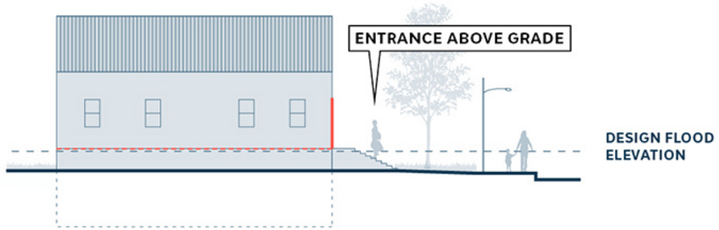
In the long term, 873 residential buildings, 132 commercial buildings, and 101 heavy commercial buildings, will likely be impacted from a low-probability event (1% annual chance flood) with 40 inches of sea-level rise. In addition, 58 governmental use buildings, 32 industrial use buildings, 18 educational buildings and 17 other (tax exempt) buildings will likely be impacted during a similar event. There will likely be minimal impacts to mixed uses with only 12 buildings impacted.

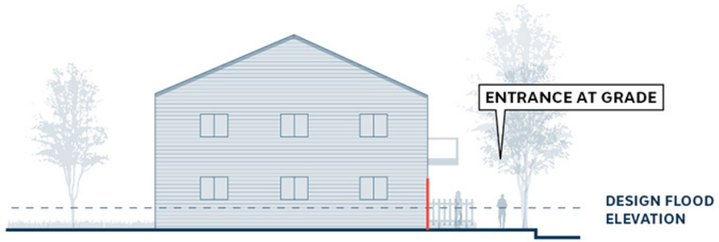


Sources: Boston Open Data, MASSGIS, BH-FRM, MAPC

IMPACT ON HOMES ON THE FRINGES OF FLOODING

Depending on the specific characteristics of individual structures, impacts of flooding will be different from building to building, especially along the fringes of flooding. As shown on the flood depth map on page 62, residential buildings in Port Norfolk and Harbor Point and a handful of buildings in Savin Hill are likely to be affected by fringe flooding with less than two feet of water during a low-probability event (1% annual chance) at 40 inches of sea-level rise (2070s). However, buildings in the two areas will be differentially impacted because of construction styles. In Port Norfolk and Savin Hill, the entrances to residential buildings and the first floors are typically 2 or 3 feet *above* grade, and the structures include basements or semi-basements. With an estimated depth of flooding to be less than two feet, these structures are likely to experience less damage to residential floors and can be adapted more easily. In Harbor Point, by contrast, the entrances of the residential buildings and first floors are typically *at* grade, so even a few feet of water can cause significant damage. Depending on the characteristics of the residential buildings in these neighborhoods, solutions can range from building adaptation to district wide solutions.





WHAT DOES THE FLOOD RESILIENCE OVERLAY MEAN FOR DORCHESTER?

The Coastal Flood Resilience Design Guidelines provide a set of strategies for existing and future developments to ensure that they are built or adapted to withstand the flooding risks posed by sea-level rise and storm surge. A corresponding zoning overlay district will ensure that new developments and projects undergoing substantial renovations are all built to this new standard. The overlay district will cover areas with a 1% chance of coastal flooding by around 2070 (40 inches of SLR) and is presently under review by the City. The overlay will place restrictions on allowed uses on ground floors below the Design Flood Elevation by requiring all mechanical equipment and residential areas to be located above the DFE. The City will further evaluate projects undergoing these changes for their impact on the public realm to ensure that they contribute to the pedestrian environment, and, to the greatest extent possible, enhance the urban design character of the streetscape.

Image Source: Dorchester by Alex Maclean for Boston Planning & Development Agency (BPDA)

STORMWATER CONSIDERATIONS

Stormwater systems within the Dorchester area are owned and operated by multiple public and private entities, including the Boston Water and Sewer Commission. This project did not examine the operation of those systems, but they will need attention to ensure that they effectively discharge stormwater and minimize local flooding with more intense precipitation and higher sea-levels. At a minimum, storm drain outfalls will need tide gates to protect against backflow and possible flooding due to storm surge and sea-level rise.

Because the deployment of temporary barriers could contribute to the stormwater system becoming overwhelmed during significant rainfall events at high tide, particularly in low-lying and coastal locations, other protective measures must be implemented, including upland detention, system storage, and pump stations to minimize or reduce the impacts of flooding.

Source: Boston Harbor Now

> *"It is important to consider stormwater along with coastal flooding. Neighborhood open spaces can be used for flood control along with park lands."*
>
> *– OPEN HOUSE 1 PARTICIPANT*

RESOURCES

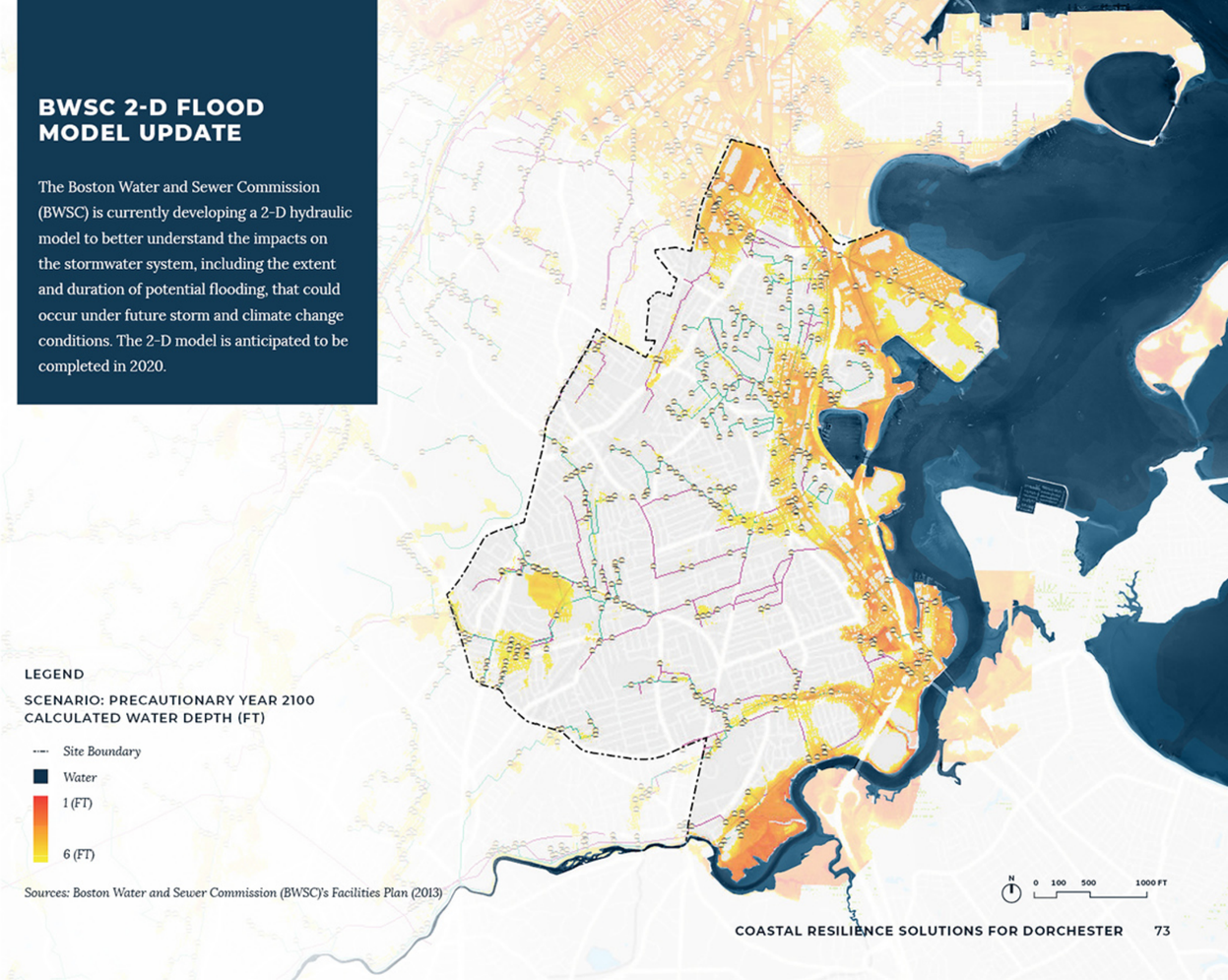
The City of Boston has recently released various resources and recommended strategies for stormwater management in parks and public right-of-ways.

2020 GREEN STORMWATER INFRASTRUCTURE DESIGN AND IMPLEMENTATION GUIDE
Boston Parks and Recreation Department

2018 CLIMATE RESILIENT DESIGN STANDARDS & GUIDELINES FOR PROTECTION OF PUBLIC RIGHTS-OF-WAY
Boston Public Works Department

BWSC 2-D FLOOD MODEL UPDATE

The Boston Water and Sewer Commission (BWSC) is currently developing a 2-D hydraulic model to better understand the impacts on the stormwater system, including the extent and duration of potential flooding, that could occur under future storm and climate change conditions. The 2-D model is anticipated to be completed in 2020.



Sources: Boston Water and Sewer Commission (BWSC)'s Facilities Plan (2013)

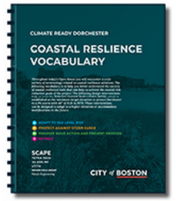
4 COASTAL RESILIENCE DESIGN SOLUTIONS

"Climate change has already impacted Dorchester, and will continue to pose a challenge this century. In this neighborhood we must develop smart strategies and make significant investments in coastal flood resilience planning. It is our responsibility to address these challenges now and protect Dorchester for generations to come." - Mayor Martin J. Walsh

The Dorchester Shoreway consists of strategic **flood protection** interventions at critical flood pathways to protect from coastal flooding while increasing neighborhood access. They prioritize **natural and nature-based features** to reduce wave action and erosion while preserving or enhancing valuable ecosystems. In some cases, the Shoreway includes **site-scale adaptation strategies** for low-lying coastal communities that will allow them to adapt to coastal flood risk while retaining a relationship to the water.

While the proposals described in this chapter identify site- or zone-specific solutions, they also enhance the resilience of the neighborhood's transportation infrastructure and community assets, expand and improve public access to and along the waterfront, and sustain the neighborhood's coastal habitats and the ecosystem services they provide. Together, the coastal resilience design solutions are a cohesive, layered approach to physical resilience with the social and ecological resilience of Dorchester's coastal communities in mind.

DESIGN STRATEGIES & THEIR APPLICATION



The ***Dorchester Shoreway*** comprises a series of connected design solutions forming a comprehensive approach to coastal resilience. While the design solutions are tailored to each site, they all draw elements from a consistent Coastal Resilience Vocabulary, explained below.

DESIGN FOR EQUITY

In addition to reducing coastal flood risk, the design solutions aim to address issues of equitable access to open space, ecosystem health, and mobility, and contribute to the identity of Dorchester's waterfront. Solutions take into consideration the community's top priorities (Effectiveness in flood protection, Social Equity & Quality of Life, and Environmental & Public Health Benefits) expressed in the community engagement process.

Integrated community engagement throughout the implementation process can keep community members posted on the progress, provide an opportunity to help identify red flags, proactively identify and mitigate potential burdens on socially vulnerable communities, and ensure that the benefits of these solutions are equally felt by all.

DESIGN FOR FLEXIBILITY AND ADAPTABILITY

Since sea-level rise and climate change projections may change over time due to the evolving science, coastal resilience solutions need to be flexible and adaptable. Each solution allows for long-term adaptation in response to changing site conditions and coastal flood risk projections. It is critical that solutions being designed today or in the near-term do not eliminate options for the long-term or result in costly re-organizing of the near-term solutions.

COASTAL RESILIENCE VOCABULARY

The strategies described below form a basic vocabulary of coastal flood risk reduction and can be categorized as **active** and **passive**. Active strategies are protection measures that need to be activated or deployed during storm events. Passive strategies do not require deployment and are the preferred interventions when feasible. The Coastal Resilience Vocabulary was presented as a tool for the Open House activities, to help participants engage with new terms related to coastal resilience solutions.

While the strategies listed below all reduce coastal flood risk, they do not all function the same way. All can be designed to adapt in the future depending on how climate change projections shift over time. Most of the strategies in the Coastal Resilience Vocabulary can **protect against storm surge**. In order to effectively keep flood waters out, these strategies must be designed to meet the Design Flood Elevation (DFE), which is established as the minimum target elevation required to protect Dorchester in a 1% annual chance flood at 40 inches of sea-level rise (SLR) that may occur by the 2070s. A subset of the strategies outlined can help open space and built and infrastructural assets **adapt to sea-level rise**. These will help minimize the impact of flooding in the future, but will not keep storm surge out. Another subset of strategies can **minimize wave action and prevent erosion**, which will increase the durability and longevity of other waterfront infrastructure and the shoreline itself. Lastly, the Coastal Resilience Vocabulary offers strategies that call for **strategic acquisition** or **strategic retreat** when site-specific conditions indicate that perimeter protection or adaptation in place are not favorable. The Dorchester Shoreway utilizes this full suite of strategies.

ADAPT TO SEA-LEVEL RISE (A)
PROTECT AGAINST STORM SURGE (P)
MINIMIZE WAVE ACTION AND PREVENT EROSION (M)
RETREAT (R)

(A) (P)

LANDSCAPE BERM

Berms are earthen mounds of various widths that provide flood protection and, where possible, public access to and along the waterfront. Where there is less space, berms can be narrow with a path on their crests. Where there is more space, they can widen to become elevated waterfront parks, creating places for communities to gather while simultaneously providing flood protection.

Example: Cedar Rapids Riverfront Multi-Purpose Levee, Cedar Rapids, Iowa. Designed by Sasaki.

(A) (P)

RAISED HARBORWALK

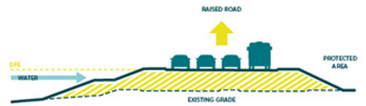
Raised waterfront promenades, like Boston's Harborwalk, provide public access to the shoreline and are raised to the Design Flood Elevation (DFE) level to protect inland communities from coastal flooding.

Example: The Waterfront Promenade at Aker Brygge, Oslo, Norway. Designed by Link Landskap

(A) (P)

RAISED ROADWAY

Elevating roadways to a target DFE keeps transportation infrastructure dry during the flood events, maintaining evacuation routes and access for emergency services. Elevated roadways may also act as flood protection for inland communities.



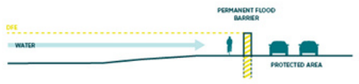
Example: Afsluitdijk Roadway, Netherlands. Designed by Zuiderzee Works.

ADAPT TO SEA-LEVEL RISE (A)
PROTECT AGAINST STORM SURGE (P)
MINIMIZE WAVE ACTION AND PREVENT EROSION (M)
RETREAT (R)

(P)

FLOODWALL

Floodwalls are engineered, structural walls designed to a target height to protect inland areas from flooding. These solutions, while useful in areas where space is very limited, can usually have drawbacks: they cut people off from the water, may be aesthetically unappealing, and may have more negative impacts on the environment than other strategies.

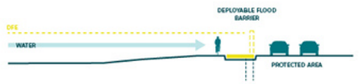


Example: Floodwall, Lake Pontchartrain, Louisiana. Designed by Southeast Louisiana Flood Protection Authority-East.

(P)

DEPLOYABLE BARRIER

Deployable barriers are active solutions that serve as floodwalls but must be deployed in preparation for an upcoming flood event. Some are deployed manually and some have the capability to be deployed automatically when a storm is approaching. These solutions sometimes result in operational challenges, which can be costly, and they are therefore often used as intermediate solutions.



Example: Deployable Barrier, New Orleans, Louisiana. Designed by U.S. Army Corps of Engineers.

(A) (P)

TIDE GATE

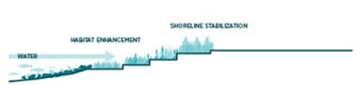
Tide gates are barriers closed during surge events to prevent water from entering. They are placed at the mouths of small streams, culverts, or small bridges. There are different types of tide gates, such as manually deployed, fully automated, and self-regulating.

Example: Self Regulating Tide Control Gates

(A) (M)

NATURAL AND NATURE-BASED SOLUTIONS

Natural and nature-based solutions use natural systems, or features that mimic them, to reduce flood risk and provide other economic, environmental, and social benefits. Natural features include existing ecosystems, such as wetlands and salt marshes, while nature-based solutions include features like parks and living shorelines. Both can maintain or create valuable habitats, attenuate wave action, and reduce erosion.

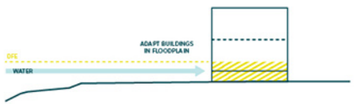


Example: Hunters Point South Park, Queens, New York. Designed by SWA/Balsley and Weiss/Manfredi. Image by David Lloyd.

(A) (P)

BUILDING-LEVEL ADAPTATION

Implementing adaptation at the individual building level includes flood proofing or raising buildings to avoid damages from flooding. Specifically for one- and two-family residential buildings, a building type commonly found in Dorchester, likely adaptation measures include relocation of utilities above flood elevations, filling in or waterproofing of sub-grade building levels, or elevating the first floor of homes.



Example: Building-Level Adaptation in New Orleans. Designed by Global Green.

(R)

STRATEGIC ACQUISITION OR STRATEGIC RETREAT

Strategic Acquisition is the voluntary acquisition of parcels to reduce long-term flood damage and implement targeted flood protection projects at key flood pathway locations. Strategic Retreat is a phased process of removing or relocating existing buildings and preventing future development in vulnerable areas. These strategies can be selectively considered where perimeter protection or adaptation are not feasible, too costly, or detract from other essential aspects of resilience.

Example: Moderate amount of retreat in Edgemere, Queens, New York. Image by Nathan Kensinger.

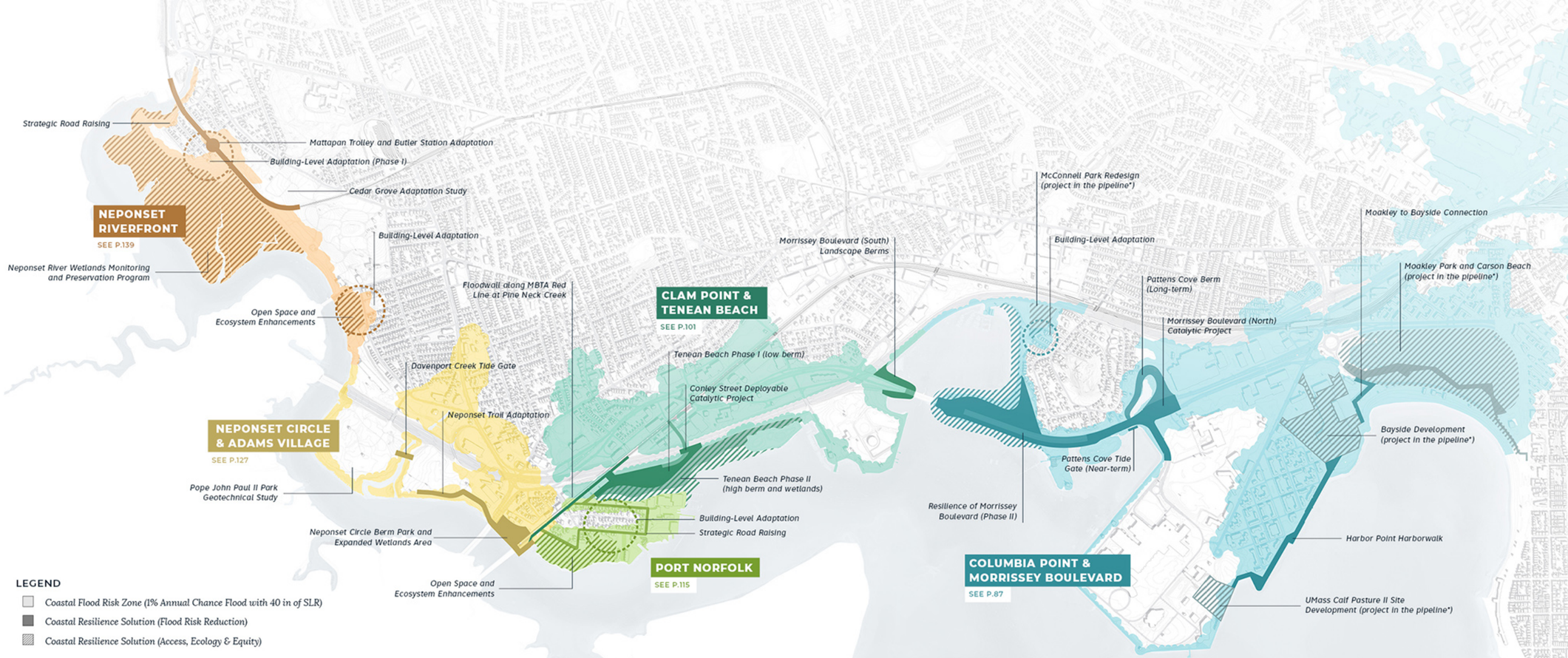
COASTAL RESILIENCE SOLUTIONS BY ZONE

WHY ZONES?

The 9.5 miles of the diverse Dorchester shoreline will face coastal flood risk in different ways based on specific topography and site characteristics. In order to effectively reduce coastal flood risk along this expanded geographical area, the coastal resilience solutions in this section are organized into zones. Each zone is defined by a set of connected flood pathways or by related areas of fringe flooding.

5 RISK ZONES, 20 RESILIENCE PROJECTS

Coastal resilience solutions within each zone depend on each other for successful reduction of coastal flood risk and cannot stand alone. In cases where interventions are designed to keep the water out, all of them must be implemented for the system to fully function to reduce the target flood risk. In cases where interventions are designed as layers, each one plays a significant, complementary role in reducing risk and cannot stand alone. Near-term solutions are separated into distinct projects to allow for easier implementation based on the nature of the physical interventions, the timeline of risk, ownership, regulatory considerations, and ongoing projects.



Sources: Boston Open Data, MASSGIS, BH-FRM

* Projects in the pipeline indicate ongoing plans or proejcts.

HOW TO READ THIS CHAPTER:

This chapter is organized by the five identified risk zones along the Dorchester waterfront. For each zone, the section describes:

EXISTING CONDITIONS & PLANNED PROJECTS

An overview of key site conditions that influenced the approach to flood risk reduction including ongoing projects and planned development in the area.

