Chapter 10: Floodplains and Coastal Erosion Hazard Areas

10.0 INTRODUCTION

This chapter examines the potential impacts on floodplains and New York State Department of Environmental Conservation (NYSDEC) Coastal Erosion Hazard Areas (CEHA) from one or more proposed initiatives (Proposed Actions) intended to enhance coastal and social resiliency along the Tottenville shoreline of the South Shore of Staten Island, NY. These initiatives include the Living Breakwaters Project (Breakwaters Project) and Tottenville Shoreline Protection Project (Shoreline Project). In accordance with the 2014 *City Environmental Quality Review (CEQR) Technical Manual* and the National Environmental Policy Act (NEPA), the chapter describes:

- The regulatory programs that protect floodplains and CEHA within the study area;
- The current condition of floodplains and CEHA within the study area;
- The floodplains and CEHA conditions in the future without the Proposed Actions (the No Action condition); and
- The potential impacts of the Proposed Actions on the floodplains and CEHA under three alternatives (Alternative 2: The Layered Strategy or the Preferred Alternative, Alternative 3: The Breakwaters without the Shoreline Protection System, and Alternative 4: The Shoreline Protection System without the Breakwaters).

Chapter 17, "Construction," provides an assessment of construction-related impacts to the floodplain and CEHA.

10.1 PRINCIPAL CONCLUSIONS

The Proposed Actions would result in the implementation of one of three alternatives analyzed in this environmental impact statement (EIS); Alternative 2 includes the Breakwaters Project and the Shoreline Project; Alternative 3 includes only the Breakwater Project component; and Alternative 4 includes only the Shoreline Project component. A No Action Alternative was also analyzed.

Under the No Action Alternative, no new structural risk reduction projects would be implemented within Raritan Bay off the south shore of Staten Island or along the adjacent shoreline and in the upland areas within Conference House Park. The existing man-made temporary dune system would remain and would continue to experience intense wave energy and be at risk from storm wave damage. Under this alternative, high rates of erosion would continue in future, further reducing the width of the beach in certain locations. Under current sea level rise estimates the height of the 100-year flood elevation would increase, effectively eliminating some beach sections and leaving others completely inaccessible at high tide. The risk for flooding within the study area would increase.

Under Alternative 2—the proposed breakwaters system of the Breakwaters Project would be installed within Raritan Bay off the south shore of Staten Island and the Shoreline Project elements and proposed Water Hub element of the Breakwaters Project would be implemented along the adjacent shoreline and in upland areas almost entirely within Conference House Park. Alternative 2 would provide coastal resiliency in vulnerable areas along the Tottenville shoreline. While this Alternative would not prevent flooding from coastal storm events, it would attenuate wave energy and reduce wave heights within the study area, and reduce or delay flooding of inland areas during certain storm events, minimizing risk to shoreline structures within the 100-year floodplain in and adjacent to the study area. It would not have the potential to result in direct or indirect adverse impacts to the floodplain and is appropriate for siting in the 100-year floodplain. This Alternative would be consistent with Executive Order (EO) 11988 and EO 13690 by improving the resiliency of communities against the impacts of flooding and risks associated with climate change. Additionally, Alternative 2 would not adversely affect the CEHA. Instead, it would result in the enhancement of natural protective features within the CEHA Natural Protective Feature Area[1] (NPFA) while providing reduced storm surge risk to NPFAs by attenuating wave energy. A Coastal Erosion Management Permit would be required for the Proposed Actions that comprise the Shoreline Project under this Alternative. The Water Hub parking area at Potential Location 1 would be within the CEHA and would require a CEHA variance for permitting.

Under Alternative 3—the Breakwaters Project, including the in-water breakwaters, shoreline restoration, and Water Hub, would be implemented without the Shoreline Project. The storm wave reduction by the breakwaters would be the same as described in Alternative 2; however, this alternative would not have the added wave reduction or risk reduction benefits that would be provided by inclusion of the Shoreline Project. This Alternative would also be consistent with EO 11988 and EO 13690.The shoreline within the CEHA would be more resilient than it would under the No Action Alternative, but would remain more vulnerable to erosion than it would under Alternative, and would not receive the enhancements of natural protective features within the CEHA NPFA. A CEHA variance would be required for the Water Hub at Potential Location 1 under this Alternative. Overall, Alternative 3 would provide greater coastal resiliency than the No Action Alternative, but it would be less effective at protecting inland areas against wave energy and therefore be less resilient than Alternative 2.