FUTURE COASTAL FLOOD RISK

A concise recap of the coastal flood risks described in the coastal flood risk chapter, including the areas and assets inundated in the 1% annual chance flood events with 9 inches (2030s) and 40 inches (2070s) of sea-level rise.

RESILIENCE APPROACH

RISK REDUCTION LAYER

A summary of the coastal resilience strategies designed to achieve coastal risk reduction.

ECOLOGY, ACCESS & EQUITY LAYER

Building on the risk reduction designs, this layer integrates other critical resilience considerations including the ecological, access, and equity goals identified in the community engagement process.

COASTAL RESILIENCE SOLUTIONS

A description and illustration of the proposed solutions. Plans, sections, and visualizations help describe each interventions.

PHASING

The timing for the implementation of the proposed solutions organized into the following phases:

- **Catalytic Projects:** Near-term priority projects in areas facing immediate coastal flood risk or in areas where opportunities for implementation appear as part of ongoing and planned projects.
- **Near-Term Projects:** Projects implemented by 2030 to reduce coastal flood risk in areas vulnerable with 9 inches of sea-level rise (2030s projections).
- **Long-Term Solutions:** Solutions implemented by 2070 to reduce coastal flood risk in areas vulnerable with 40 inches of sea-level rise (2070s projections).
- **Strategic Opportunities:** Opportunities to invest in adapting major infrastructural assets (i.e. MBTA Red Line and the Southeast Expressway) as they appear in the lifecycle of the assets and in the pipeline of responsible agencies.

PERFORMANCE

An evaluation of the project's economic and risk reduction performance.

- **Benefit Cost Analysis (BCA)**
  The benefits and costs of each project were assessed using a methodology consistent with prior Climate Ready Boston plans. These approaches estimate project costs and monetize select project benefits to generate a Benefit-Cost Ratio (BCR). The project costs include concept-level design, engineering, and economics.

  The monetized benefits consider the following categories: Direct physical damage to buildings and their contents; Displacement and relocation costs as a function of building damage; and mental stress and anxiety and lost productivity as a function of the buildings impacted.

  It is important to note that this concept-level BCA focuses on building-driven benefit categories. Building-related benefits are typically the primary driver of the BCR for a flood risk management project.

  However, in a dense neighborhood like Dorchester with significant public land and public infrastructure along the waterfront, there are a number of important potential benefits which have not been monetized at this phase of study whose inclusion would be expected to capture significant additional benefits and better characterize qualitative public and social benefits which are not measured by this BCR. These include: Direct damage to transportation and utility infrastructure; Transportation loss of service impacts (emergency egress, travel detours and delays); Utility loss of service impacts (electrical, potable water, wastewater); environmental and ecosystem services benefits (biodiversity, wetland health, etc.); and other social and public benefits (neighborhood connectivity, recreation quality, etc.).

  Thus, it is important to recognize that benefits would increase relative to costs and the BCRs would be higher if these additional benefits are incorporated into the BCR. These additional benefits are described qualitatively for each area.

- **Flood risk reduction modeling**
  Coastal hydrodynamic modeling was utilized to understand the performance and effectiveness of the adaptation measures proposed at each of the five identified risk zones. The performance modeling focused on assessing not only the reduction in flood extent and risk due to the various project elements, but also the potential added flood protection benefits of nature-based adaptations in each zone.

  The proposed coastal resilience solutions for each zone have been added to the coastal hydrodynamic models and specific return period storm events in the near-term and long-term climates were re-simulated. The results revealed the effectiveness of the proposed solutions, and give further insight on the performance and timeframe of coastal risk following adaptation implementation. The model results indicate the potential performance of individual elements, specifically the nature-based components, at reducing wave energy, erosion, and damage potential within certain zones. This allows for determination on where nature-based solutions add value and should be considered.

Image Source: Dorchester by Alex Maclean for Boston Planning & Development Agency (BPDA)

COLUMBIA POINT & MORRISSEY BOULEVARD

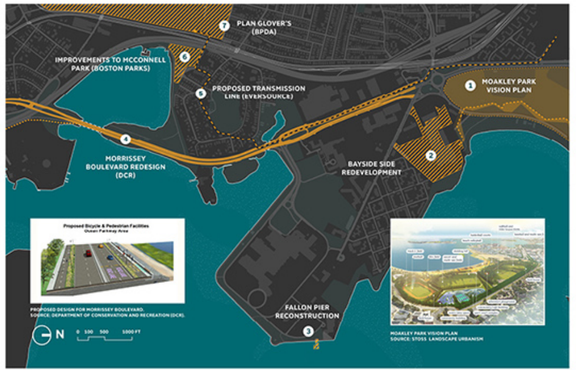
This risk zone includes Joe Moakley Park, the University of Massachusetts-Boston campus on Columbia Point, JFK/UMASS station, Morrissey Boulevard, and the residential neighborhoods of Harbor Point and Savin Hill. The UMass-Boston Expo (Bayside) Redevelopment Site and Morrissey Boulevard are not only at significant risk from both frequent and severe coastal flooding, but also act as critical inundation pathways impacting the Columbia Point peninsula and parts of South Boston and the South End.

Coastal resilience solutions here must address one of the lowest and most immediately at-risk inundation pathways in the city, and will require the collaboration of city, state, private, and institutional partners. Specifically, a critical flood pathway at the Bayside Redevelopment site provides an opportunity to demonstrate how flood protection can be integrated into new development and how public-private partnerships can be leveraged to ensure flood risk reduction and other community benefits.

Proposed solutions for Morrissey Boulevard aim to transform this at-risk and heavily used roadway to a resilient multi-modal corridor. Morrissey Boulevard will become a critical component of the flood protection solution not just for Dorchester but for the city as a whole. Such combined investments in multi-purpose infrastructure that can provide flood protection while addressing other community needs like increased mobility and multi-modal transportation opportunities, will be key to Dorchester's long-term resilience.

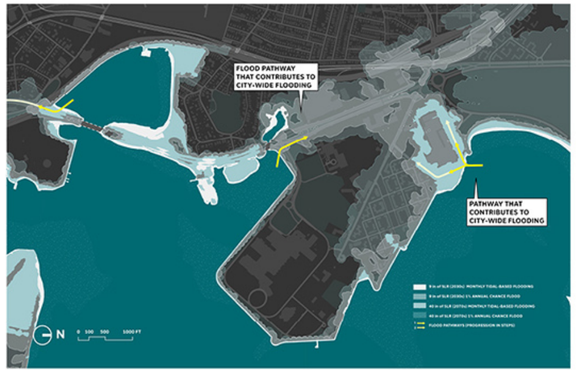
> *"There's an opportunity here to redesign coastal areas to be more public, more bike and pedestrian friendly, and less car dependent."*
>
> – OPEN HOUSE 1 PARTICIPANT

EXISTING CONDITIONS & PLANNED PROJECTS



This flood risk area includes significant waterfront open spaces such as Joe Moakley Park and McConnell Park; institutions, namely the University of Massachusetts-Boston campus, but also Boston College High School and residential neighborhoods in Savin Hill and Harbor Point. In addition, the area includes substantial transportation infrastructure including the JFK/UMASS station, the MBTA Red Line and Commuter Rail, and Morrissey Boulevard. Several new plans and developments are in the process of implementation or are being considered including the Moakley Park Vision Plan (1), a mixed-use development at the Bayside site (2), the Fallon Pier Reconstruction (3), and a DCR-led re-design of Morrissey Boulevard (4). Other planned or ongoing projects include an Eversource planned utility line along Morrissey (5), open space improvements to McConnell Park (6), and redevelopment at Glover's Corner (7), including the aspiration for a pedestrian bridge over the Southeast Expressway.

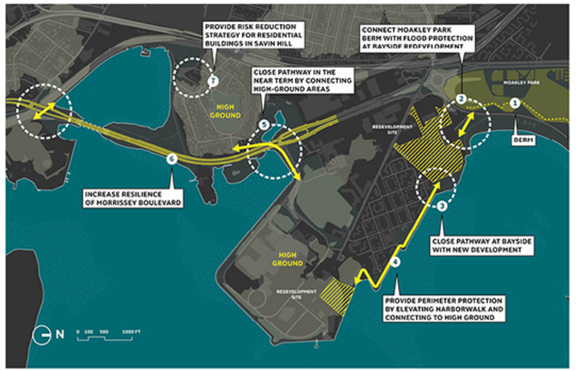
FUTURE COASTAL FLOOD RISK



The flood pathways in this area contribute to some of the most extensive and significant future coastal flooding in the City of Boston. In the near-term 1% annual chance flood event, flood pathways at Moakley Park, Bayside, and Morrissey Boulevard at the intersection with Bianculli Boulevard will all be inundated, causing extensive inland flooding in South Boston. These three pathways make up the southern entry point for flood waters into South Boston. The Fort Point Channel area is the north pathway. (See the report ***Coastal Resilience Solutions for South Boston*** for more information.) Morrissey Boulevard is also vulnerable to coastal flooding and sea-level rise. Currently, this major roadway floods during the highest tides (king tides) and during storm events, and flooding will only become more frequent and severe in the future. In the long-term, Morrissey is also vulnerable to monthly tidal flooding.

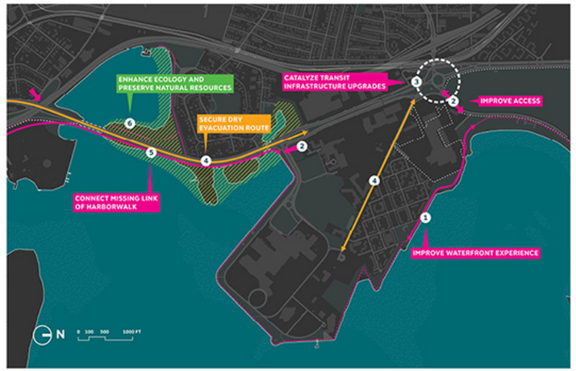
RESILIENCE APPROACH

RISK REDUCTION LAYER



The approach to reducing coastal flood risk in this area includes ensuring that the ongoing planned development at the Bayside site and Moakley Park form a continuous flood protection system that ties into an elevated Harborwalk along the Harbor Point neighborhood (1, 2, 3, and 4). In addition, the approach includes closing the flood pathway at Morrissey Boulevard (North) with interventions along the roadway and at Pattens Cove (5), increasing the resilience of Morrissey Boulevard itself to maintain emergency access and dry evacuation routes in flood events (6), and facilitating adaptation of vulnerable buildings in the Savin Hill neighborhood (7).

ECOLOGY, ACCESS & EQUITY LAYER



The improvements at Moakley Park and the Bayside site have the opportunity to catalyze major, resilient transit infrastructure upgrades while improving access to, and the experience of, the waterfront at Carson Beach, Harbor Point, and Morrissey Boulevard (1, 2, and 3). Additional improvements to road infrastructure will ensure that low-lying residential areas like Harbor Point have dry evacuation routes in flood events and emergency responders can access the neighborhood (4). Along Morrissey Boulevard, flood protection strategies will also enhance public access along the waterfront and connect to the existing Harborwalk at Columbia Point and the proposed Harborwalk at Commercial Point (5). Natural and nature-based interventions along Morrissey will further reduce risk, enhance ecology and natural habitat, and preserve the area's natural resources. In addition, open space improvements to Malibu Beach will create a resilient waterfront park and destination in Dorchester (6).

COASTAL RESILIENCE SOLUTIONS

The coastal resilience solutions for this flood risk zone are focused at three areas: **1) Moakley Park, Bayside, and Harbor Point; 2) Morrissey Boulevard;** and **3) Savin Hill.**

MOAKLEY PARK, BAYSIDE, & HARBOR POINT

The Design Flood Elevation at this location is 16.2 feet NAVD88.

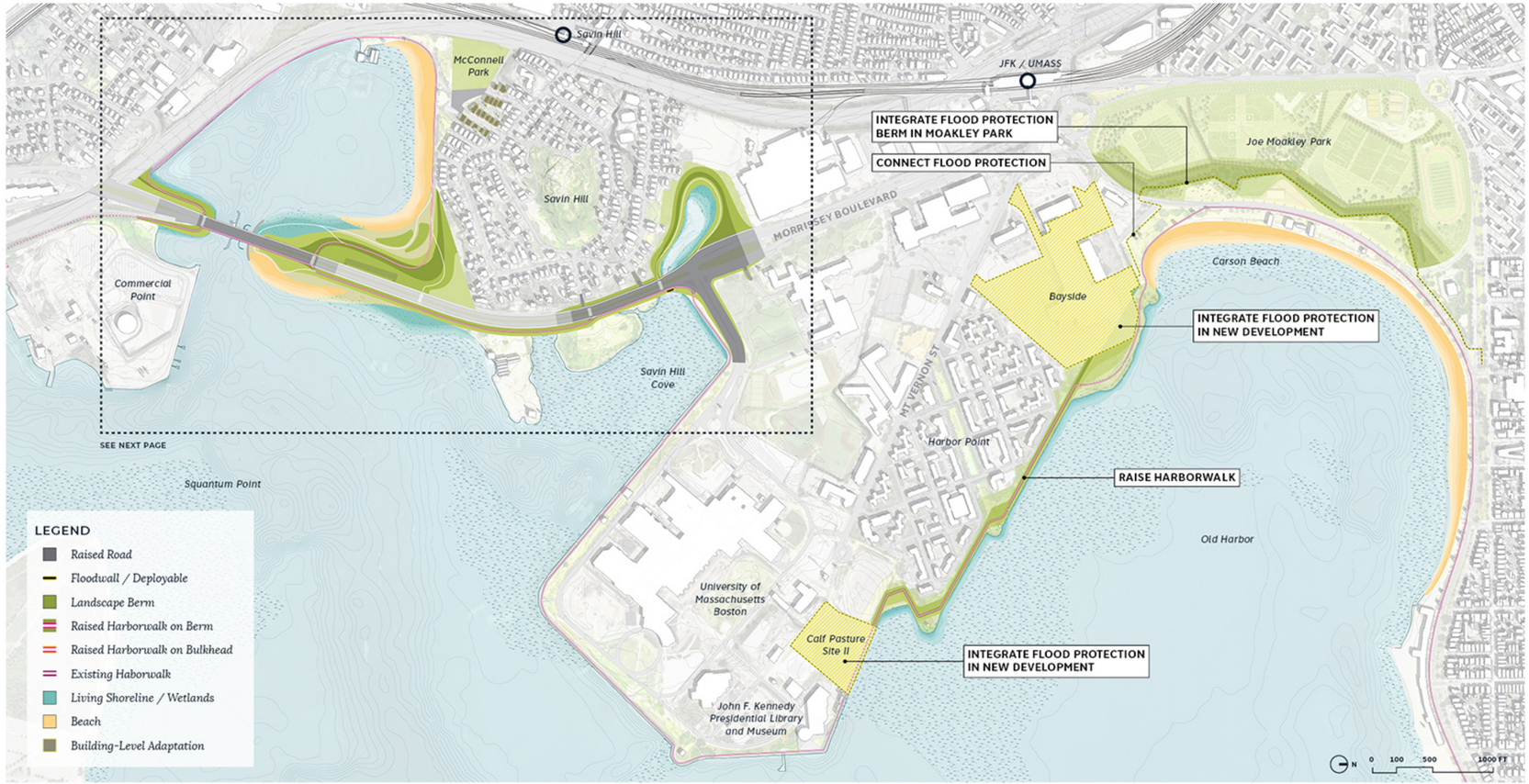
Existing plans for Moakley Park and the redevelopment at the Bayside site integrate flood protection strategies on each of their individual sites. In addition, plans for Moakley Park include connections of the flood protection system to the north (proposed in ***Coastal Resilience Solutions for South Boston***) and to the south at the Bayside development site. When completed, the flood pathways at Moakley Park and Bayside will be closed with a series of connected flood protection strategies (developed in each of those ongoing plans).

Anticipating sea-level rise in the long-term, the existing Harborwalk along the Harbor Point residential neighborhood will be raised to +16.1 feet NAVD88 and design strategies to improve the waterfront experience, including elements that allow people to engage with the shoreline and improved public access to and along the waterfront, will be incorporated.

SAVIN HILL

The Design Flood Elevation at this location is 16.1 feet NAVD88.

In Savin Hill, McConnell Park offers an opportunity to invest in resilient open space. Proposed improvements at McConnell Park include raising portions of the property–to ensure the park remains functional as a recreational space–and improving connections along Springdale St. In addition, the designs propose raising curbs along Denny St. by 9 inches to help reduce localized flooding from frequent storms in the near-term. To complement this strategy, building-level adaptation is proposed for six buildings in the near-term and twelve additional buildings in the long-term to address increasing coastal flood risks. In the long-term, the park and adjacent parking lot will be vulnerable to more frequent flooding, which presents an opportunity to consider adaptive reuse or retreat of the parking lot. Beyond the target horizon of this plan (that is, when sea-level rise exceeds 40 inches, or when a larger than 1% annual chance flood event occurs), McConnell Park will become an inundation pathway to Glover's Corner. This means that in the next 50 years, when an opportunity for investment in the park appears, measures to further elevate the park and incorporate flood protection elements will need to be considered.



MORRISSEY BOULEVARD

The Design Flood Elevation at this location is 16.1 feet NAVD88.

In the near-term, the flood pathway at Morrissey Boulevard North is closed by raising the intersection at Bianculli Boulevard to 16.1 feet NAVD88, tying into high ground at Columbia Point and at Savin Hill (at Evandale Terrace). A tide gate is proposed at the bridge at Patten's Cove which will close during flood events to prevent flood waters from entering South Boston through that flood pathway. Tide gates also provide the ability to regulate water levels in Pattens Cove to prevent wetland habitat loss as the sea-level rises.

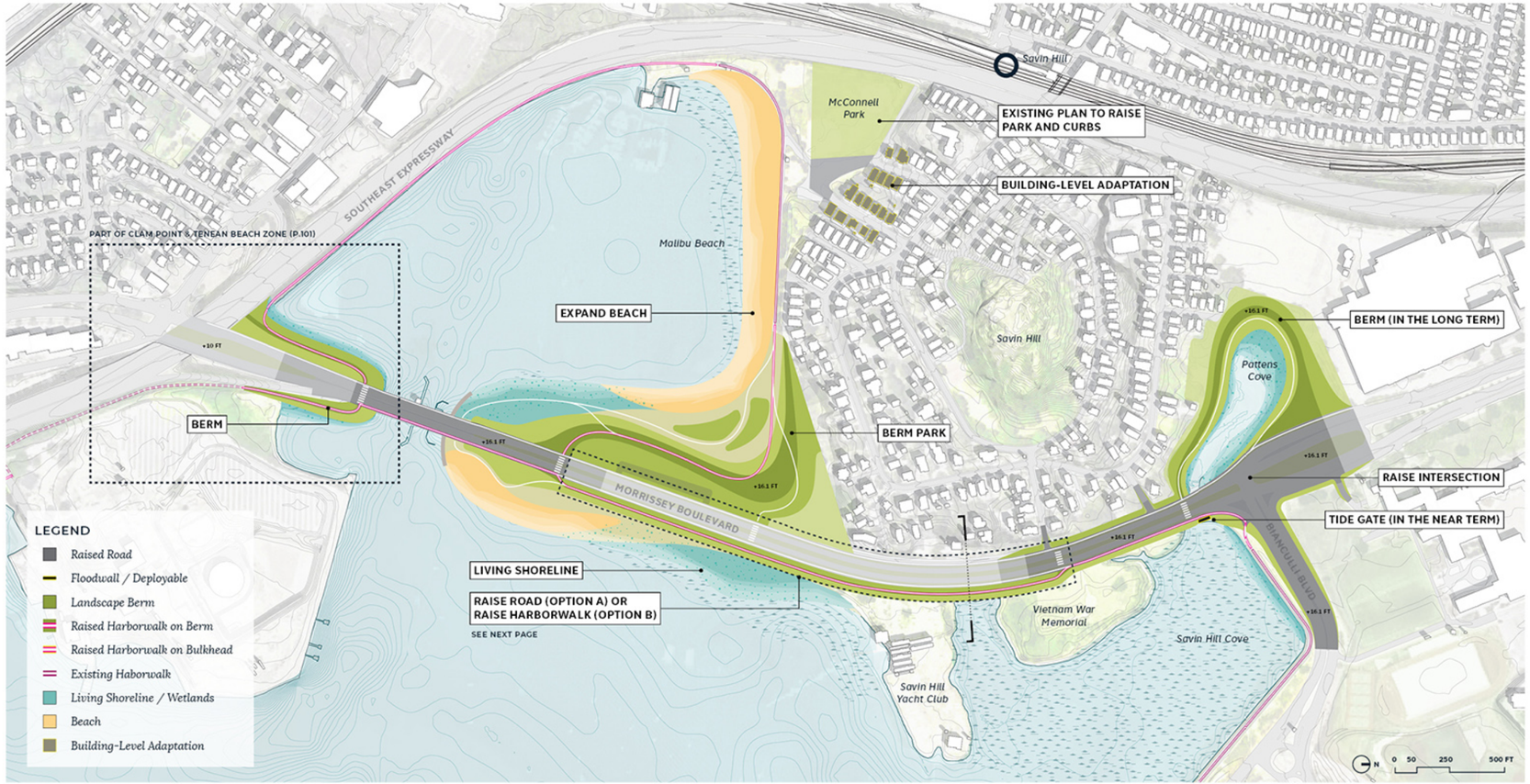
One of two potential options to increase the resilience of Morrissey Boulevard in the long term is to raise the entire roadway to +16.1 feet NAVD88. The second option for Morrissey Boulevard is to raise the roadway to elevation +10 feet NAVD88 (as per DCR's existing plan) and construct a landscape berm to the DFE of +16.1 feet NAVD88 along the edge of the roadway.

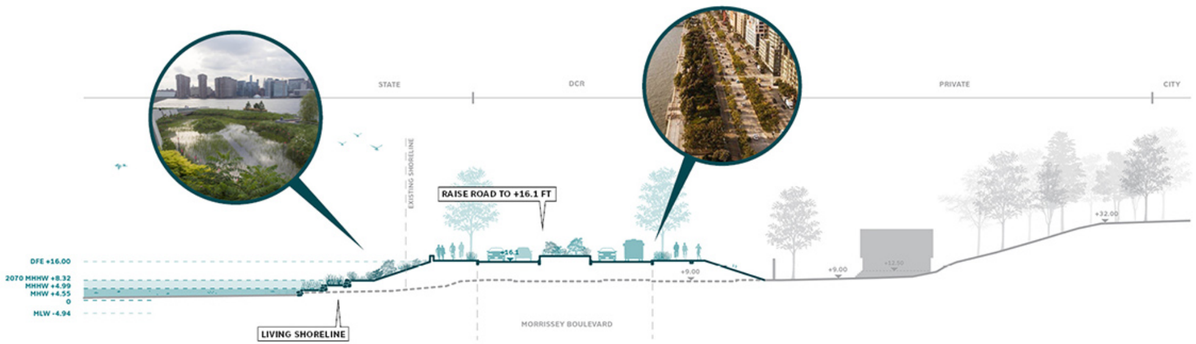
Both options are coupled with living shoreline and expanded beach interventions along the boulevard to preserve and enhance the existing fringe tidal wetlands that offer ecological and recreational benefits to adjacent communities.

In both scenarios, there is the option to phase the tide gate at Pattens Cove out and construct a continuous landscape berm at +16.1 feet NAVD88 around the cove to tie into high ground and block storm surge. The advantage of this strategy is the transition from an active flood protection technique to a passive technique that remains in place at all times. The disadvantage of this strategy is that the ability to regulate water levels in Pattens Cove is lost, likely leading to loss of tidal wetland habitat with no space to migrate, and loss of ability to potentially use the cove for additional stormwater storage during future storm events.

Coastal resilience solutions around the southern side of Morrissey Boulevard (at the underpass below the Southeast Expressway) include berms on either side. These proposals are part of the Clam Point & Tenean Beach risk zone. (See p.101)

If and when repairs to or reconstruction of Beades Bridge along Morrissey Boulevard take place, options to raise and widen the bridge and allow for pedestrian "get downs" around the bridge footings would maximize resilience and improve access.



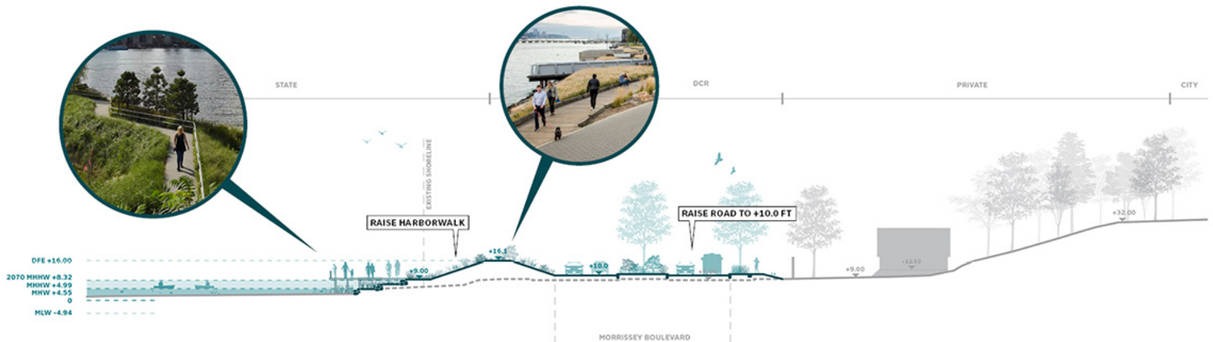


OPTION A: RAISE MORRISSEY BOULEVARD

One of two potential options to increase the resilience of Morrissey Boulevard in the long-term is to raise the entire roadway to +16.1 feet NAVD88. This will reduce the likelihood that the road will flood in the 1% annual chance flood and maintain a dry route for emergency responders and evacuation. The adjacent park at Malibu Beach is raised to facilitate access from the road into the park. Raising all of Morrissey Boulevard to Beades Bridge provides an opportunity to re-think the roadway as a true boulevard with designated bike lanes and continuing the pedestrian Harborwalk south to Victory Park.

This solution will require adding some fill in existing waters and may present some challenges with access to approximately two or three adjacent properties.

In addition, natural and nature-based features like living shorelines and expanded beach areas along the shoreline can preserve and enhance the existing condition of fringe tidal wetlands that already exist along the roadway.



OPTION B: RAISE HARBORWALK ON BERM

The second option for Morrissey Boulevard proposes raising the roadway to elevation +10 feet NAVD88 and constructing a landscape berm at the DFE of +16.1 feet NAVD88 along the edge of the roadway.

The proposed berm would also accommodate continuous, public access and natural and nature-based features along the shoreline. In addition, the berm can offer separation of the recreational use from the sightline and of a busy roadway, and potentially the noise of traffic.

The landscape berm would tie into Beades Bridge and continue into the waterfront park at Malibu Beach, with enhancements made to the public space to improve the waterfront experience. Similarly, this solution will require adding some fill in existing waters, and will present access issues to adjacent properties on the seaward side.

This solution provides the same degree of flood protection for Morrissey Boulevard, but the residual risk of flood waters overtopping and being trapped behind the landscape berm is greater with this approach.

PHASING

CATALYTIC PROJECTS

1 **Morrissey Boulevard (North)**

The Morrissey Boulevard North project includes the following elements:

- Raise the intersection of Morrissey Boulevard and Bianculli Boulevard to the DFE (+16.1 feet NAVD88) to close the near-term flood pathway.
- Install a tide gate at Pattens Cove for protection up to the DFE (+16.1 feet NAVD88).
- Extend continuous public access from Columbia Point to the Vietnam War Memorial.
- Install living shoreline elements.

NEAR-TERM PROJECTS

2 **Moakley Park:** Integrate flood protection berm up to the DFE (+16.2 feet NAVD88) in Moakley Park (per Moakley Park Vision Plan).

3 **Bayside Redevelopment:** Integrate flood protection in new development at Bayside site up to the DFE (+16.2 feet NAVD88).

4 **Moakley to Bayside Connection:** Connect the Moakley Park berm and the Bayside integrated flood protection with a berm up to the DFE (+16.2 feet NAVD88).

5 **Harbor Point Harborwalk Phase I:** Raise Harborwalk and integrate public water access enhancements along the edge. In the near term, the proposal includes a 4 feet berm, reaching the elevation of +14 feet NAVD88.

6 **Calf Pasture Site II Development:** Integrated flood protection in new development at UMass Calf Pasture Site II (DFE +16.2 feet NAVD88).

7 **Morrissey Boulevard Phase I:** Raise Morrissey Boulevard to elevation +10 feet NAVD88 to minimize impact from frequent flooding (per DCR's existing plan).

8 **McConnell Park:** Raise McConnell Park and adjacent curbs to ensure the park continues to function as a recreational space and to reduce frequent flooding of the park in the near-term (per Boston Parks & Recreation plan).

9 **Building-Level Adaptation at Savin Hill Phase I:** Adapt approximately six residential buildings at risk adjacent to McConnell Park to address near-term flooding.

LONG-TERM SOLUTIONS

10 **Harbor Point Harborwalk Phase II:** Install a low floodwall (an additional 2.2 feet) on top of harborwalk berm to reach the DFE (+16.2 feet NAVD88).

11 **Building-Level Adaptation at Savin Hill Phase II:** Expand the building-level adaptation zone to include approximately 12 more buildings at risk as needed.

12 **Berm around Pattens Cove:** Replace the tide gate at Pattens Cove with a berm around the cove up to the DFE (+16.1 feet NAVD88). (Optional)

13 **Morrissey Boulevard Phase II:** This phase of Morrissey Boulevard includes either of the long-term options described in the previous page, and a few open space and recreational elements:

- **OPTION A:** Adapt and raise segment of Morrissey Boulevard up to the DFE (+16.1 feet NAVD88) to ensure maximum service level by the 2070s.
- **OPTION B:** Raise Harborwalk along Morrissey Boulevard up to the DFE (+16.1 feet NAVD88). Tie into high ground through a berm on Malibu Beach.
- Install living shoreline elements along Morrissey Boulevard and expand beach areas at Malibu and near Morrissey Boulevard.
- Extend continuous public access from the Vietnam War Memorial to Commercial Point.

STRATEGIC OPPORTUNITIES

14 **Beades Bridge:** In the case of future investment, consider raising and widening the bridge and allow for pedestrian "get downs" around the bridge footings.

15 **Raising the Southeast Expressway:** In the case of future investment, consider raising the expressway to address low and potentially vulnerable segments and allow for greater clearances at underpasses and thus provide the possibility of raising roads below.

16 **Raising McConnell Park:** In the case of future investment, consider raising the grade at the rear of the park to address the flood pathway towards Glover's Corner that appears beyond this plan's target horizon.

PERFORMANCE

BENEFIT-COST ANALYSIS

In accordance with prior Climate Ready Boston plans, the methodology for the Benefit-Cost Analysis suggests estimating all project costs but monetizing only select project benefits to generate a benefit-cost ratio (BCR). See below the project elements that are included and those that are not included in the monetized analysis. The matrix offers a summary of the comprehensive flood protection, environmental and social benefits of the proposals. For further information on the methodology refer to p. 85 of this chapter.

ESTIMATED PROJECT COSTS

	*CATALYTIC PROJECT	LONG-TERM OPTION A	LONG-TERM OPTION B
Cost	$55.6 M	$90.9 M	$83.7 M
Annual O&M	$566,000	$909,000	$837,000

BENEFIT-COST RATIO

DISC. RATE	*CATALYTIC PROJECT	LONG-TERM OPTION A	LONG-TERM OPTION B
3%	4.0	3.3	3.4
7%	1.5	1.4	1.4

	Benefits	*Costs*
MONETIZED	**BUILDINGS** • *Avoided Damages to buildings and their contents, and associated functions (displacement and relocation costs, mental stress and anxiety, loss of productivity)*	**FLOOD PROTECTION** • *Raise road intersection (Morrissey and Bianculli Blvd)** • *Tide Gate at Pattens Cove** • *Raise Morrissey Boulevard (DCR proposal) (low, near term)* • *Integrate flood protection at Bayside Development* • *Moakley to Bayside Berm Connection* • *Raise Harborwalk at Harbor Point* • *Raise Morrissey Boulevard (long-term option A)* • *Raise Harborwalk along Morrissey (long-term option B)* **BUILDING-LEVEL ADAPTATION** • *Building-Level Adaptation around McConnell Park* **ACCESS & RECREATION** • *Harborwalk connection from Columbia Point to Commercial Point* **OPEN SPACE ENHANCEMENTS** • *Open space enhancements in Malibu Beach* • *Living shoreline along Morrissey interventions*
NOT MONETIZED	**INFRASTRUCTURE** • *Avoided damages to transportation and utility infrastructure such as the Southeast Expressway, Morrissey Boulevard and JFK/UMass Station* • *Avoided loss of service in transportation (emergency egress, travel detours and delays)* • *Avoided loss of service in utilities* **ACCESS & RECREATION** • *Increase waterfront access along Morrissey Boulevard* • *Connect the missing link of the harborwalk between Columbia Point and Victory Park* • *Provide public recreational amenities* **ECOLOGY** • *Enhance ecology and preserve natural resources along Morrissey Boulevard, Malibu Beach and Pattens Cove*	

FLOOD MODELING

Flood modeling results verify that the proposed coastal resilience solutions from Morrissey Boulevard to Moakley Park can effectively block surge both in the near-term and long-term. The inclusion of nature-based strategies along Morrissey Boulevard would further reduce coastal risk.

The combination of coastal resilience solutions at the intersection of Morrissey Boulevard and Bianculli Boulevard (catalytic project), the raised harborwalk at Harbor Point, the integrated flood protection at the Bayside Redevelopment, and the Moakley Park berm, successfully close the flood pathway that would otherwise be an entry point to flood large extends of Columbia Point, parts of Roxbury and South End. The flood modeling results indicate the nature-based solutions along Morrissey Boulevard, such as the expanded beach and dune areas and the living shoreline, significantly reduce wave energy in the near-term. By reducing wave energy these nature-based solutions can provide significant flood risk reduction benefits including reduced likelihood of road damage, less erosion and scour, and reduced rates of overtopping and flooding during more frequent, smaller storm events, all in addition to their ecological and recreational benefits.

1% Annual Chance Flood with 9 in of SLR (2030s) with near-term coastal resilience solutions in place

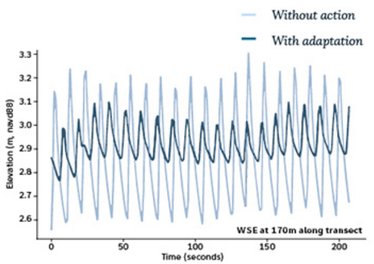
1% Annual Chance Flood with 40 in of SLR (2070s) with near-term and long-term coastal resilience solutions in place

LEGEND

- *Coastal Flood Risk Area without action*
- *Coastal Flood Risk Area with coastal resilience solutions*
- *Coastal Resilience Solution (Flood Risk Reduction)*
- *Coastal Resilience Solution (Access, Ecology & Equity)*

MORRISSEY BOULEVARD WAVE MODELING TRANSECT

FLOOD SCENARIO	WAVE HEIGHT REDUCTION
10% Annual Chance Flood with 9 in of SLR	66%
1% Annual Chance Flood with 9 in of SLR	47%
10% Annual Chance Flood with 40 in of SLR	27%
1% Annual Chance Flood with 40 in of SLR	15%



Reduction in waves at Morrissey Boulevard occurring during a 10% annual chance storm with 9 in of SLR due to the proposed beach and living shoreline elements. The results show a 66% reduction in wave height and energy that would reduce erosion and damage to Morrissey Boulevard. The light blue line shows results with no living shoreline or beach restoration in place, while the darker blue line shows the results with the living shoreline and beach nourishment implemented.

Image Source: Old Colony Yacht Club by marinas.com (2016)

CLAM POINT & TENEAN BEACH

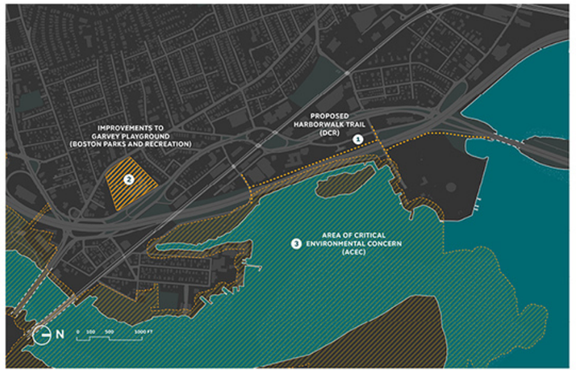
The Clam Point and Tenean Beach flood risk area encompasses the shoreline and neighborhood between the Morrissey Boulevard underpass at the Southeast Expressway (I-93) and Tenean Beach. The coastal flood risk in this area originates from three flood pathways, and in the 40 inches of sea-level rise scenario extensive areas of inland neighborhoods become flooded. Residential homes, commercial businesses, cultural institutions and schools, tidal marshes and mudflats, and critical transportation infrastructure such as the MBTA Red Line, Morrissey Boulevard, and the Southeast Expressway (I-93) are all vulnerable to this future coastal flooding during storm events.

At the flood pathway sites and the areas adjacent to them, proposed improvements to open space and ecosystems can reduce risk to adjacent infrastructure, businesses, and residences while enhancing waterfront recreation and restoring valuable tidal ecosystems.

Coastal resilience solutions at Clam Point & Tenean Beach will enhance existing waterfront destinations for the neighborhood and create new open space resources, while simultaneously addressing near- and long-term coastal flood risks. Focusing on the key points of access to the waterfront, which are also two of the three flood pathways in the area, the interventions enhance key connections from the inland neighborhoods and establish continuous public access along the waterfront. Together, enhanced open spaces and ecosystems, and structural solutions, reduce risk to adjacent infrastructure and neighborhoods.

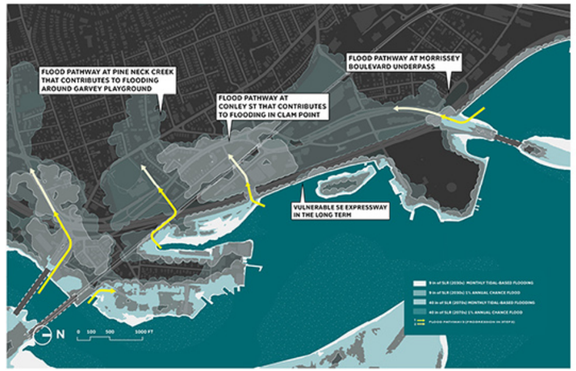
> *"There needs to be better and safer biking and walking infrastructure - a connected network. There needs to be more emphasis on native plants and improved/ restored coastal environments."*
>
> – ONLINE SURVEY 1 RESPONDENT

EXISTING CONDITIONS & PLANNED PROJECTS



Sites in this flood risk zone include Tenean Beach, Victory Park, Garvey Park, residential neighborhoods, and commercial / industrial use areas. The major transportation infrastructure in this area includes Morrissey Boulevard, the MBTA Red Line and Commuter Rail, and the Southeast Expressway (I-93), as well as other key evacuation routes for communities like Port Norfolk. Currently, the Massachusetts Department of Conservation and Recreation (MASS DCR) is proposing continuing the Neponset River Greenway from Malibu Beach to Tenean Beach (1), and Boston Parks and Recreation is working on improvements to Garvey Playground (2). In addition, tidal marsh and mudflat systems and habitats along the waterfront are part of a state designated Area of Critical Environmental Concern (ACEC), as referenced in ***Chapter 2: Context***.

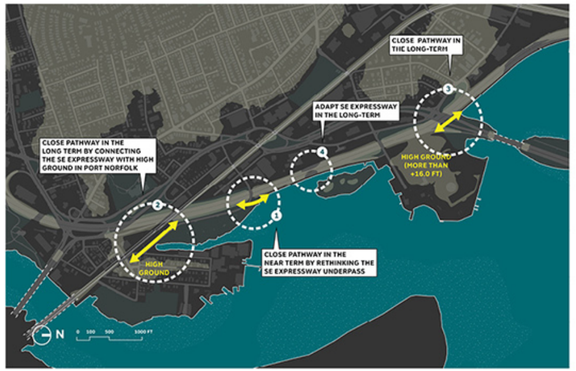
FUTURE COASTAL FLOOD RISK



Flooding enters the Clam Point Neighborhood via three flood pathways, while Tenean Beach is directly exposed to fringe flooding. In the near-term (9 inches of sea-level rise, 2030s), the flood pathway at Conley Street is activated and causes localized coastal flooding in the adjacent industrial and residential areas inland. Tenean Beach begins to experience monthly tidal flooding as a result of rising sea-levels. In the long-term (40 inches of sea-level rise, 2070s), all three flood pathways are inundated, and extensive inland flooding occurs and the monthly tidal flooding at Tenean Beach expands further inland to Conley Street. Critical transportation infrastructure, such as the local road network and the MBTA Red Line and Commuter Rail, also becomes vulnerable.

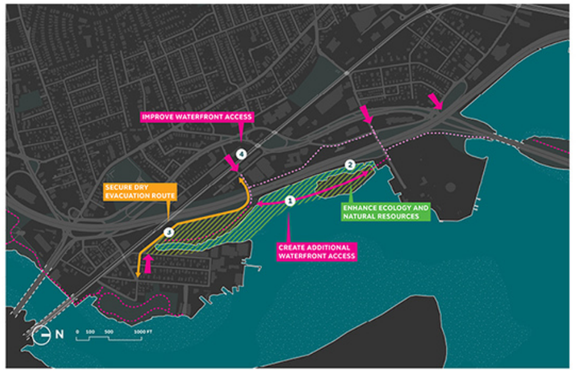
RESILIENCE APPROACH

RISK REDUCTION LAYER



The primary goal for this area is to close the three flood pathways (1, 2, and 3 as shown above) to prevent inland coastal flooding during the target design flood event (1% annual chance flood with 40 inches of sea-level rise) and make the park at Tenean Beach resilient to flooding. In addition, the restoration and expansion of tidal ecosystems helps reduce erosion and attenuate wave energy along the waterfront, forming a layered approach that increases the resilience of the open space and Southeast Expressway Corridor (4). Beyond the target horizon of the study, low points along the Southeast Expressway will need to be protected or elevated.

ECOLOGY, ACCESS & EQUITY LAYER



In addition to reducing coastal flood risk, the proposed solutions for this area improve public access to and along the waterfront (1 and 4), generate new resilient parks and open spaces, and preserve or enhance tidal ecosystems and habitat (2). Improvements made to infrastructure can also reduce the risk of coastal flooding blocking evacuation and emergency access routes (3).

COASTAL RESILIENCE SOLUTIONS

MORRISSEY BOULEVARD (SOUTH)

The Design Flood Elevation at this location is 16.1 feet NAVD88.

In this area, two landscape berms close the flood pathway, tying back into the Southeast Expressway on each side of Morrissey Boulevard and extending north to Beades Bridge. The landscape berms accommodate public waterfront access through an expansion of the Neponset River Greenway and Harborwalk trail and include living shoreline elements that help expand habitat and reduce erosion at the toe of the berm.

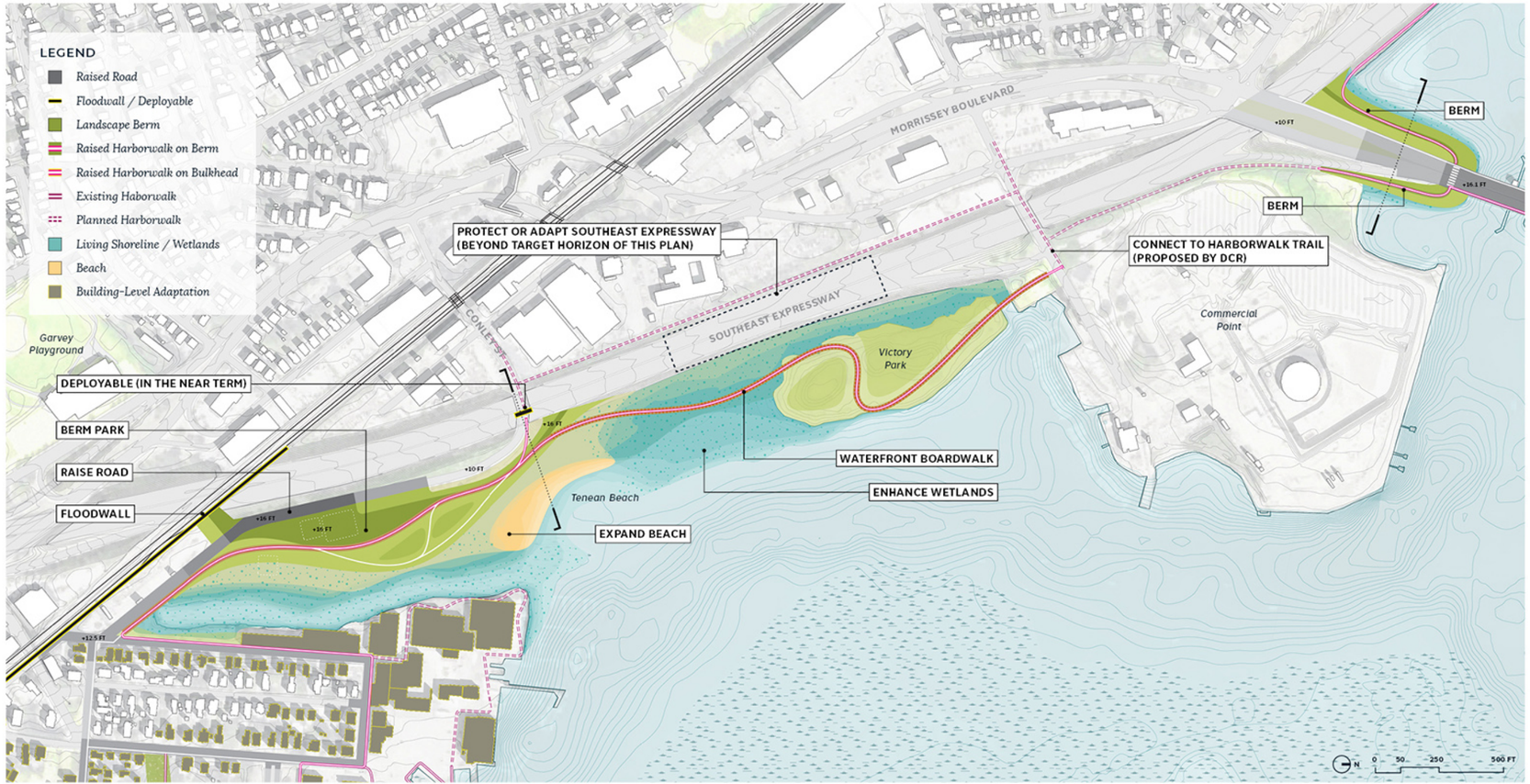
VICTORY PARK TO TENEAN BEACH

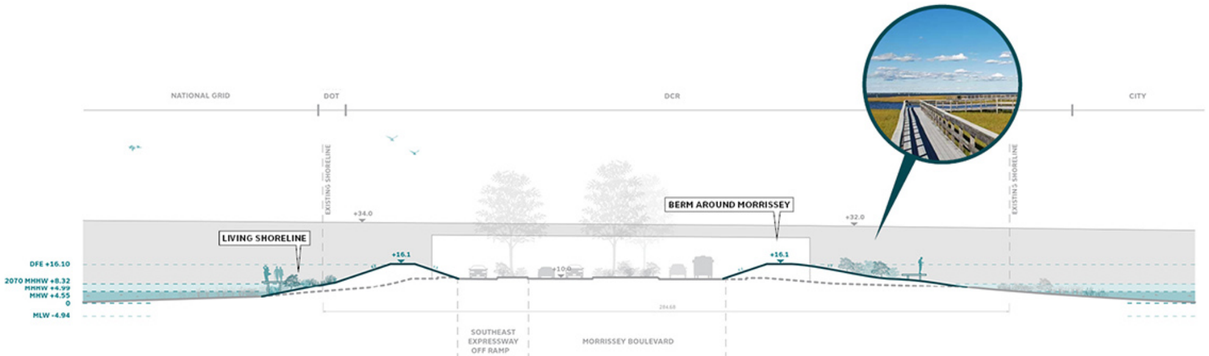
The Design Flood Elevation at this location is 16.0 feet NAVD88.

At Tenean Beach, open space enhancements create a more resilient recreational landscape and neighborhood amenity. At the Conley Street underpass, a deployable barrier addresses near-term flood risks and streetscape interventions enhance and improve access to the waterfront. In addition, a low berm (+12.5 feet NAVD88) is constructed along Tenean Beach to address frequent flooding (low water surface elevation). An elevation of +12.5 feet NAVD88 is projected to provide protection up to a level of 2% annual chance flood with 9 inches of sea–level rise (2030s), and approximately a 50% annual chance flood with 40 inches of sea-level rise (2070s).

In the long-term, the berm is adapted and raised to the DFE (+16.0 feet NAVD88), making the deployable barrier at Conley Street redundant. The long-term intervention is coupled with a floodwall along the MBTA Red Line. These two elements protect from flood waters entering Clam Point. Integrated into these flood protection elements, are features that improve access and equity and, as a system, together create a more resilient waterfront for all residents. The berm expands into a raised park providing space for residents to enjoy active recreation and access to the beach, while also creating areas for tidal marsh to expand and migrate with sea-level rise. Coastal planting strategies and tidal marsh expansion in this area provide habitat and increase the resilience of the waterfront. In addition, a continuous public waterfront path connects Port Norfolk and Tenean Beach north to Victory Park to expand recreational opportunities along the waterfront.

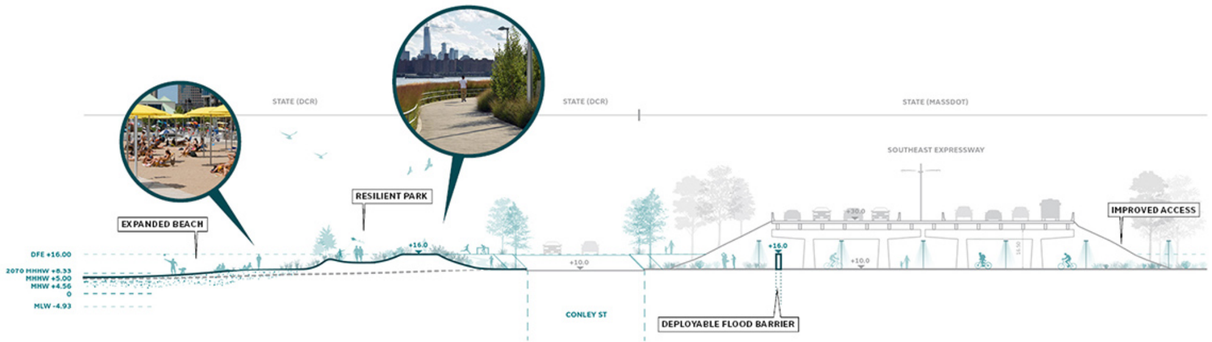
Beyond the target horizon of this plan (that is, when sea-level rise exceeds 40 inches, or when a larger than 1% annual chance flood event occurs), parts of the Southeast Expressway become vulnerable, and will need to be raised or protected. These measures can be integrated with the outboard pedestrian path from Victory Park to Tenean Beach. In addition, in the event of future major repair or reconstruction projects in the Morrissey Boulevard underpass, raising the bridge and the boulevard itself could reduce residual risk along Morrissey Boulevard.





MORRISSEY BOULEVARD (SOUTH)

The two proposed landscape berms on either side of Morrissey boulevard close the flood pathway entering through the underpass and offer opportunities to get close to the water and a continuous pedestrian and bike waterfront path. In the event of future investment in the Southeast Expressway bridge at the underpass, both the bridge and roadway below could be raised to reduce residual risk along Morrissey Boulevard.

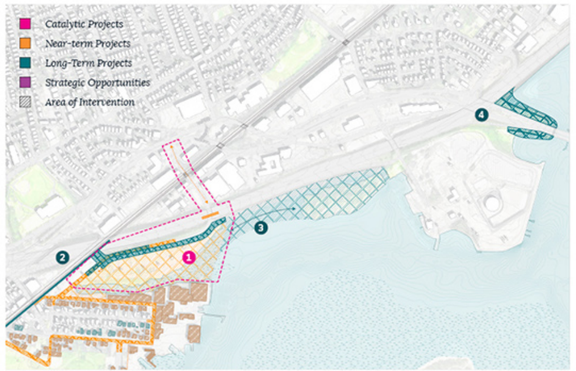


TENEAN BEACH

The design of the flood protection berm along Tenean beach emphasizes accessibility along the waterfront and from inland areas towards the water. The gentle slope allows for easy access up and over the berm and offers areas for programming and recreation.

Coastal resilience solutions from Victory Park to Tenean Beach include flood protection elements such as a berm park along Tenean Beach, a boardwalk connection between Victory Park and Tenean Beach, and nature-based solutions to mitigate wave action and reduce erosion, such as beach and wetlands expansion.

PHASING



CATALYTIC & NEAR-TERM PROJECTS

1 **Tenean Beach Phase I & Conley Street Deployable**
Catalytic Project includes the following interventions:

- Install deployable gate at Conley Street underpass to close the near-term pathway up to the DFE (+16.0 feet NAVD88).
- Construct a low landscape berm to +12.5 feet NAVD88 to mitigate risk in frequent flood events.
- Raise Conley Street to +12.5 feet NAVD88 to preserve emergency access in frequent flood events.
- Pedestrian and bike improvements along Conley Street.
- Open space enhancements at Tenean Beach.

LONG-TERM SOLUTIONS

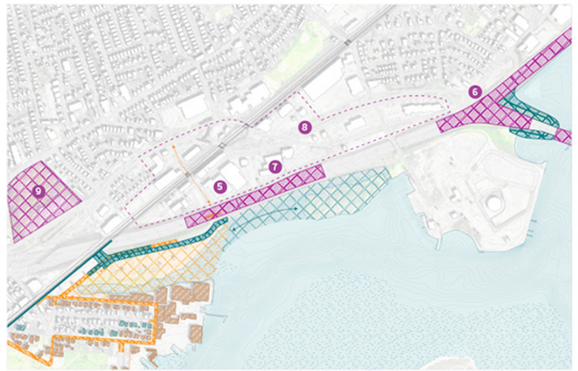
2 **Floodwall along MBTA Red Line at Pine Neck Creek:** Create floodwall to the DFE (+16.0 feet NAVD88) along MBTA Red Line tracks at Pine Neck Creek to close the long-term pathway.

3 **Tenean Beach Phase II**
Phase II of the Tenean Beach improvements adapts and expands improvements from Phase I.

- Tidal marsh restoration and expansion from Victory Park to Pine Neck Creek.
- Establish continuous public boardwalk connection from Victory Park to Tenean Beach.
- Adapt landscape berm and Conley Street improvements to the DFE (+16.0 feet NAVD88) for a passive long-term solution. The deployable barrier becomes redundant. (Preferred option)
  - Alt 1: If the flood protection system needs to be limited in minimum interventions: Continue relying on deployable at Conley Street in the long term.
  - Alt 2: If flood protection needs to be independent of the expressway: Adapt berm and raised road to reach DFE (+16.0 feet NAVD88). Extend berm along Southeast Expressway. Deployable becomes redundant.

4 **Morrissey Boulevard (South)**

- Construct landscape berms to the DFE (+16.1 feet NAVD88) on both sides of Morrissey Boulevard. The two berms tie into the Southeast Expressway to the South and to high ground around Beades Bridge landing to the north.
- Complete public path connection south to Victory Park (per DCR's plan). Construct living shoreline enhancements along berms to reduce erosion risk.



STRATEGIC OPPORTUNITIES

5 **Southeast Expressway and Conley Street underpass:** In the event of future investment in the Southeast Expressway, consider raising the highway bridge, raising Conley Street at the underpass, and widening the underpass for better access and reduced residual risk along Conley Street.

6 **Southeast Expressway and Morrissey Boulevard underpass:** In the event of future investment in the Southeast Expressway, consider raising the highway bridge and Morrissey Boulevard at the underpass.

7 **Southeast Expressway Low Points:** Portions of the Southeast Expressway are just at or slightly below +16.0 feet NAVD88 and could be at risk of flooding in the long-term. If major repairs are required in the future, there is an opportunity to raise portions of the expressway above this elevation.

8 **Clam Point:** Clam Point inland areas contain many low points at risk for floodwater and stormwater pooling. In the case of redevelopment of commercial properties in Clam Point, use the sites for stormwater storage and management (either with or without development).

9 **Garvey Playground:** In the case of future investment in Garvey Playground, incorporate stormwater storage and management.

PERFORMANCE

BENEFIT-COST ANALYSIS

In accordance with prior Climate Ready Boston plans, the methodology for the Benefit-Cost Analysis suggests estimating all project costs but monetizing only select project benefits to generate a benefit-cost ratio (BCR). See below the project elements that are included and those that are not included in the monetized analysis. The matrix offers a summary of the comprehensive flood protection, environmental and social benefits of the proposals. For further information on the methodology refer to p. 85 of this chapter.

ESTIMATED PROJECT COSTS

	*CATALYTIC PROJECT	LONG-TERM PROJECT
Cost	*$16.6 million*	*$39.2 million*
Annual O&M	$166,000	$392,000

BENEFIT-COST RATIO

DISCOUNT RATE	*CATALYTIC PROJECT	LONG-TERM PROJECT
3%	5.9	3.8
7%	1.9	1.5

	Benefits	*Costs*
MONETIZED	**BUILDINGS** • *Avoided Damages to buildings and their contents, and associated functions (displacement and relocation costs, mental stress and anxiety, loss of productivity)*	**FLOOD PROTECTION** • *Deployable Barrier at Conley Street** • *Tenean Beach Phase I (berm and road to low elevation)** • *Tenean Beach Phase II (berm and road to high elevation)* • *MBTA Red Line Floodwall at Pine Neck Creek* • *Morrissey Boulevard (South)* **ACCESS & RECREATION** • *Enhanced access along Conley Street** • *Boardwalk connection between Victory Park and Tenean Beach* **OPEN SPACE ENHANCEMENTS** • *Open space enhancements in Tenean Beach** • *Enhance and expand wetlands area between Victory Park and Tenean Beach*
NOT MONETIZED	**INFRASTRUCTURE** • *Avoided damages to transportation and utility infrastructure, such as the MBTA Red Line, the Southeast Expressway, and Morrissey Boulevard* • *Avoided loss of service in transportation (emergency egress, travel detours and delays)* • *Avoided loss of service in utilities* • *Minimize erosion and wave action along the Southeast Expressway* **ACCESS & RECREATION** • *Increase waterfront access* • *Provide public recreational and programmatic amenities* • *Connect the missing link of the harborwalk between Victory Park and Tenean Beach* **ECOLOGY** • *Enhance ecology and preserve natural resources* • *Opportunity to create a mitigation site between Victory Park and Tenean Beach*	

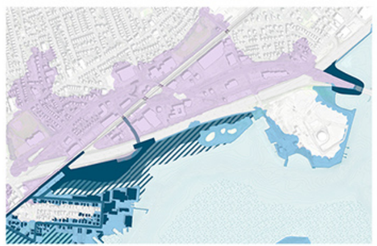
FLOOD MODELING

Flood modeling results verify that near-term and long-term solutions in Clam Point & Tenean Beach successfully reduce coastal flood risk in the near-term and long-term.

Model results verify that near-term proposals for a deployable gate at Conley Street and a low-berm at Tenean Beach successfully close the near-term flood pathway to Clam Point and reduce coastal flood risk. In addition, the model results showcase that the adapted berm at Tenean Beach, in combination with the floodwall along the MBTA Red Line tracks and the landscape berms at the Morrissey Boulevard underpass, successfully close the two long-term pathways (Pine Neck Creek and Morrissey Boulevard) and prevent extended coastal flooding in Clam Point and along the MBTA Red line.

Nature-based solutions, such as the enhanced and expanded wetlands between Victory Park and Tenean Beach offer erosion reduction benefits along the Southeast Expressway for more commonly occurring storm events. This aligns with Nature-Based Solutions for Coastal Highway Resilience recommendations by Federal Highway Administration (FHWA).

1% Annual Chance Flood with 9 in of SLR (2030s) with near-term coastal resilience solutions in place



1% Annual Chance Flood with 40 in of SLR (2070s) with near-term and long-term coastal resilience solutions in place

LEGEND

- *Coastal Flood Risk Area without action*
- *Coastal Flood Risk Area with coastal resilience solutions*
- *Coastal Resilience Solution (Flood Risk Reduction)*
- *Coastal Resilience Solution (Access, Ecology & Equity)*

SOUTHEAST EXPRESSWAY WAVE MODELING TRANSECT

FLOOD SCENARIO	WAVE HEIGHT REDUCTION
10% Annual Chance Flood with 9 in of SLR	36%
1% Annual Chance Flood with 9 in of SLR	23%
10% Annual Chance Flood with 40 in of SLR	23%
1% Annual Chance Flood with 40 in of SLR	23%

Image Source: Port Norfolk Yacht Club by marinas.com (2016)

PORT NORFOLK

The waterfront community of Port Norfolk consists primarily of residential homes, with some commercial use along the waterfront, and Joseph Finnegan Park, a large waterfront park on the southeastern shoreline. The neighborhood currently experiences regular tidal flooding along the perimeter and fringe flooding in flood events, and this will only be exacerbated as sea-levels rise. According to local residents, the recent redesign of Joseph Finnegan Park has alleviated some of the frequent flooding and associated upkeep costs.

To mitigate future flood risk while also maintaining a connection to the waterfront, the coastal resilience solutions for Port Norfolk create adaptation and protection measures to incrementally reduce coastal risk over time. Coastal resilience solutions at Port Norfolk include a combination of enhanced open space and tidal ecosystems, road raising, and building-level adaptation, to allow this waterfront neighborhood to adapt to rising seas and storms in a layered and flexible manner that respects its waterfront identity.

> *"Port Norfolk has already experienced flooding and I'm afraid of losing access to services. Solutions here must ensure people can get in and out safely. Also improving access to the water and open spaces that are part of the Neponset Estuary."*
>
> *– ONLINE SURVEY 2 RESPONDENT*

EXISTING CONDITIONS & PLANNED PROJECTS

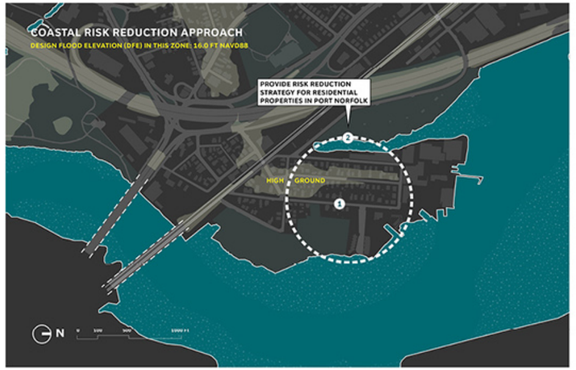
Port Norfolk has an industrial history, and today the shoreline is mostly industrial and commercial, but the majority of the neighborhood is residential. Joseph Finnegan Park and Tenean Beach are important recreational and open space amenities, and the neighborhood is connected to the Neponset River Greenway. In addition to the recent improvements at Joseph Finnegan Park by MASS DCR (1), there are plans for a private mixed-use development at the tip of the peninsula (Neponset Wharf Development) (2). The shoreline of Port Norfolk is also located in an Area of Critical Environmental Concern (3).

FUTURE COASTAL FLOOD RISK

As sea-levels rise, Port Norfolk will become increasingly exposed to both regular tidal flooding and considerable fringe flooding during flood events. In the near-term (9 inches of sea-level rise, 2030s), some areas begin to experience more regular tidal flooding and residential homes and waterfront businesses are vulnerable to fringe flooding in storm events. As sea-levels continue to rise in the long-term (40 inches of sea-level rise, 2070s), this flooding only becomes more extensive and more homes and infrastructure are impacted. Because it is a peninsula, Port Norfolk is at risk of becoming isolated in flood events, as one of the two evacuation and emergency access routes (Conley Street) is flooded in the future.

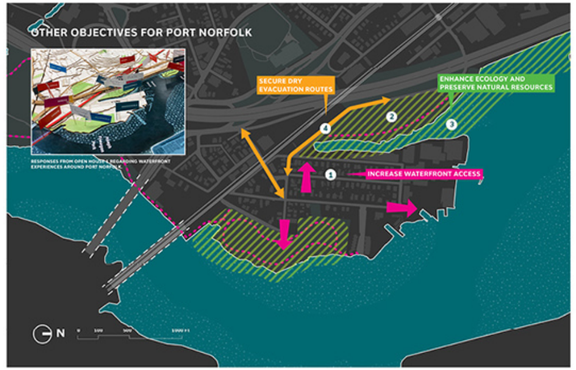
RESILIENCE APPROACH

RISK REDUCTION LAYER



In order to effectively reduce coastal flood risk, resilient open space improvements, natural and nature-based features, strategic road raising (1), and building-level adaptation (2) are proposed for this area. Incorporating these solutions over time provides flexibility for the community to incrementally adapt as sea-levels rise, while maintaining a connection to the water. In addition, the strategic road raising reduces the risk of evacuation and emergency access routes being compromised in flood events.

ECOLOGY, ACCESS & EQUITY LAYER



A layered approach in Port Norfolk not only increases the resilience of the community to coastal flooding, but also provides open space and public access benefits that foster social resilience and contribute to the overall resilience of the community. Coastal resilience solutions in Port Norfolk provide greater connections to the waterfront through upland public connections (1), an improved waterfront park (2), preserved or enhanced tidal ecosystems (3), and secure dry evacuation routes (4).

COASTAL RESILIENCE SOLUTIONS

PORT NORFOLK

The Design Flood Elevation at this location is 16.0 feet NAVD88.

OPEN SPACE & TIDAL ECOSYSTEM ENHANCEMENTS

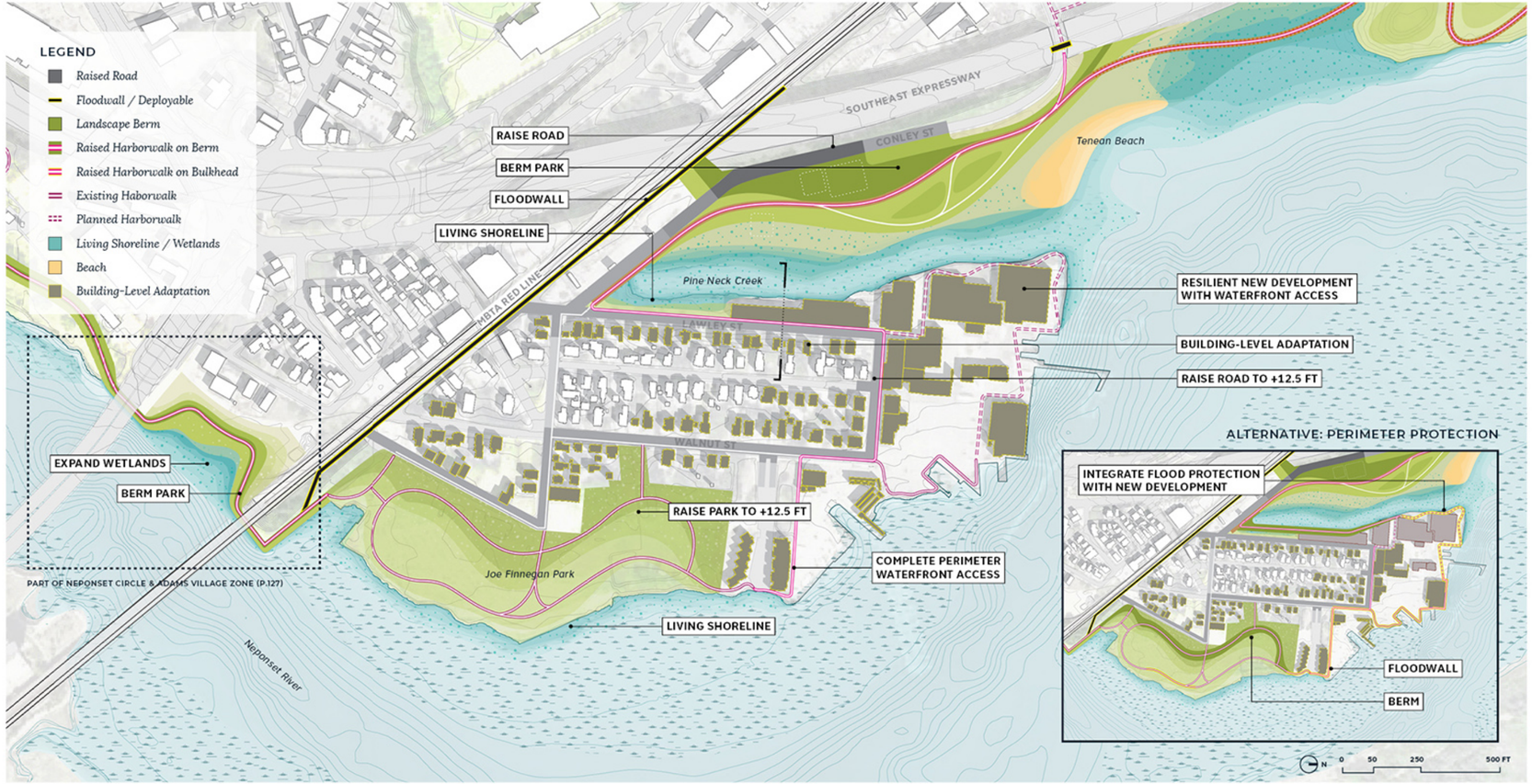
Building upon the successful recent improvements to Joseph Finnegan Park in alleviating some of the nuisance flooding, additional enhancements to this open space include raising parts of the park, improvements to stormwater management, living shorelines, and improved public access. In addition, because waterside portions of Port Norfolk are within the Area of Critical Environmental Concern, monitoring and maintaining existing tidal ecosystems will preserve critical habitat and contribute to the overall resilience of the area.

STRATEGIC ROAD RAISING

Port Norfolk only has two means of access and egress. Strategically raising roads in the area reduces the risk of evacuation routes and emergency routes being flooded and also provides protection during flood events with lower water surface elevation. Strategic road raising of the perimeter streets (Lawley, Ericsson, and Walnut) to +12.5 feet NAVD88 offers protection up to a level of 2% annual chance flood with 9 inches of sea-level rise (2030s), and 50% annual chance flood with 40 inches of sea-level rise (2070s). This elevation provides significant risk reduction but is also practical as it is anticipated to be implementable with minimal impact on properties.

LONG-TERM ALTERNATIVES

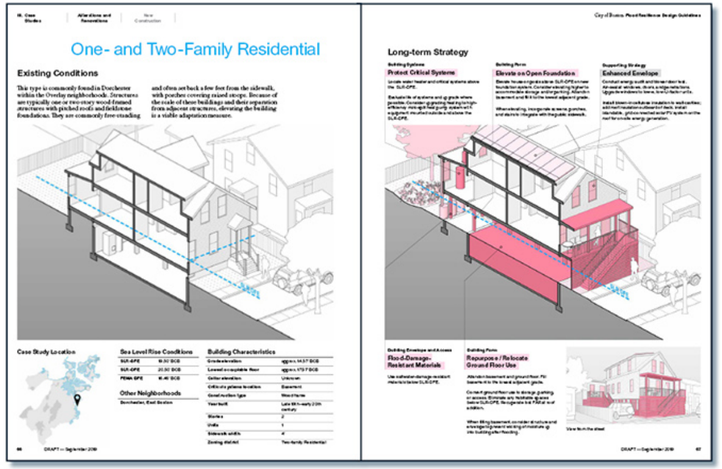
For the near-term, solutions include road raising and building-level adaptation. For the long-term there are two alternatives: (A) to continue the adaptation measures and further adapt individual buildings as the flood risk grows, or (B) to create an entirely new perimeter protection system consisting of berms and flood walls. The first alternative allows for incremental and independent flood risk reduction at a lower cost while retaining views and access to the water. Homeowners can flood-proof or raise their homes without depending on their neighbor to also take action. The second alternative is dependent on coordination with private owners and new developments along the perimeter, and will only be effective once it's fully completed. This option will block visual and physical access to the water as well as likely impact private properties due to space constraints along the waterfront. In the case of overtopping (a flood beyond 1% or with more than 40 inches of sea-level rise), the first alternative has lower residual risk, meaning there will be only a few inches or feet of water in home yards, whereas the second one carries higher residual risk, meaning once the water is inside the flood protection system, higher levels of water (such as 6 or 7 feet) will be observed. The narrow site constraints, higher costs, environmental impacts, and the increased residual risk make the perimeter protection alternative unfeasible.



BUILDING-LEVEL ADAPTATION

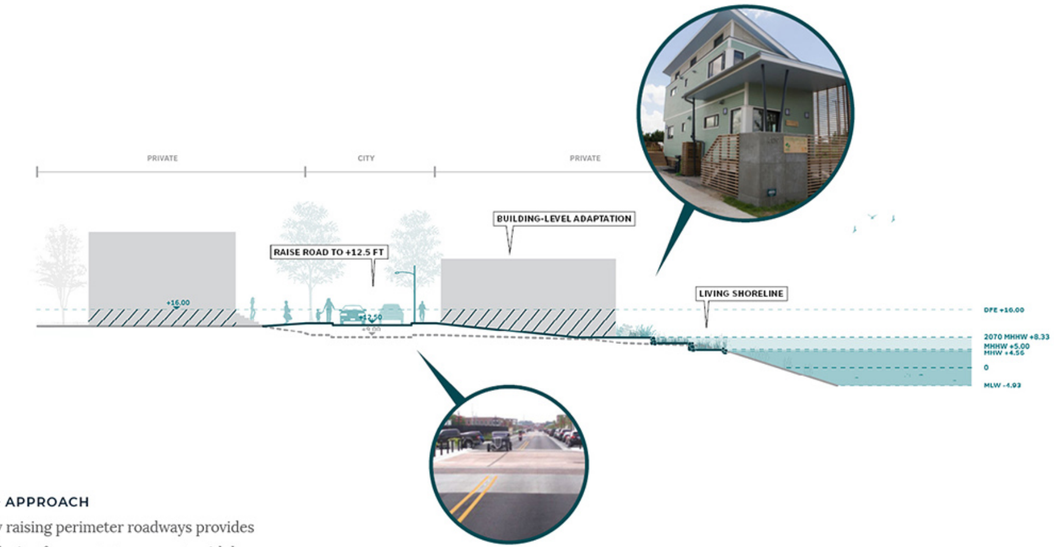
To complement the strategic road raising, adaptation measures at the building level will allow individual residences (approx. 40 in the near-term and an additional 20 in the long-term) and new developments to withstand storm surge and flood risk during less frequent and larger storm events with higher water surface elevation. Adaptation measures may include relocation of utilities above flood elevations, filling in sub-grade building levels, or elevating the first floor of homes, as indicated at the City's Coastal Flood Resilience Design Guidelines.

As outlined in ***Chapter 3: Coastal Flood Risk*** (see p. 47), the *Coastal Flood Resilience Design Guidelines* provide a set of strategies for existing and future developments to ensure that they are built or adapted to withstand the flooding risks posed by sea-level rise and storm surge. The overlay will place restrictions on allowed uses on ground floors below the Design Flood Elevation by requiring all mechanical equipment and residential areas to be located above the DFE. The City will further evaluate projects undergoing these changes for their impact on the public realm to ensure that they contribute to the pedestrian environment, and, to the greatest extent possible, enhance the urban design character of the streetscape.



The adjacent pages from the **Coastal Flood Resilience Design Guidelines** *contain an illustration of suggested strategies for one- and two-family residential building type, commonly found in Dorchester. For more information got to bostonplans.org*

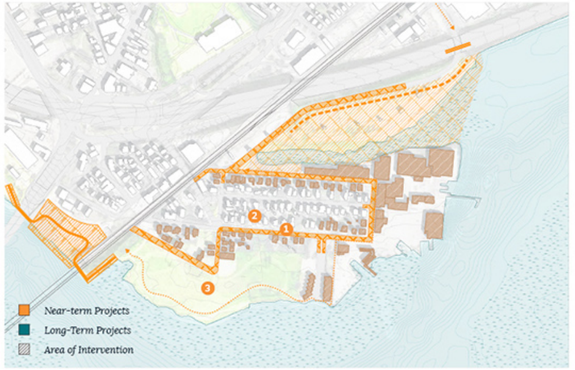
Specifically for one- and two-family residential buildings, a building type commonly found in Dorchester, likely adaptation measures include relocation of utilities above flood elevations, filling in or waterproofing of sub-grade building levels, or elevating the first floor of homes. Further building-specific analysis is required to understand individual building construction and compare finished floor elevations to the Design Flood Elevation to determine the specific recommended interventions or if elevation would be advantageous for that structure.



A LAYERED APPROACH

Strategically raising perimeter roadways provides protection during frequent storm events with low water surface elevation, and therefore alleviates homeowners from the cost of regular upkeep. Raising the streets Lawley, Ericsson, and Walnut appears feasible as the majority of residential structures are set back and elevated 2 or 3 feet from the street. This will allow for an easy adaptation of the roadways, incorporating elements of enhanced pedestrian and bike connectivity.

PHASING



NEAR-TERM PROJECTS

1. **Raise Roadways:** Raise perimeter roadways to elevation 12.5 feet NAVD88. Improve pedestrian and bike access along perimeter roadways.

2. **Building-Level Adaption for Port Norfolk Phase I:** Adaptation measures are needed for approximately 40 buildings vulnerable to near-term coastal flooding.

3. **Open Space and Ecosystem Enhancements:** Further adaptation of Joseph Finnegan Park will reduce risk in frequent storm events as sea-levels rise. These enhancements may include strategic raising of the park, improvements to stormwater management, living shorelines, and additional programming and improved public access to enhance everyday use.

LONG-TERM SOLUTIONS

4. **Building-Level Adaption for Port Norfolk Phase II**
   Responding to a growing risk, building-level adaptation measures are needed for approximately 20 additional buildings vulnerable to long-term coastal flooding.

   Alternative: Perimeter Protection
   Construct a perimeter flood protection system with berms and floodwalls in coordination with private owners and new developments along the perimeter.

Recently reconstructed Joseph Finnegan Park in Port Norfolk.

PERFORMANCE

BENEFIT-COST ANALYSIS

In accordance with prior Climate Ready Boston plans, the methodology for the Benefit-Cost Analysis suggests estimating all project costs but monetizing only select project benefits to generate a benefit-cost ratio (BCR). See below the project elements that are included and those that are not included in the monetized analysis. The matrix offers a summary of the comprehensive flood protection, environmental and social benefits of the proposals. For further information on the methodology refer to p. 85 of this chapter.

ESTIMATED PROJECT COSTS

	PREFERRED LONG-TERM	*ALTERNATIVE LONG-TERM
Cost	*$20.5 million*	*$65.7 million*
Annual O&M	$205,000	$657,000

BENEFIT-COST RATIO

DISCOUNT RATE	PREFERRED LONG-TERM	*ALTERNATIVE LONG-TERM
3%	5.3	2.4
7%	2.5	1.6

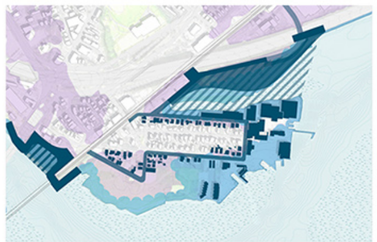
	Benefits	*Costs*
MONETIZED	**BUILDINGS** • *Avoided Damages to buildings and their contents, and associated functions (displacement and relocation costs, mental stress and anxiety, loss of productivity)*	**FLOOD PROTECTION** • *Strategy Road Raising* • *Perimeter floodwall/berm (*Alternative option for long-term)* **BUILDING-LEVEL ADAPTATION** • *Building-Level Adaptation Phase I* • *Building-Level Adaptation Phase II (Preferred option for long-term)* **ACCESS & RECREATION** • *Perimeter pedestrian connection around Port Norfolk* **OPEN SPACE ENHANCEMENTS** • *Open space and ecological enhancements in Joe Finnegan Park and Pine Neck Creek*
NOT MONETIZED	**INFRASTRUCTURE** • *Avoided damages to transportation and utility infrastructure such as the MBTA Red Line and local streets* • *Avoided loss of service in transportation (emergency egress, travel detours and delays)* • *Avoided loss of service in utilities* **ACCESS & RECREATION** • *Increase waterfront access along the perimeter of Port Norfolk* **ECOLOGY** • *Enhance ecology and preserve natural resources along Pine Neck Creek and the Neponset River*	**PROPERTY ACQUISITION** • *Property acquisition cost (uncertain due to the long-term horizon and development potential)*

FLOOD MODELING

Flood modeling results verify that road raising and coastal edge elevation provide some flood control. This may allow more time for building-level adaptations that will be required in the long-term.

Proposed interventions at Port Norfolk are focused on building-level adaptation. Flood modeling results are only able to capture the extent of flooding, but not the changes on the impact that flooding will have on individual structures.

Model results show that in the near term, there is some benefit from nature-based solutions that can help buy time for implementation of building-level adaptation. In the long term, deeper waters limit the effectiveness of nature-based solutions at this location, and further adaptation measures at the building scale will be required.



1% Annual Chance Flood with 9 in of SLR (2030s) with near-term coastal resilience solutions in place

1% Annual Chance Flood with 40 in of SLR (2070s) with near-term and long-term coastal resilience solutions in place

LEGEND

- *Coastal Flood Risk Area without action*
- *Coastal Flood Risk Area with coastal resilience solutions*
- *Coastal Resilience Solution (Flood Risk Reduction)*
- *Coastal Resilience Solution (Access, Ecology & Equity)*

Image: Neponset Circle at king tide on October 29, 2019, 12:30 PM. According to The National Oceanic and Atmospheric Administration (NOAA), water elevation at this station (Neponset River #8444488) was at 11.98 ft above Mean Lower Low Water (MLLW), which is -5.26 ft. This means water elevation was at +6.72 ft NAVD88. For reference, the ground level in the foreground of the image is at +8 ft NAVD88.

NEPONSET CIRCLE & ADAMS VILLAGE

This flood risk zone refers to the area of shoreline between Port Norfolk and Pope John Paul II Park and includes the neighborhoods of Adams Village and Neponset, as well as parts of Ashmont. This area consists primarily of single and multi-family residences, some low-density commercial use, and recreational open space. These neighborhoods are vulnerable to extensive coastal flooding as sea-levels rise and the flood waters enter through two main flood pathways at Neponset Circle and Davenport Creek. The flood pathway at the Neponset Circle waterfront site is a relatively narrow portion of low ground along the shoreline where flood waters will enter, and extensive inland flooding may occur in future flood events as sea-levels rise. This pathway is located primarily on one privately-owned property.

The strategy proposed at Neponset Circle is an example of how strategic acquisition of a vulnerable non-residential waterfront property at a key flood pathway can provide the opportunity to cost-effectively reduce the flood risk. This strategy is especially applicable in areas such as this, where large inland areas are vulnerable to projected coastal flooding from a single point along the shoreline. Solutions at this location have the opportunity to enhance neighborhood amenities by integrating flood protection, public open space, and habitat creation into site redevelopment.

While not always feasible or appropriate, this may be a viable strategy in some locations in Dorchester and city-wide. Here, this strategy provides more physical space for flood protection, thus creating more opportunities for more cost-effective and less intrusive flood protection strategies. It also provides more area for open space enhancements to create new amenities for the neighborhood, tidal ecosystem expansion to reduce shoreline erosion and provide wildlife habitat and a continuous waterfront park system along the Neponset River.

> *"There's an opportunity to improve the waterfront and expand the greenway while also protecting the homes inland of Neponset Circle."*
>
> *– OPEN HOUSE 1 PARTICIPANT*

EXISTING CONDITIONS & PLANNED PROJECTS

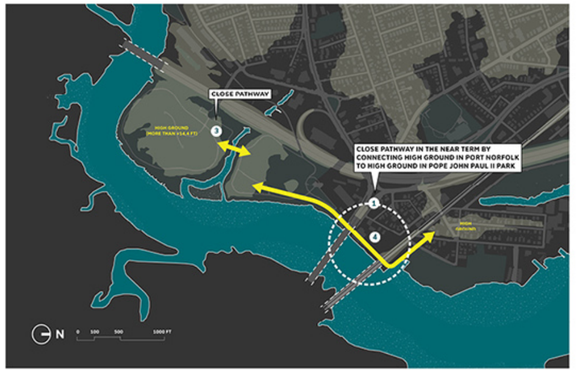
The Neponset Circle zone consists of a privately-owned parcel (Neponset Circle site) located between the MBTA Red Line bridge and Neponset Avenue bridge and state-owned open space at Pope John Paul II Park, a capped landfill. The shoreline is a patchwork of fringe tidal marshes, rock revetments, and sea walls along the Neponset River and is part of an Area of Critical Environmental Concern (ACEC) (1).

FUTURE COASTAL FLOOD RISK

One major flood pathway and one secondary flood pathway are the entry points for water flooding the inland neighborhood. In the near-term, the major flood pathway at the Neponset Circle site is inundated, exposing infrastructure, residential homes, and businesses to flooding. In the long-term, floodwaters from the secondary flood pathway at Davenport Creek combine with floodwaters from Neponset Circle, exposing an even greater number of single and multi-family residences in Adams Village and Ashmont. Groundwater increases may become a problem for the capped landfill at Pope John Paul II Park, and further adaptation study will be required there.

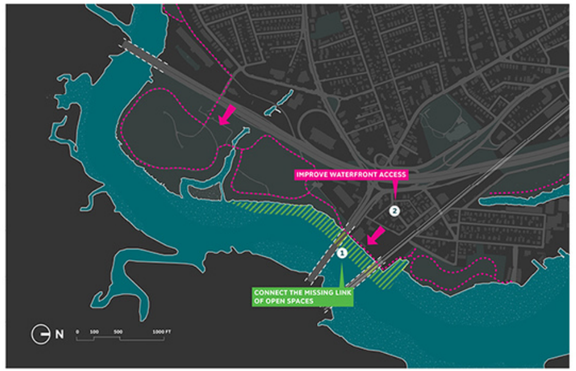
RESILIENCE APPROACH

RISK REDUCTION LAYER



Flood protection measures at both flood pathways are employed to protect the inland neighborhoods from extensive coastal flooding. These protection measures will tie into adjacent high ground above the Design Flood Elevation (DFE). The coastal resilience solutions include a landscape berm constructed to the DFE (Action 1), nature-based features in the form of tidal ecosystem enhancements (Action 2), and a tide gate at Davenport Creek (Action 3).

ECOLOGY, ACCESS & EQUITY LAYER



The Neponset Circle site is located between two large open spaces, Pope John Paul II Park and Joseph Finnegan Park. Converting the surface parking and current use to public open space will establish a continuous system of waterfront parks along the Neponset River, with the Neponset Greenway being the primary public access path connecting the spaces together (Action 1). Upland connections into the residential neighborhoods (Action 2) enhance public access to the waterfront and Neponset River Greenway, a popular bike and running path in Dorchester.

COASTAL RESILIENCE SOLUTIONS

The coastal resilience solutions for this area are located on two main sites, the Neponset Circle waterfront site and Davenport Creek.

NEPONSET CIRCLE WETLANDS AND BERM PARK

The Design Flood Elevation at this location is 14.4 feet NAVD88.

To implement the proposed solutions at the Neponset Circle flood pathway, the acquisition of one non-residential property along the waterfront is required. The coastal resilience solutions include a landscape berm constructed to the DFE (+14.4 feet NAVD88) with the Neponset River Greenway and public access paths, open space enhancements to provide public recreational space for the neighborhood, tidal wetland preservation and expansion into the site, and improved public access to the waterfront.

In addition to providing coastal flood risk reduction benefits, the interventions also complete the chain of open spaces along the Neponset River and Neponset River Greenway, creating a continuous system of public waterfront parks. The expansion of tidal wetlands into the site creates space and opportunities to provide mitigation for tidal habitat loss in other areas of the Boston Harbor, as a result of the need to construct flood protection in constrained areas.

ALTERNATIVE: RAISE HARBORWALK

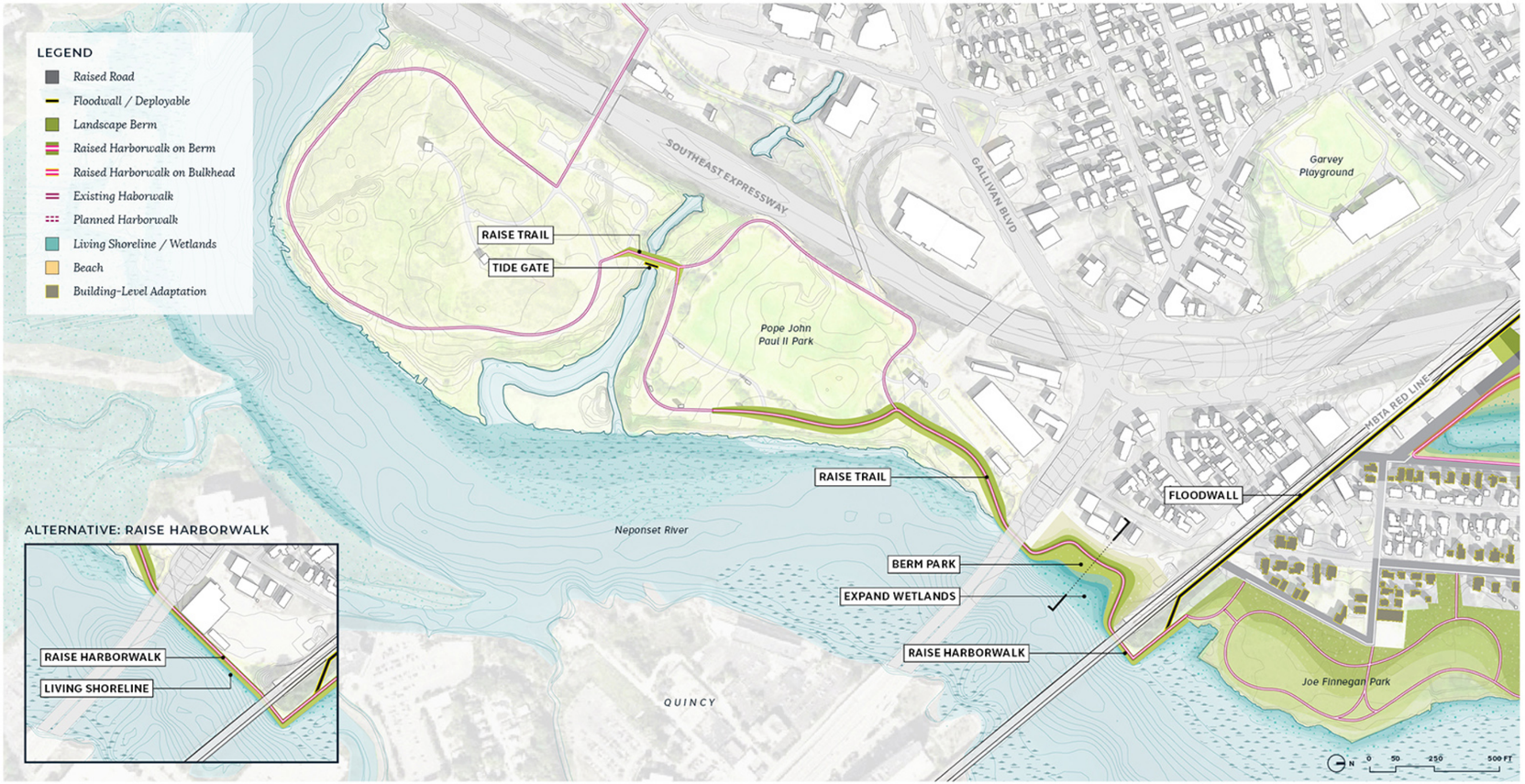
An alternative measure for the Neponset Circle site would have raised in place the existing Harborwalk path to the DFE (+14.4 feet NAVD88). However, this alternative has difficult and restricted site conditions and low ecosystem and recreational value.

TIDE GATE AT DAVENPORT CREEK

At the narrowest point of the creek, where there is now a pedestrian bridge, a tide gate will close the flood pathway during future flood events.

POPE JOHN PAUL II PARK

In the long-term, portions of the waterfront trail through Pope John Paul II Park will be adapted to the DFE (+14.4 feet NAVD88). A geotechnical study will be required to determine the best adaptation strategy for the capped landfill.



ALTERNATIVE: RAISE HARBORWALK

Raising the Harborwalk in place can be coupled with living shoreline interventions that allow for tidal and subtidal ecosystem enhancements. This option offers fewer ecosystem and recreational benefits compared to the preferred solution.

Connection to raised trail at Pope John Paul II Park

Accessible and active open spaces

Landscape berm with pedestrian and bike path

Design Flood Elevation +14.4 FT NAVD88

Mean Higher High Water (with 40in of SLR) +8.35 FT NAVD88

Mean Higher High Water +5.02 FT NAVD88

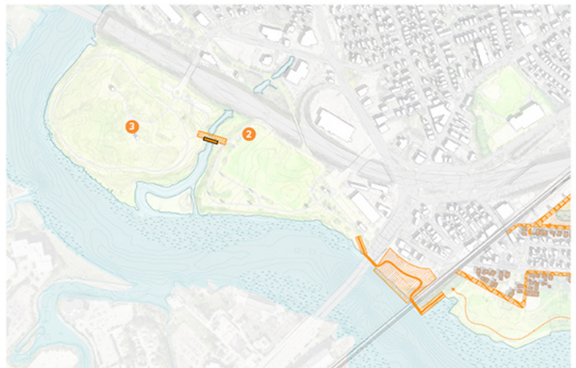
Mean Low Water -4.91 FT NAVD88

Floodable open spaces with resilient planting

Expanded and enhanced wetlands area

The proposed expanded wetlands area and berm park at Neponset Circle will increase waterfront access, connect the existing open spaces along the Neponset Riverfront, enhance ecology, expand natural resources, and lastly provide public recreational amenities. In addition, this site can act as a mitigation site for other resiliency projects in the neighborhood that might require fill in the water.

PHASING



CATALYTIC PROJECTS

1 Neponset Circle Berm Park and Expanded Wetlands Area (Preferred)

- A landscape berm constructed to the DFE (+14.4 feet NAVD88).
- Tidal wetland preservation and expansion into the site.
- Open space and recreational enhancements.
- Pedestrian and bike improvements on site and into the neighborhood.

Neponset Circle Raised Harborwalk (Alternative)

- Raise the existing harborwalk up to the DFE (+14.4 feet NAVD88).
- Construct living shoreline elements.

NEAR-TERM PROJECTS

2 Davenport Creek Tide Gate

A tide gate at Davenport Creek will reduce flood risk in Adams Village.

3 Pope John Paull II Park Geotechnical Study

A study to determine the best adaptation strategies for the capped landfill.

LONG-TERM SOLUTIONS

4 Neponset Trail Adaptation

As the flood pathway at Neponset Circle widens, the flood protection alignment along the Neponset River Greenway expands and ties into high ground.

PERFORMANCE

BENEFIT-COST ANALYSIS

In accordance with prior Climate Ready Boston plans, the methodology for the Benefit-Cost Analysis suggests estimating all project costs but monetizing only select project benefits to generate a benefit-cost ratio (BCR). See below the project elements that are included and those that are not included in the monetized analysis. The matrix offers a summary of the comprehensive flood protection, environmental and social benefits of the proposals. For further information on the methodology refer to p. 85 of this chapter.

ESTIMATED PROJECT COSTS

	PREFERRED OPTION	*ALTERNATIVE OPTION
Cost	*$10.8 million*	*$14 million*
Annual O&M	$108,000	$140,000

BENEFIT-COST RATIO

DISCOUNT RATE	PREFERRED OPTION	*ALTERNATIVE OPTION
3%	2.7	2.8
7%	1.0	1.1

	Benefits	*Costs*
MONETIZED	**BUILDINGS** • *Avoided Damages to buildings and their contents, and associated functions (displacement and relocation costs, mental stress and anxiety, loss of productivity)*	**FLOOD PROTECTION** • *Berm Park (Preferred option)* • *Raised Harborwalk (*Alternative Option)* • *Tide Gate at Davenport Creek* • *Neponset Trail Adaptation in Pope John Paul II Park* **PROPERTY ACQUISITION COSTS** • *Property acquisition cost for waterfront property (for Preferred option) (Assessed value 2019)* **OPEN SPACE ENHANCEMENTS** • *Open space enhancements (with Preferred option)* • *Expanded wetlands area (with Preferred option)* • *Living Shoreline*
NOT MONETIZED	**INFRASTRUCTURE** • *Avoided damages to transportation and utility infrastructure such as Gallivan Boulevard, Davenport Creek, and the Neponset Greenway* • *Avoided loss of service in transportation (emergency egress, travel detours and delays)* • *Avoided loss of service in utilities* **ACCESS & RECREATION** • *Increase waterfront access* • *Recreational and programmatic amenities* **ECOLOGY** • *Enhance ecology and preserve natural resources* • *Connect the missing link of open spaces along the Neponset* • *Opportunity to create a mitigation site at Neponset Circle*	

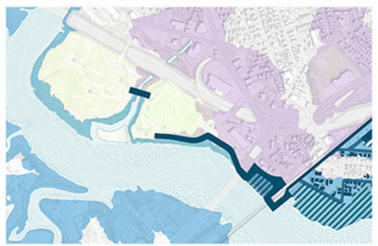
FLOOD MODELING

The flood model results confirm that interventions at Neponset Circle successfully reduces coastal flood risk and closes the flood pathway to Adam's Village both in the near-term and the long-term.

Results from the flood model showcase that the coastal resilience solutions for Neponset Circle, with the landscape berm and the extended wetlands area allow for both a protective feature and floodable open space.

At the same time, the berm closes the flood pathway to the Neponset Circle area and Adam's Village, and therefore reduces coastal flood risk both in the near-term and the long-term.

1% Annual Chance Flood with 9 in of SLR (2030s) with near-term coastal resilience solutions in place



1% Annual Chance Flood with 40 in of SLR (2070s) with near-term and long-term coastal resilience solutions in place

LEGEND

- *Coastal Flood Risk Area without action*
- *Coastal Flood Risk Area with coastal resilience solutions*
- *Coastal Resilience Solution (Flood Risk Reduction)*
- *Coastal Resilience Solution (Access, Ecology & Equity)*

NEPONSET RIVER WATERFRONT

The Neponset Riverfront zone stretches from Pope John Paul II Park to the Neponset River Dam. The shoreline consists of extensive networks of tidal wetlands and habitat, residential buildings along the shoreline, the Neponset River Greenway path and park system, and the Mattapan Trolley. This area is vulnerable to fringe flooding as sea-levels rise, impacting small numbers of buildings along the shoreline, putting transit infrastructure at risk, and threatening the health and longevity of the tidal wetland systems of the estuary.

The tidal wetlands in the Neponset River Estuary are crucial to the environmental health of the area, filtering nutrients and pollution from the water, protecting communities from rising sea-level and harsh storms, supporting breeding grounds for fish and other aquatic species, and offering recreational opportunities. Protecting the Neponset River Estuary means preserving a valuable ecosystem and the resources it provides to local species and surrounding communities.

The coastal resilience solutions propose a framework for monitoring and preserving tidal wetlands to reduce risk, adapt buildings, raise roads to secure evacuation routes and emergency access, and in some cases, explore strategic retreat from vulnerable areas.

> *"We need green space, especially marshes for carbon sequestration, and places like the greenway that people can use daily."*
>
> – OPEN HOUSE 2 PARTICIPANT

EXISTING CONDITIONS & PLANNED PROJECTS

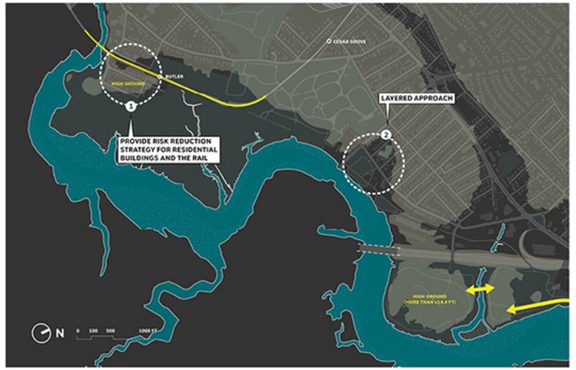
The shoreline along the Neponset River is a system of tidal wetlands that form the Neponset River Estuary and the majority of the Area of Critical Environmental Concern (ACEC) (1). In addition, the Neponset River Greenway, a very popular state-owned and operated trail, runs along the waterfront. The Mattapan Trolley line also runs along this area, and the Butler Station falls within the future flood risk area.

FUTURE COASTAL FLOOD RISK

In both the near-term and long-term, the Neponset Riverfront is vulnerable to fringe flooding along the shoreline. As sea-levels rise, the extents of the fringe flooding expand further inland and impact more buildings and infrastructure. The Mattapan Trolley is at risk of inundation in a 1% chance flood event with 9 inches of sea-level rise (2030s). In addition to coastal flood risk due to sea-level rise, the tidal ecosystems are at risk of being lost as water levels rise faster than the natural systems can adapt.

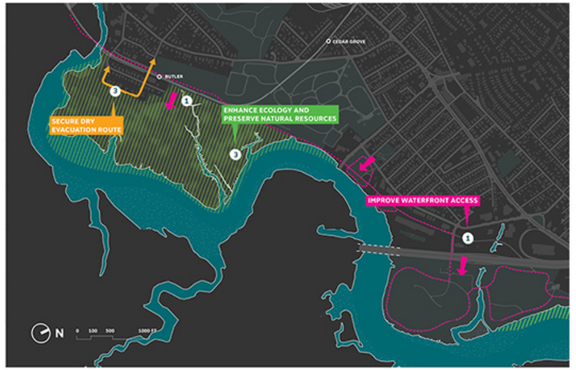
RESILIENCE APPROACH

RISK REDUCTION LAYER



A combination of building-level adaptation strategies, road raising, a robust marsh monitoring and restoration program, and strategic retreat enable the neighborhood and the tidal estuary ecosystem to adapt to rising sea-levels and coastal flood risk while also maintaining an identity as a waterfront community and robust estuary ecosystem (1 and 2). In addition, solutions to address coastal flood risk to the Mattapan Trolley will be required in the near term.

ECOLOGY, ACCESS & EQUITY LAYER



The Neponset Riverfront is already a recreational destination for many in the neighborhood, and future open space and coastal resilience solutions can further enhance access to the waterfront while also creating spaces that are resilient to frequent flood events (1). In addition, coastal resilience solutions secure dry evacuation routes (2). Maintaining and preserving tidal wetland systems and critical habitat contributes to the overall resilience and ecosystem health of the estuary and ACEC (3).

PROPOSED COASTAL RESILIENCE SOLUTIONS

NEPONSET RIVERFRONT

The Design Flood Elevation at this location is 14.4 feet NAVD88.

Because this area is vulnerable to fringe flooding at the shoreline, a combination of coastal resilience solutions function together to create a layered approach to reduce risk and allow time for adaptation.

BUILDING-LEVEL ADAPTATION

Similar to the strategies proposed in Port Norfolk, building-level adaptation measures will allow individual residences to withstand flooding from future flood events in the near-term (approx. five buildings) and the long-term (approx. additional 25 buildings). See the building-level adaptation strategies included in the City's "*Coastal Flood Resilience Design Guidelines*" profiled in the Port Norfolk section (p. 120).

WETLAND MONITORING AND PRESERVATION

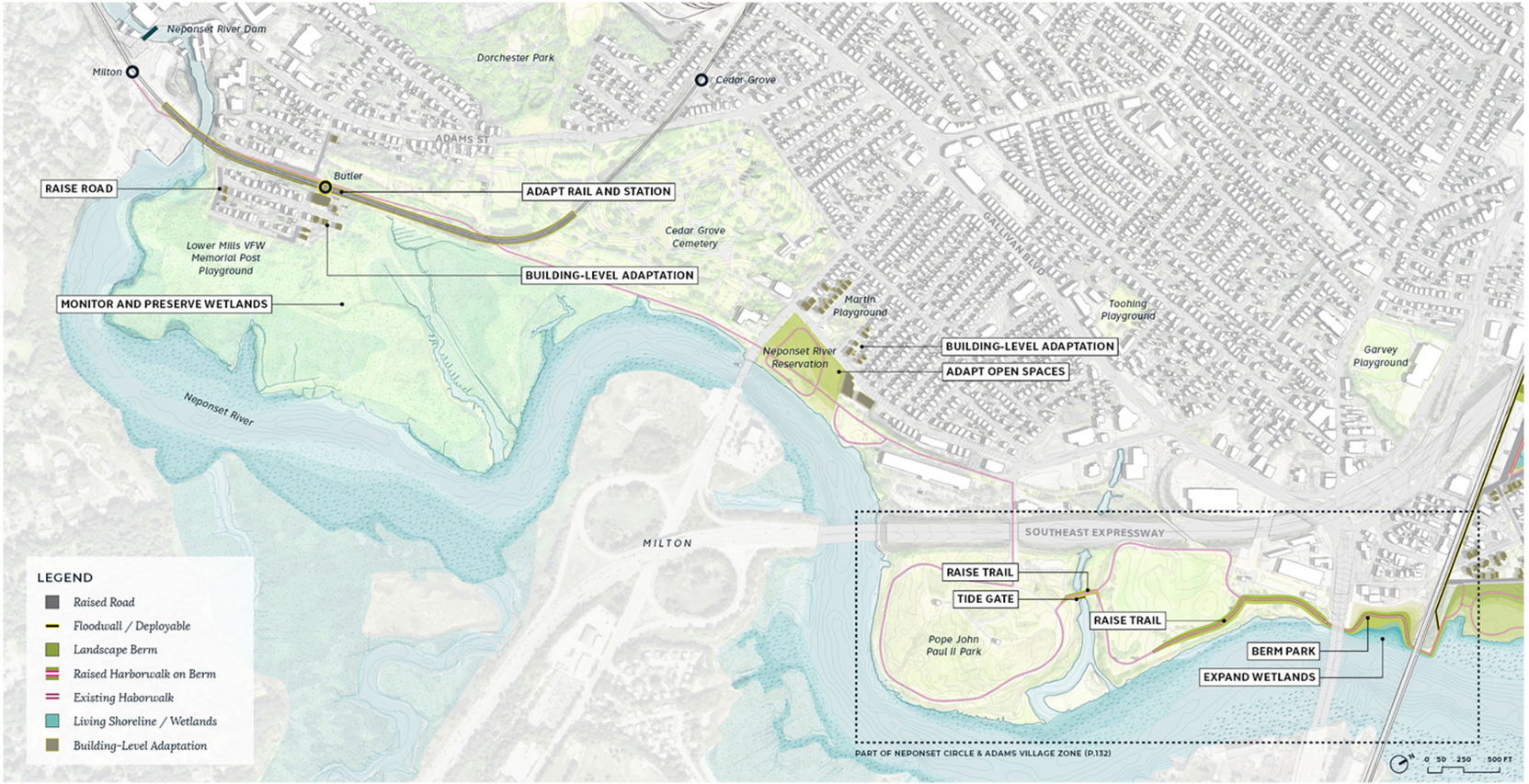
The tidal wetland ecosystems of the Neponset River provide risk reduction benefits, critical habitat, and environmental quality in this area. Implementing a robust monitoring protocol for these systems will establish methods for gathering data and interpreting how the tidal wetlands respond to sea-level rise. If the data collected shows loss of tidal ecosystems, measures such as thin-layer sediment placement and other strategies to increase marsh elevation can help these systems adapt over time, preserving the ecosystem services they provide for future generations.

ADAPT RAIL AND ROAD INFRASTRUCTURE

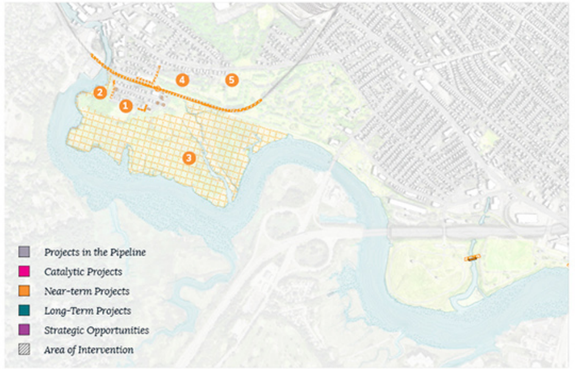
As the extents of fringe flooding grow further inland as sea-levels rise, roads become vulnerable to coastal flooding during flood events. Strategically raising these roads to provide dry evacuation routes and emergency access in flood events will increase the overall resilience of the area. The Mattapan Trolley and Butler Station are vulnerable to flooding in the near term. Strategies to adapt this critical infrastructure to coastal flood risk will need to be implemented by 2030.

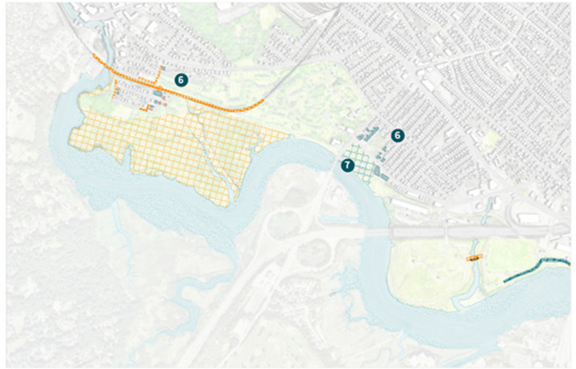
STRATEGIC RETREAT

In the long-term, some isolated or low-density sites along the shoreline exposed to increased flooding may be challenging, impractical, or even infeasible to protect. It will be necessary to consider strategic and planned retreat on a case-by-case basis in coordination with property owners as a potential risk reduction strategy. Retreat scenarios may include assisted relocation to high ground and outside of the flood risk area, required setbacks from the shoreline, or voluntary buy-out programs. In addition, retreat provides more space for tidal wetlands and ecosystems to migrate upland and adapt to sea-level rise.



PHASING





NEAR-TERM PROJECTS

1. **Building-Level Adaptation Phase I:** Adaptation measures are implemented for approximately 5 buildings vulnerable to near-term coastal flooding.
2. **Strategic Road Raising:** Select road raising to secure evacuation routes.
3. **Neponset River Wetlands Monitoring and Preservation Program:** Begin the process of gathering data and monitoring marsh response to sea-level rise in the near term.
4. **Mattapan Trolley and Butler Station Adaptation:** Resiliency measures to ensure the functionality of the rail and station by 2030.
5. **Cedar Groves Adaptation Study:** The Cedar Grove Cemetery is vulnerable to future coastal flooding. Future studies are required to determine flood adaptation strategies for this area.

LONG-TERM SOLUTIONS

6. **Building-Level Adaptation Phase II:** Adaptation measures for approximately 25 additional buildings vulnerable to long-term coastal flooding.
7. **Neponset River Reservation Park Improvements:** Includes elevating portions of the part to +12.5 feet NAVD88 to reduce flood risk of vulnerable buildings in more frequent storms.

Image Source: Dorchester by Alex Maclean for Boston Planning & Development Agency (BPDA)

PERFORMANCE

BENEFIT-COST ANALYSIS

In accordance with prior Climate Ready Boston plans, the methodology for the Benefit-Cost Analysis suggests estimating all project costs but monetizing only select project benefits to generate a benefit-cost ratio (BCR). See below the project elements that are included and those that are not included in the monetized analysis. The matrix offers a summary of the comprehensive flood protection, environmental and social benefits of the proposals. For further information on the methodology refer to p. 85 of this chapter.

ESTIMATED PROJECT COSTS

	*LOWER MILLS SUB-AREA	**NRR PARK SUB-AREA
Cost	*$1 million*	$800,000
Annual O&M	$10,000	$8,000

BENEFIT-COST RATIO

DISCOUNT RATE	*LOWER MILLS SUB-AREA	**NRR PARK SUB-AREA
3%	0.4	2.5
7%	0.2	1.4

	Benefits	*Costs*
MONETIZED	**BUILDINGS** • *Avoided Damages to buildings and their contents, and associated functions (displacement and relocation costs, mental stress and anxiety, loss of productivity)*	**BUILDING-LEVEL ADAPTATION** • *Building-Level Adaptation for residential buildings in Lower Mills*
NOT MONETIZED	**INFRASTRUCTURE** • *Avoided damages to transportation and utility infrastructure such the Mattapan Trolley, and the Neponset Greenway* • *Avoided loss of service in transportation (emergency egress, travel detours and delays)* • *Avoided loss of service in utilities* **ECOLOGY** • *Monitor closely critical environmental assets along the Neponset wetlands, to develop adaptation strategy for the long term*	**TRANSPORTATION INFRASTRUCTURE UPGRADES** • *Adapted MBTA rail line and Butler Station** • *Raised roadways** **ECOLOGY** • *Wetlands monitoring and preservation program* • *Open Space improvements at Neponset River Reservation Park***

FLOOD MODELING

Results from flood modeling show that natural restoration and adaptation measures along the Neponset River can reduce the extent of fringe flooding impacting neighborhoods and infrastructure both in the near-term and the long-term.

Modeling results show that Neponset River Marsh restoration, adaptation, and management measures that enable marshes to adapt to and elevate with sea-level rise, can significantly reduce the flooding extents at some of the most critical locations impacted by the upper edge of fringe flooding, including the MBTA Butler Station, and the Cedar Grove Cemetery.

Flood model results indicate that maintaining the salt marsh elevation relative to sea-level would delay or postpone the need for flood protection or mitigation measures at Butler station, adjacent streets and homes in this area. Natural restoration and adaptation measures at this location, essentially provide more time to monitor actual sea-level rise trends and plan accordingly.

1% Annual Chance Flood with 9 in of SLR (2030s) with near-term coastal resilience solutions in place

1% Annual Chance Flood with 40 in of SLR (2070s) with near-term and long-term coastal resilience solutions in place

LEGEND

- *Coastal Flood Risk Area without action*
- *Coastal Flood Risk Area with coastal resilience solutions*
- *Coastal Resilience Solution (Flood Risk Reduction)*
- *Coastal Resilience Solution (Access, Ecology & Equity)*

STORMWATER CONSIDERATIONS

Severe storm events not only have the potential to cause considerable coastal flooding from storm surge, they can also bring massive amounts of precipitation that can cause major stormwater flooding inland. Although this report is specifically focused on reducing the risk of coastal flooding, this section describes some high-level considerations and strategies for mitigating the risk of stormwater flooding in Dorchester.

CONSIDERATIONS

When developing neighborhood-scale solutions for coastal flood protection, it is important to consider potential factors for inland stormwater flooding. Strong coordination with Boston Water and Sewer Commission (BWSC) during the development of this plan ensures that proposed solutions do not exacerbate stormwater flooding and consider low-lying inland areas.

Ensure Flood Protection Solutions Do Not Exacerbate Stormwater Flooding: As with all coastal flood protection solutions that create barriers to keep flood waters from coming in, these same solutions also have the potential to block stormwater that does not flow into the drainage systems and catch basins from getting out. It is essential that all coastal flood protection solutions consider stormwater impacts and minimize or mitigate inland stormwater flooding.

Consider Low-Lying Inland Areas: Several sites in Dorchester are extremely low and at risk for considerable stormwater flooding in heavy rainfall events. For example, Garvey Playground in the Clam Point flood risk zone holds considerable potential for the implementation of strategies to mitigate stormwater flood risk. In addition, low-lying sites are also more vulnerable if coastal flooding and storm surge were to overtop flood protection elements at the shoreline, because flood waters will naturally drain to and stay in these areas longer.

APPROACH

When designing stormwater management systems coupled with shoreline coastal flood protection solutions, there are three key strategies:

Capture and Delay: This strategy captures stormwater runoff and slows it from entering the municipal drainage system. This can be achieved through green infrastructure strategies such as bioswales, rain gardens, porous pavement systems, and urban canopy. Building-level strategies may incorporate blue/green roof strategies or capture systems like cisterns.

Store and Recharge: This strategy involves storing large stormwater volumes to reduce peak flows during severe storm events. These types of interventions may include natural floodplain restoration, constructed wetlands, infiltration basins, bioretention meadows, or large, subsurface storage volumes.

Discharge: Ultimately, stormwater will need to be discharged to the adjacent waterbody, in this case the harbor or the Neponset River. This can be achieved by gravity drainage, or, as is often required in heavy rain events, pumping. The first two strategies can be combined and maximized to minimize discharge and reduce the size and cost of grey infrastructure. When implemented correctly, (1) capturing and delaying and (2) storing and recharging stormwater may reduce the need and frequency of pump stations and lessen the burden on municipal drainage systems.

STRATEGY	TOOLS	PARKS	ROADWAYS	COMMERCIAL BUILDING SITES	RESIDENTIAL AREAS	VACANT LOTS & PARKING LOTS	COASTAL ZONE
1 CAPTURE & DELAY *slow down stormwater runoff from entering municipal drainage system*	*Urban Canopy*	●	●	●	●	●	●
	Bioswales	●	●	●		●	
	Rain Gardens	●	●	●	●	●	
	Porous Pavement	●	●	●	●	●	
	Rain Barrels and Reuse Cisterns	●		●	●		
	Green and Blue Roofs			●	●		
2 STORE & RECHARGE *store stormwater to reduce peaks during large storm events*	*Natural Floodplain Restoration*	●	●				●
	Constructed Wetlands	●		●		●	●
	Detention / Infiltration Basin	●		●		●	
	Bioretention Basin or Meadow	●		●		●	
	Subsurface Storage	●	●	●		●	
3 DISCHARGE *pumps & drains to discharge water after the storm*	*Pump Stations*						●
	Storm drains						●

5 IMPLEMENTATION

Image Source: Dorchester by Alex Maclean for Boston Planning & Development Agency (BPDA)

The ***Coastal Resilience Design Solutions*** chapter provides a detailed description of the solutions that form the Dorchester Shoreway, and together these solutions will reduce coastal flood risk and create a stronger, more equitable, and more resilient Dorchester. **The implementation of these solutions must proceed in a coordinated manner to achieve comprehensive coastal resilience.** This chapter describes the proposed phasing of these solutions, the overall benefit-to-cost ratio of all solutions, and discusses other implementation considerations including coordination of property owners and likely regulatory and permitting requirements.

Project phasing is divided into catalytic projects, near-term projects, long-term solutions, and strategic opportunities. The phasing plan considers the timeline of coastal flood risk, but also the complexity and cost of implementing the solutions, including considerations of land ownership, regulatory review, and other factors.

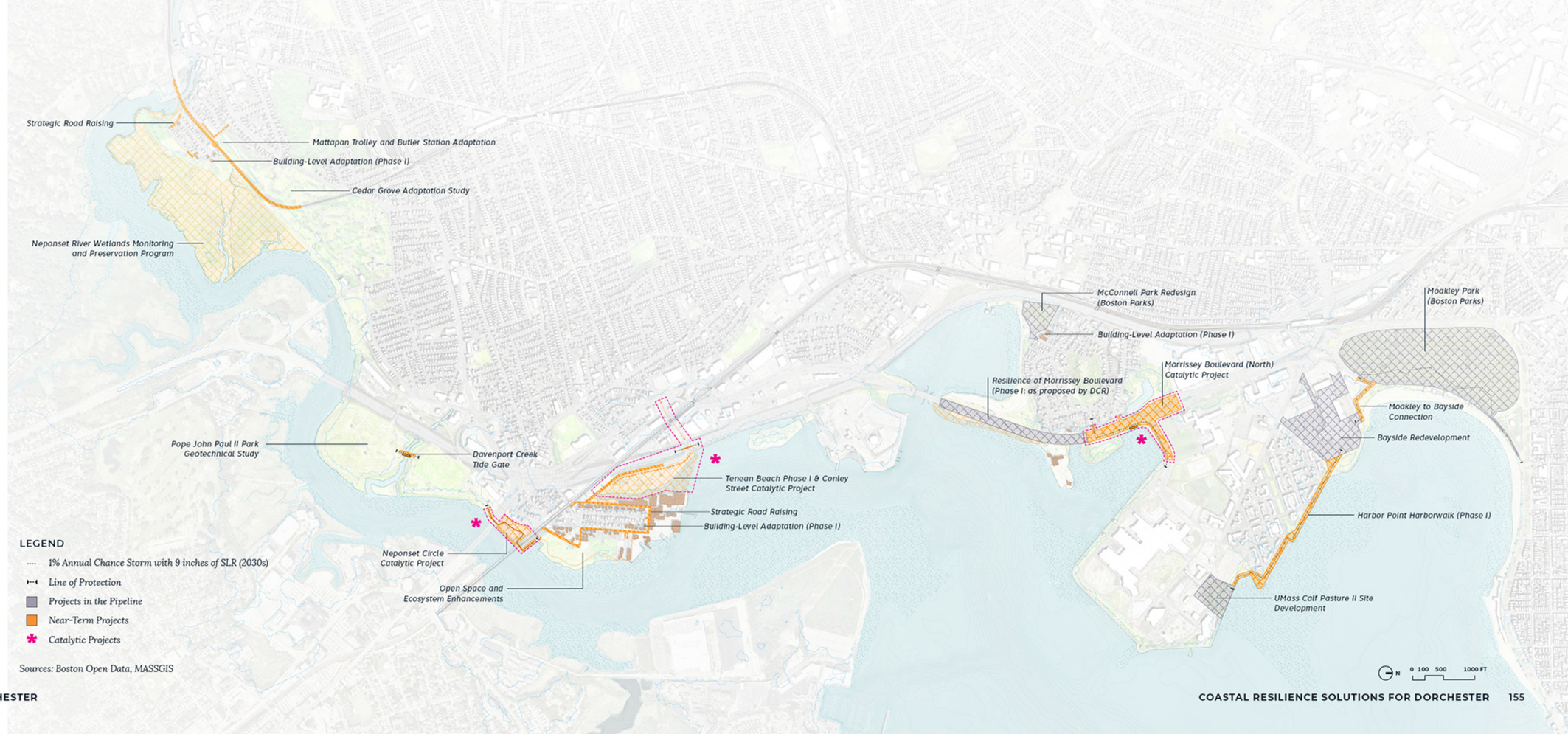
PHASING PLAN

NEAR-TERM PROJECTS

Near-term projects are projects that need to be completed by 2030 to reduce risk in areas vulnerable to coastal flooding during flood events up to the 1% annual chance flood with 9 inches of sea-level rise (2030s projection). Where possible, near-term projects are implemented to the Design Flood Elevation (DFE) with 40 inches of sea-level rise (2070s projection). In some cases, the initial phase addresses only near-term risks, and these must be adapted or expanded later to address risks in the long-term.

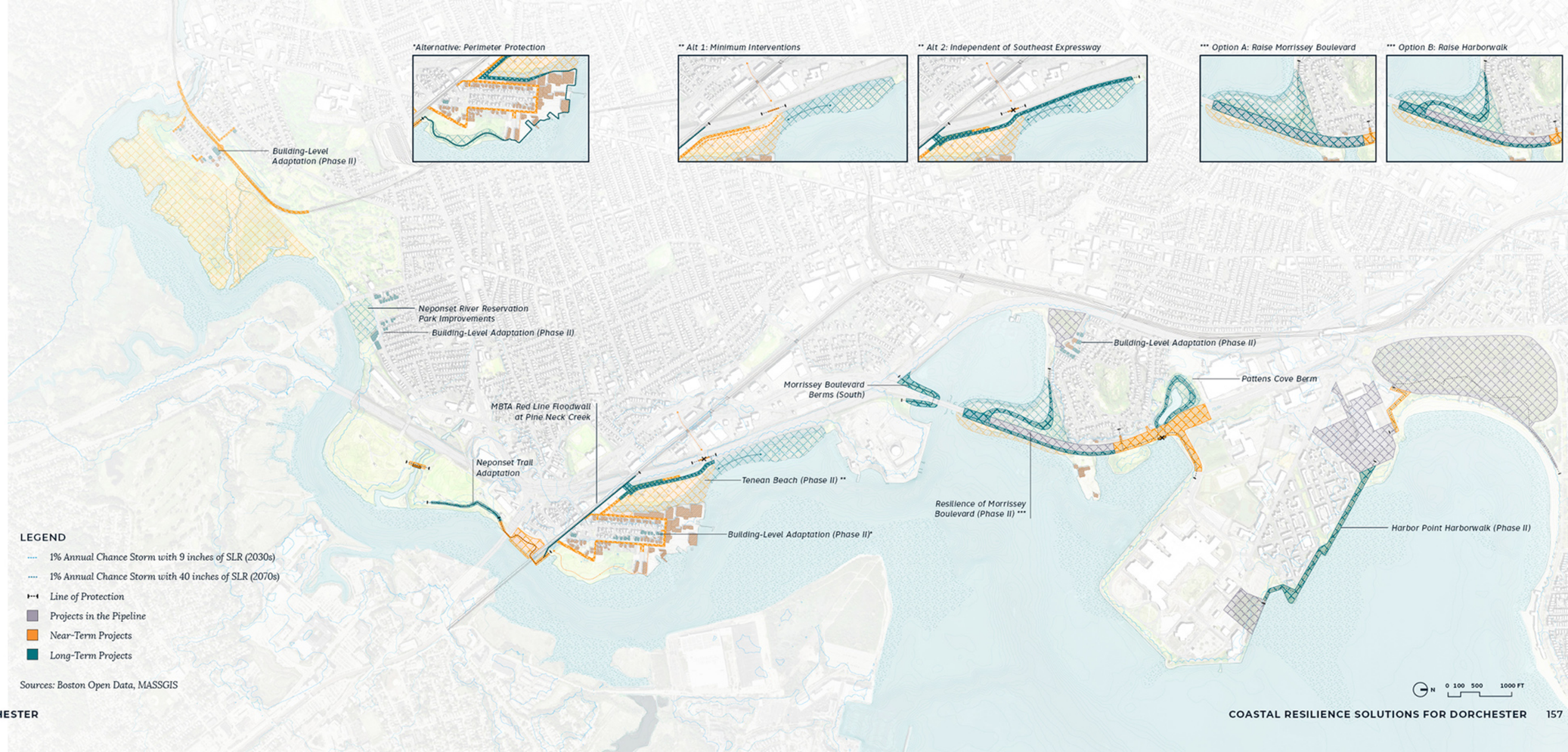
CATALYTIC PROJECTS

A subset of near-term projects, catalytic projects, are projects that are prioritized for implementation based on a combination of immediate flood risk conditions and pathways to implementation. Catalytic projects protect areas of high and immediate risk– they are vulnerable to flooding in the 1% annual chance or more frequent floods today. They are also either located on city-owned property (e.g. deployable barrier at Conley Street near Tenean Beach) or a single privately-owned parcel (e.g. Neponset Circle), or their implementation can align with an existing or ongoing project (e.g. Morrissey Boulevard).



LONG-TERM SOLUTIONS

Long-term solutions are projects that need to be implemented by 2070 to reduce coastal flood risk in areas vulnerable in the 1% annual chance flood with 40 inches of sea-level rise (2070s projections). These projects must be completed by the 2070s, but earlier implementation is recommended due to the evolving climate change projections and risks. Potential implementation of these long-term projects will need to be guided through monitoring of future sea-level conditions.



STRATEGIC OPPORTUNITIES

Strategic Opportunities identify sites where additional investment in adaptation and open space could occur as part of repair or reconstruction projects in the normal life cycle of major assets (i.e. the Southeast Expressway). While the Coastal Resilience Solutions are all implementable without these modifications, these additional investment opportunities could increase resilience and access, decrease costs, or enable a wider range of coastal resilience solutions in the future.

A RAISING THE SOUTHEAST EXPRESSWAY

If and when repairs or reconstruction of the Southeast Expressway are required, consideration should be given to raising the Expressway to (1) address the lowest segment of the roadway between Conley Street and Victory Park, and between Morrissey Boulevard and McConnell Park, which may become vulnerable to flooding in the 1% annual chance flood with 40 inches of sea-level rise (2070s projections), and (2) allow for greater clearances at underpasses and thus provide the possibility of raising roads below, making it easier to construct passive protection and maintain comfortable access.

B GARVEY PLAYGROUND STORMWATER DESIGN

The playground, including play areas, ball fields, and recreation center, is in one of the most low-lying areas of the neighborhood. Future investments should consider raising park program areas and incorporating stormwater storage during any reconstruction or other planned improvements to the park.

C CLAM POINT SUSTAINABLE REDEVELOPMENT

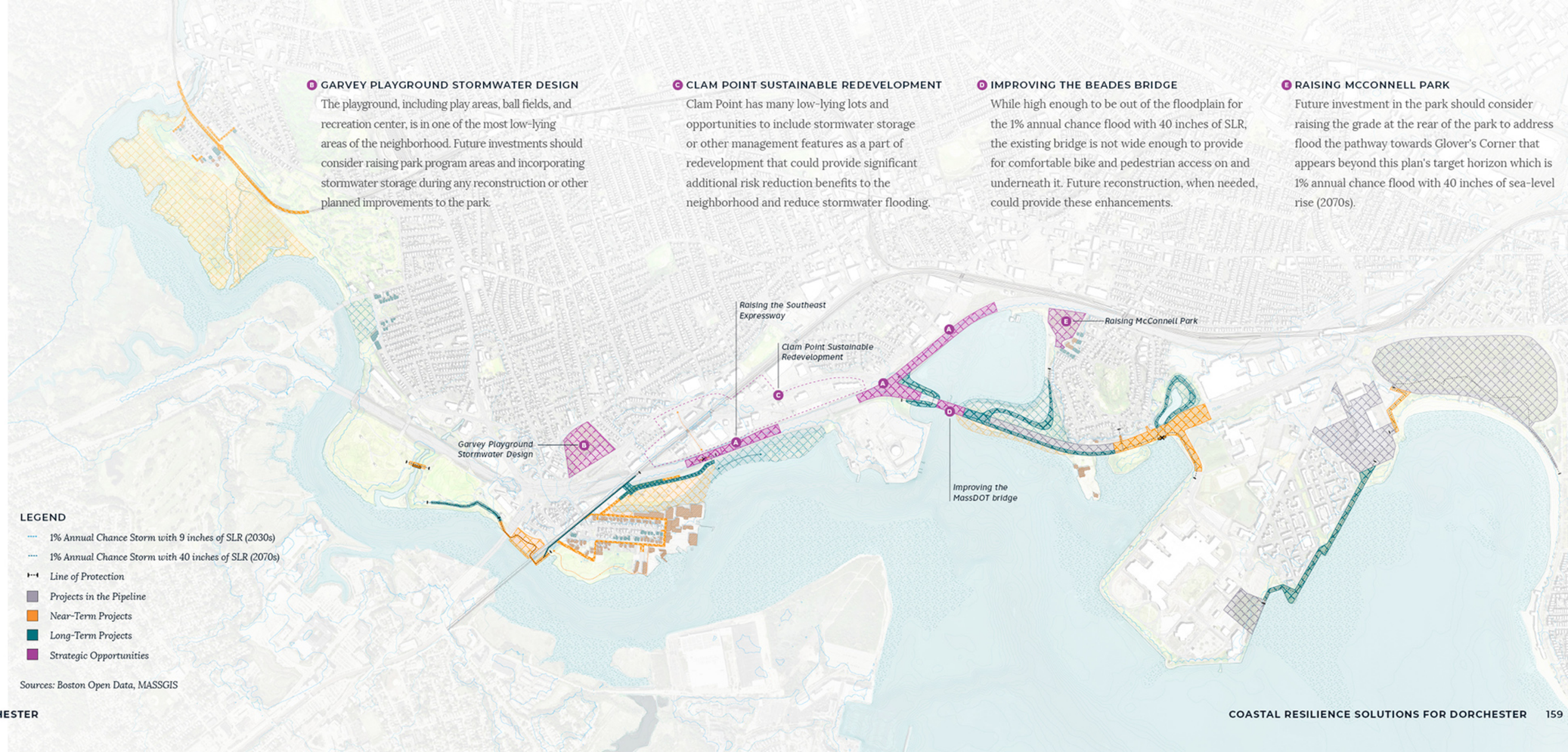
Clam Point has many low-lying lots and opportunities to include stormwater storage or other management features as a part of redevelopment that could provide significant additional risk reduction benefits to the neighborhood and reduce stormwater flooding.

D IMPROVING THE BEADES BRIDGE

While high enough to be out of the floodplain for the 1% annual chance flood with 40 inches of SLR, the existing bridge is not wide enough to provide for comfortable bike and pedestrian access on and underneath it. Future reconstruction, when needed, could provide these enhancements.

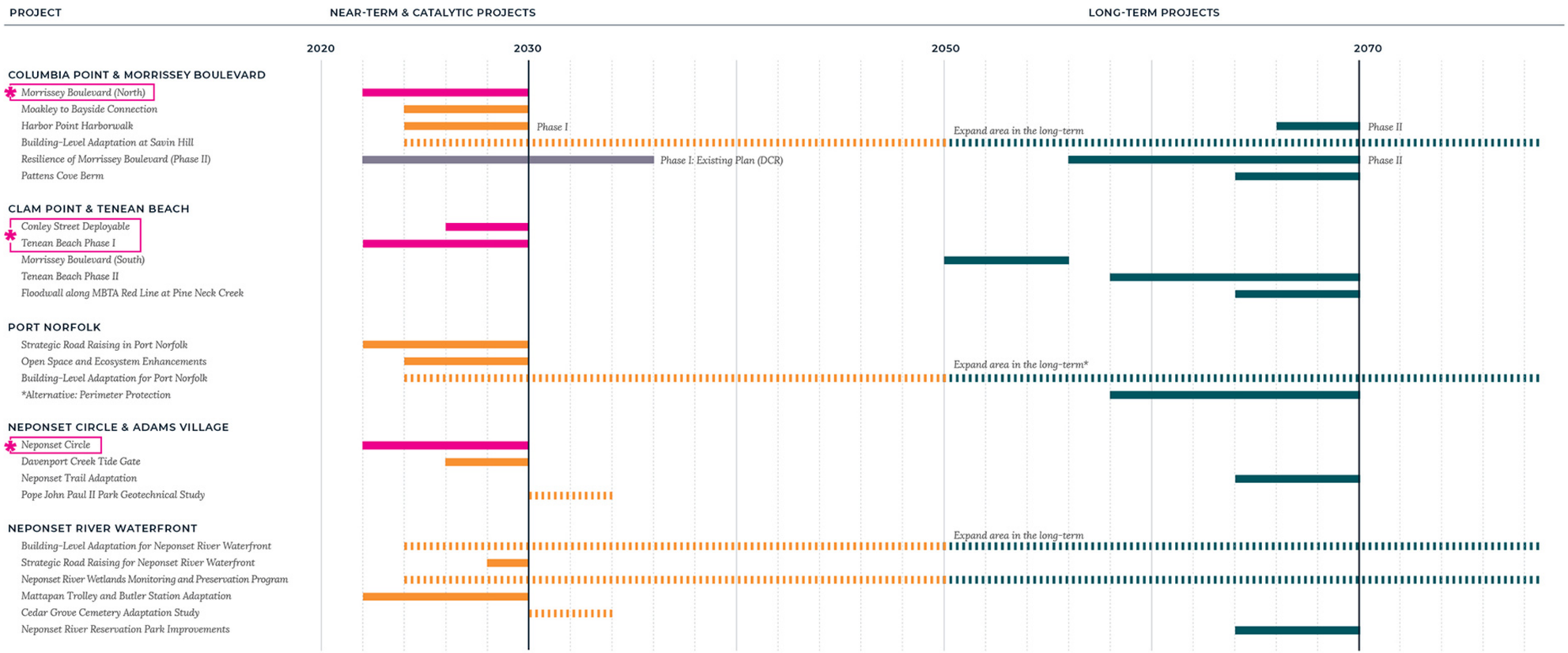
E RAISING MCCONNELL PARK

Future investment in the park should consider raising the grade at the rear of the park to address flood the pathway towards Glover's Corner that appears beyond this plan's target horizon which is 1% annual chance flood with 40 inches of sea-level rise (2070s).



TIMELINE

The timeline to the right (which extends to the next page) summarizes the phasing of the coastal resilience solutions illustrated on the preceding pages. Near-term projects are shown in orange, with catalytic projects highlighted in pink. Long-term solutions are shown in teal, and Strategic opportunities in purple. Projects already underway are indicated in gray and are not included in the calculation of project costs for this plan. Programs or studies are indicated in dashed lines.



OVERALL BENEFIT-COST RATIO

Chapter 4: Coastal Resilience Design Solutions provides a detailed description of individual project costs and estimated Benefit-Cost Ratios (BCR) of each project in each zone. These were assessed using a methodology consistent with prior Climate Ready Boston plans, which estimates project costs and monetizes select project benefits to generate a benefit-cost ratio (BCR). The costs reflect concept-level design, cost engineering, and economics and account for many, but not all, of the likely benefits generated by the proposed projects, and thus should be considered conservative. For a more detailed description of what is included in the BCR calculations and a qualitative assessment, see ***Chapter 4.***

Two combined BCRs were computed for the entire study area to convey the range of solutions. The first combined BCR takes a least-cost approach in selecting a solution for each zone. The second combined BCR includes the most comprehensive options considering both the benefits quantified herein and potential for other benefits not yet monetized at this phase of study (e.g. transportation or environmental benefits). The aggregated BCR for Dorchester ranges from **1.4** to **4.2** depending on the discount rate. Total implementation cost in current prices (without discounting) ranges from **$111** to **$215 million**, with annual operation and maintenance cost ranging from **$1.1** to **$2.1 million**.

Zone	*Range (low-high)*
Columbia Point & Morrissey Boulevard	*$55.6 - $90.8 million*
Clam Point & Tenean Beach	*$22.6 - $45.6 million*
Port Norfolk	*$20.5 - $65.7 million*
Neponset Circle	*$10.8 - $14 million*
Neponset River Waterfront	*$1.8 million*
Estimated overall cost	*$111 - $215 million*
Estimated annual operation and maintenance cost	*$1.1 - $2.1 million*
Estimated overall benefit-cost ratio	*1.4 - 4.2*

COORDINATION AND COLLABORATION WITH PROPERTY OWNERS

As described in ***Chapter 2: Context*** (see p. 36 "Ownership"), the Commonwealth of Massachusetts owns the majority of the Dorchester Waterfront (7.2 of the 9.5 miles, or 76%)—not the City of Boston. Another 1.7 miles (18%) is privately owned, and 0.3 miles (3%) federally owned. Only 0.3 miles (3%) is owned by the City of Boston. This means that collaboration and coordination, particularly with the Commonwealth, will be essential to the successful implementation of coastal resilience solutions. Key partners and the roles they will need to play in advancing critical projects are described below. Critical partnerships are also highlighted and described in more detail as part of the description of each project in ***Chapter 4: Coastal Resilience Design Solutions***. All of these future partners and stakeholders were consulted in the development of this plan.

MASSACHUSETTS DEPARTMENT OF CONSERVATION AND RECREATION (MASS DCR)

Mass DCR owns and maintains the majority of Dorchester's waterfront, including most of the waterfront parks and Morrissey Boulevard. The City and DCR are discussing how the solutions in this report will inform the ongoing plan to improve Morrissey Boulevard's resilience to flooding and safety for cyclists and pedestrians. Mass DCR owns and maintains the majority of Dorchester's waterfront, including most of the waterfront parks and Morrissey Boulevard. The City and DCR are discussing how the solutions in this report will inform the ongoing plan to improve Morrissey Boulevard's resilience to flooding and safety for cyclists and pedestrians.

MASSACHUSETTS DEPARTMENT OF TRANSPORTATION (MASS DOT)

MassDOT operates state roads and federal highways in the project area. This includes the Southeast Expressway (I-93) and Beades Bridge along Morrissey Boulevard. Any projects that may impact the operation of these assets will require coordination and collaboration with MassDOT. Morrissey Boulevard is an asset of Mass DCR; however, it must meet standards for transportation set by Mass DOT and federal transportation agencies, and coordination with MassDOT will be required for the successful implementation of proposals along the Boulevard.

MASSACHUSETTS BAY TRANSPORTATION AUTHORITY (MBTA)

MBTA operates the rail lines and stations in the project area including the Red Line, the Mattapan Trolley, and the Commuter Rail. Potential projects that are in, adjacent to, or must cross these rail rights-of-way will require coordination and collaboration with MBTA. Projects that require modifications to rail infrastructure to protect or increase the resilience of stations and rail lines would need to be implemented by MBTA.

UNIVERSITY OF MASSACHUSETTS-BOSTON (UMASS-BOSTON)

UMass-Boston is a key stakeholder in Columbia Point. The campus itself is located on high ground and is not at risk of flooding. However, solutions around the Harbor Point Harborwalk and Morrissey Boulevard should be coordinated with UMass-Boston to ensure connections to high-ground and pedestrian and bike access across and through Columbia Point.

PRIVATE PROPERTY OWNERS

There are a few key locations where integral components of the flood protection system will need to take place on or directly adjacent to private property. Most significantly, these include the Bayside redevelopment site and Neponset Circle. Coordination with these landowners will be critical to the successful implementation of individual projects and future effectiveness of flood protection strategies. Where building-level adaptation is needed on a property-by-property basis, collaboration with owners to facilitate adoption of building-level adaptation measures will be vital.

REGULATORY CONSIDERATIONS

The solutions included in this report must be implemented within a complex network of city, state, and federal regulations and policies. Federal and state environmental regulations protect important resources and are critical to ensuring that projects avoid, minimize, or mitigate the impacts on environmental, particularly aquatic, resources. However, many of these policies date back to the 1970s and do not always consider the need for flood protection or the increasing consequences of climate change, including warming oceans, sea-level rise, or flood-related pollution.

In the future, particularly over time periods relevant to long-term solutions, there may be opportunities to update existing regulations to better facilitate resilience at all scales–from individual properties, to neighborhoods, to the city as a whole–while sustaining the original mission of these regulations–to protect the environment and quality of life. Near-term, particularly catalytic, projects will most likely need to be implemented within current regulatory frameworks, though some of these are already changing. Thus, for all solutions, it is critical to understand the context, constraints, and even opportunities that these regulations pose for these projects.

The following types of actions will require permits, trigger regulatory review, and necessitate increased coordination between the City and regulatory agencies:

Projects proposing disturbance or fill within waterways, wetlands, tidelands, or at the shoreline will require both federal and state permits as well as city review.
These areas are governed by both federal, state, and local regulations. Federal regulations include Section 404 of the Clean Water Act (33 USC 1344) and Section 10 of the Rivers and Harbors Act (33 USC 403). State regulations include the Massachusetts Wetlands Protection Act (the "Act") regulations (310 CMR 10.00), Coastal Zone Management (CZM) Requirements, and the Massachusetts Public Waterfront Act (Massachusetts General Law Chapter 91). The City also passed a Local Wetland Ordinance (LWO) during the period of this study. The LWO adds additional protections to resource areas called out under the Act, along with protecting new resource areas defined under the Ordinance. Any projects involving fill or disturbance in waterways and/or tidelands/tidal wetlands will require coordination with and permits from the US Army Corps of Engineers (USACE) and the Massachusetts Department of Environmental Protection (MassDEP). For Dorchester, this will include any projects that include the maintenance or restoration of tidal wetlands or implementation of living shorelines as well as projects that will or may require fill to construct coastal protection features such as the elevated harborwalk along the shoreline.

Projects in the Area of Critical Environmental Concern (ACEC) will be reviewed with closer scrutiny to avoid or minimize adverse environmental impacts.
An ACEC designation recognizes significant ecosystems and is intended to foster appreciation and stewardship of the unique natural and cultural resources in an area. The designation works through the existing state environmental regulatory and review framework. Projects within an ACEC that are subject to state agency jurisdiction or regulation, particularly those that are initiated by an agency, require a state permit, or are funded by a state agency, are reviewed with closer scrutiny to avoid or minimize adverse environmental impacts. Ultimately, the designation provides a framework for citizens, communities, and agencies to work together and ensure the long-term preservation and management of these areas.

All projects in tidelands or filled tidelands will require Chapter 91 review and permitting.
The Massachusetts Public Waterfront Act (Massachusetts General Law Chapter 91) or "Chapter 91" seeks to preserve and protect the rights of the public, and to guarantee that private uses of tidelands and waterways serve a proper public purpose.

The Public Waterfront Act emphasizes the importance of public access to the water and was the driving force to develop the Boston Harborwalk. Chapter 91 and the regulations present in 310 CMR 9.00 identify the state as the regulating body for construction, dredging, and filling of coastal and inland waterways.

These activities in waterways require a license from MassDEP, and in some cases, review under the Massachusetts Environmental Policy Act. For Dorchester, this will include many of the identified projects as much of the land along the shoreline are filled tidelands. Projects that do not meet the standards for approval under the regulations can seek a variance under 310 CMR 9.21; however, the variance process can be lengthy and unpredictable.

Building-level adaptation solutions will need to meet state and city building and zoning requirements.
Building modifications are regulated by both Massachusetts' Building Code (administered by Board of Building Regulations and Standards) and Boston's zoning code. The state building code provides minimum standards for flood-resistant buildings within FEMA's flood zones and was updated in 2018 to include provisions for flood resilient design and construction. The City's recently released "Flood Resilience Design Guidelines" provides a toolkit of building-scale flood resilience strategies and is a resource to help Boston property owners and developers make informed, forward-looking decisions about flood protection for existing buildings and new construction. The guidelines will be applied to new projects within a "Coastal Flood Resilience Zoning Overlay District," which is currently under development and will encompass areas at risk during a 1% annual chance flood with 40 inches of sea-level rise (2070s projections). The guidelines are key to implementing resilience in Dorchester, particularly in areas where building-level adaptation will be a critical element of overall resilience, such as Port Norfolk.

Prior Climate Ready Boston reports, specifically the report for South Boston, have described permitting considerations and strategies associated with each of these regulatory and permitting requirements and considerations. See ***Coastal Resilience Solutions for South Boston*, "Chapter 4: Regulatory Resilience Strategies"** for a detailed discussion of current regulations and challenges for coastal resilience projects as well as a comprehensive description of potential courses of action for navigating existing permitting pathways or modifying regulations to support implementation of Coastal Resilience Solutions for Boston and its neighborhoods.

BUILDING-LEVEL PROGRAMS AND POLICIES

In addition to strategies relating to state and federal regulations, the City will continue to develop policy and programs that facilitate properties adapting or becoming part of the neighborhood flood protection system. Two areas are particularly important to implementing the coastal resilience solutions for Dorchester:

All new developments must be prepared for future levels of flooding. The Boston Planning and Developing Agency is developing, within the City's Zoning Code, a Coastal Flood Resilience Overlay District that is consistent with the projected areas of flooding used in this plan. The Overlay District will establish flood-resilience standards and guidelines for projects, and support the district-level solutions described in this document. The City's Wetlands Ordinance, implemented by the Conservation Commission, works inworks will in conjunction with the proposed overlay district.

Existing buildings will need to adapt to future conditions. Continue planning to establish a Resilience Audit and Education program. This plan has already identified three specific areas in Dorchester where building-level adaptation will be necessary as part of a comprehensive strategy. Existing buildings may also need to prepare for more extreme heat and more intense precipitation, as described in the 2016 Climate Ready Boston report and summarized there under ***Strategy 10: Retrofit existing buildings against climate hazards.*** The City has already released several technical guides for retrofitting existing buildings, and will continue to expand outreach and education efforts and examine other possible programs to support building owners undertaking this work.

The table identifies key coordination required based on property ownership or operations and summarizes the anticipated regulatory review and permits and applicable policy strategies for each proposed project (organized by risk zone).

REGULATORY CONSIDERATIONS OVERVIEW TABLE

PROJECT	COORDINATION	APPLICABLE REGULATIONS, PERMITS, POLICIES, OR PROGRAMS				
		Wetland Regulations (Federal and State) & Local Wetlands Ordinance (City)	*Chapter 91*	*Building Code (State)*	*Flood Resilience Building Guidelines (City)*	*Building-Level Programs and Policies*
COLUMBIA POINT & MORRISSEY BOULEVARD						
Morrissey Boulevard Catalytic Project (North)	DCR, DOT	●	●	○	○	○
Moakley to Bayside Connection		○	○	○	○	○
Harbor Point Harborwalk	DCR, UMass-Boston	○	●	○	○	○
Building-Level Adaptation at Savin Hill	*Private Property Owners*	○	○	●	●	●
Resilience of Morrissey Boulevard (Phase II)	DCR, DOT, UMass-Boston	●	●	○	○	○
Pattens Cove Berm	DCR	●	●	○	○	○
CLAM POINT & TENEAN BEACH						
Tenean Beach Phase I & Conley Street Catalytic Project	DCR, DOT	●	●	○	○	○
Morrissey Boulevard (South)	DCR, DOT	●	●	○	○	○
Tenean Beach Phase II	DCR	●	●	○	○	○
Floodwall along MBTA Red Line at Pine Neck Creek	MBTA	○	○	○	○	○
PORT NORFOLK						
Strategic Road Raising in Port Norfolk		○	●	○	○	○
Open Space and Ecosystem Enhancements	DCR	●	●	○	○	○
Building-Level Adaptation for Port Norfolk	*Private Property Owners*	○	○	●	●	●
**Alternative: Perimeter Protection*	*Private Property Owners*	●	●	●	●	●
NEPONSET CIRCLE & ADAMS VILLAGE						
Neponset Circle	*Private Property Owners*	●	●	○	○	○
Davenport Creek Tide Gate	DCR	●	○	○	○	○
Neponset Trail Adaptation	DCR	○	●	○	○	○
Pope John Paul II Park Geotechnical Study	DCR	○	○	○	○	○
NEPONSET RIVER WATERFRONT						
Building-Level Adaptation for Neponset River Waterfront	*Private Property Owners*	○	○	●	●	●
Strategic Road Raising for Neponset River Waterfront		○	●	○	○	○
Neponset River Wetlands Monitoring and Preservation Program		●	○	○	○	○
Mattapan Trolley and Butler Station Adaptation	MBTA	○	●	○	○	○
Cedar Grove Cemetery Adaptation Study		○	○	○	○	○
Neponset River Reservation Park Improvements	DCR	●	●	○	○	○

CONCLUSIONS

Building on the Resilient Boston Harbor Vision, ***Coastal Resilience Solutions for Dorchester*** *presents a vision for the future of the Dorchester shoreline, offering strategies to* ***adapt*** *to coastal flood risk while also establishing a framework to* ***connect*** *the waterfront parks, beaches, and marshes in Dorchester, transforming them into one accessible, continuous waterfront –* ***The Dorchester Shoreway.***

The primary goal and major focus of the coastal resilience solutions is to develop strategies to **equitably reduce coastal risk** in Dorchester while also **enhancing access and mobility**; **promoting the health of valuable ecosystems**; and **reinforcing a connected, cohesive sense of place**.

Near-term projects target already at-risk areas and critical flood pathways such as the Bayside site, Morrissey Boulevard North, Clam Point, and Neponset Circle, while the long-term solutions complete the Shoreway and increase the resilience and adaptability of the entire Dorchester waterfront and adjacent neighborhoods. These solutions are designed to build upon one another and to be flexible and adaptable to future changes. In addition to the coastal risk reduction solutions, the plan offers a series of strategic considerations that could increase resilience of major transportation infrastructure, enable a wider range of future resilience solutions for different at-risk sites, or provide more cost-effective solutions by coupling resilience improvements with the repair or replacement lifecycle of critical infrastructure.

NEXT STEPS

Starting with three catalytic projects, the Plan aims to increase the resilience of the Dorchester shoreline over the coming years. These are projects that have been prioritized for implementation based on a combination of immediate flood risk conditions and clear pathways to implementation. The four catalytic projects are:

- Morrissey Boulevard (North)
- Tenean Beach Phase I
- Conley Street Deployable
- Neponset Circle

Catalytic and near-term projects, as well as long-term solutions will require further technical and engineering analysis, as well as funding and design coordination. In collaboration with key State Agencies and private owners, the City can move one step closer toward the realization of the Dorchester Shoreway, a vision for a resilient, accessible, and connected Dorchester shoreline.

TIDAL DATUMS AND DEFINITIONS

Boston City Datum (BCD): The vertical control datum established for the City of Boston.

North American Vertical Datum of 1988 (NAVD88): The vertical control datum established in 1991 by the minimum-constraint adjustment of the Canadian-Mexican-United States leveling observations. NAVD88 can be converted to Boston City Base (BCB) by using a conversion factor of NAVD88 +6.46 feet.

Mean Higher High Water (MHHW): The average of the higher high water height of each tidal day observed over the National Tidal Datum Epoch

Mean High Water (MHW): The average of all the high water heights observed over the National Tidal Datum Epoch.

Mean Sea-Level (MSL): The arithmetic mean of hourly heights observed over the National Tidal Datum Epoch.

Mean Low Water (MLW): The average of all the low water heights observed over the National Tidal Datum Epoch.

Mean Lower Low Water (MLLW): The average of the lower low water height of each tidal day observed over the National Tidal Datum Epoch.

Design Flood Elevation (DFE): The minimum elevation required to protect the neighborhood in a 1% annual chance flood with 40 inches of sea-level rise (2070s).

ELEVATIONS IN **DARK BLUE** IN **NAVD88**
ELEVATIONS IN **LIGHT BLUE** IN **BCD**

LOCATION	MHHW	MHW	MSL	MLW	MLLW	DFE
NEPONSET RIVERFRONT	5.12 ft 11.58 ft	4.68 ft 11.14ft	0.05 ft 6.51 ft	-4.81 ft 1.65 ft	-5.16 ft 1.30 ft	14.4 ft 20.86 ft
NEPONSET CIRCLE & ADAM'S VILLAGE	5.02 ft 11.48 ft	4.58 ft 11.04 ft	-0.05 ft 6.41 ft	-4.91 ft 1.55 ft	-5.26 ft 1.20 ft	14.4 ft 20.86 ft
PORT NORFOLK	5.00 ft 11.46 ft	4.56 ft 11.02 ft	-0.07 ft 6.39 ft	-4.93 ft 1.53 ft	-5.28 ft 1.18 ft	16.0 ft 22.46 ft
CLAM POINT & TENEAN BEACH	5.00 ft 11.46 ft	4.56 ft 11.02 ft	-0.07 ft 6.39 ft	-4.93 ft 1.53 ft	-5.28 ft 1.18 ft	16.0 ft 22.46 ft
MORRISSEY BOULEVARD	4.99ft 11.45 ft	4.55 ft 11.01 ft	-0.08 ft 6.38 ft	-4.94 ft 1.52 ft	-5.29 ft 1.17 ft	16.1 ft 22.56 ft
COLUMBIA POINT	4.99 ft 11.45 ft	4.55 ft 11.01 ft	-0.08 ft 6.38 ft	-4.94 ft 1.52 ft	-5.29 ft 1.17 ft	16.2 ft 22.66 ft

Sources: NOAA, FEMA, BH-FRM

Low tide near Old Colony Yacht Club, June 2017.
Source: Boston Harbor Now

CITY *of* BOSTON

OCTOBER 2020

To learn more about the ongoing Climate Ready Boston work visit:

boston.gov/climate-ready