Under Alternative 4—the Shoreline Project would be developed without the in-water breakwater structures, the shoreline restoration, or the Water Hub. This Alternative would be consistent with EO 11988 and EO 13690 by improving the resiliency of communities against the impacts of flooding and risks associated with climate change; however the Shoreline Project components would be vulnerable to existing wave energy without the proposed breakwater system. This Alternative would not include shoreline restoration in a narrow and particularly vulnerable to erosion. Alternative 4 would enhance shoreline protective features of the NPFA but would not reduce long-term shoreline erosion rates. A Coastal Erosion Management Permit would be required for the Proposed Actions that comprise the Shoreline Project under this Alternative. Overall Alternative 4 would provide greater resiliency than the No Action Alternative, but would not provide the reduction in wave energy and height prior to reaching the shoreline that would occur under Alternative 2.

[1]NPFAs are areas that contain natural features such as beaches, dunes, bluffs, and nearshore areas.

10.1.1 STUDY AREA

The Proposed Actions would be undertaken in the Tottenville area of Staten Island, along the neighborhood's southern shoreline and nearshore waters within the waters of Raritan Bay. Tottenville is located at the southwestern tip of Staten Island, and is the southernmost neighborhood in New York City (**Figure 10-1**). It is bounded by water on three sides, with the Arthur Kill to the west and north and Raritan Bay to the south. The study area comprises the portion of Raritan Bay between the Tottenville shoreline and the proposed offshore breakwaters, and the shoreline of Conference House Park (approximately 5,400 linear feet of shoreline) from approximately west of the intersection of Swinnerton Street and Billop Avenue, extending to the east to the parking area at the southern terminus of Page Avenue, and the northwestern portion of Conference House Park between approximately Hylan Boulevard and Shore Road.

10.2 REGULATORY CONTEXT

10.2.1 FEDERAL

- National Flood Insurance Act of 1968 (44 CFR § 59) and Floodplain Management Executive Order ("EO") 11988 (42 FR 26951), as amended by EO 13690. Development in floodplains defined by Federal Emergency Management Agency (FEMA) mapping is regulated at the federal level by the Floodplain Management EO 11988 as revised by EO 13690, and National Flood Insurance Act of 1968 (44 CFR § 59). EO 11988 requires federal agencies to avoid to the extent possible the long and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. EO 13690 is a revision of EO 11988 that proposes a new Federal Flood Risk Management Standard (FFRMS) that applies to federal actions, such as federal grants used for repair and redevelopment after a natural disaster. Other elements of EO 13690 include a directive for agencies to use, where possible, natural systems, ecosystem processes and nature-based approaches when developing alternatives for consideration. EO 13690 also specifies that it is the policy of the United States to improve the resilience of communities and federal assets against the impacts of flooding and recognizes the risks and losses due to climate change and other threats. The FFRMS allows agencies to use one of three methods for determining the flood elevation and hazard area boundaries to consider in siting, design, and construction. The three methods are (1) use data and methods informed by best-available, actionable climate science; (2) build two feet above the 100-year flood elevation for standard projects, and three feet above for critical buildings like hospitals and evacuation centers; (3) build to the 500-year flood elevation. Title 24, Subtitle A Part 55 of the Code of Federal Regulations (24 CFR § 55) contains the U.S. Department of Housing and Urban Development's (HUD) regulations implementing the requirements of EO 11988 and EO 11990, Protection of Wetlands, and the 8 step decision making process for making determinations on compliance with these two Executive Orders.

10.2.2 STATE

- **Coastal Erosion Hazard Areas Law, Article 34, ECL, Implementing Regulations 6 NYCRR Part 505.** The Coastal Erosion Hazard Areas Law authorizes NYSDEC to identify and map coastal erosion hazard areas and to regulate certain activities and development within those areas under 6 NYCRR Part 505. A coastal erosion management permit is

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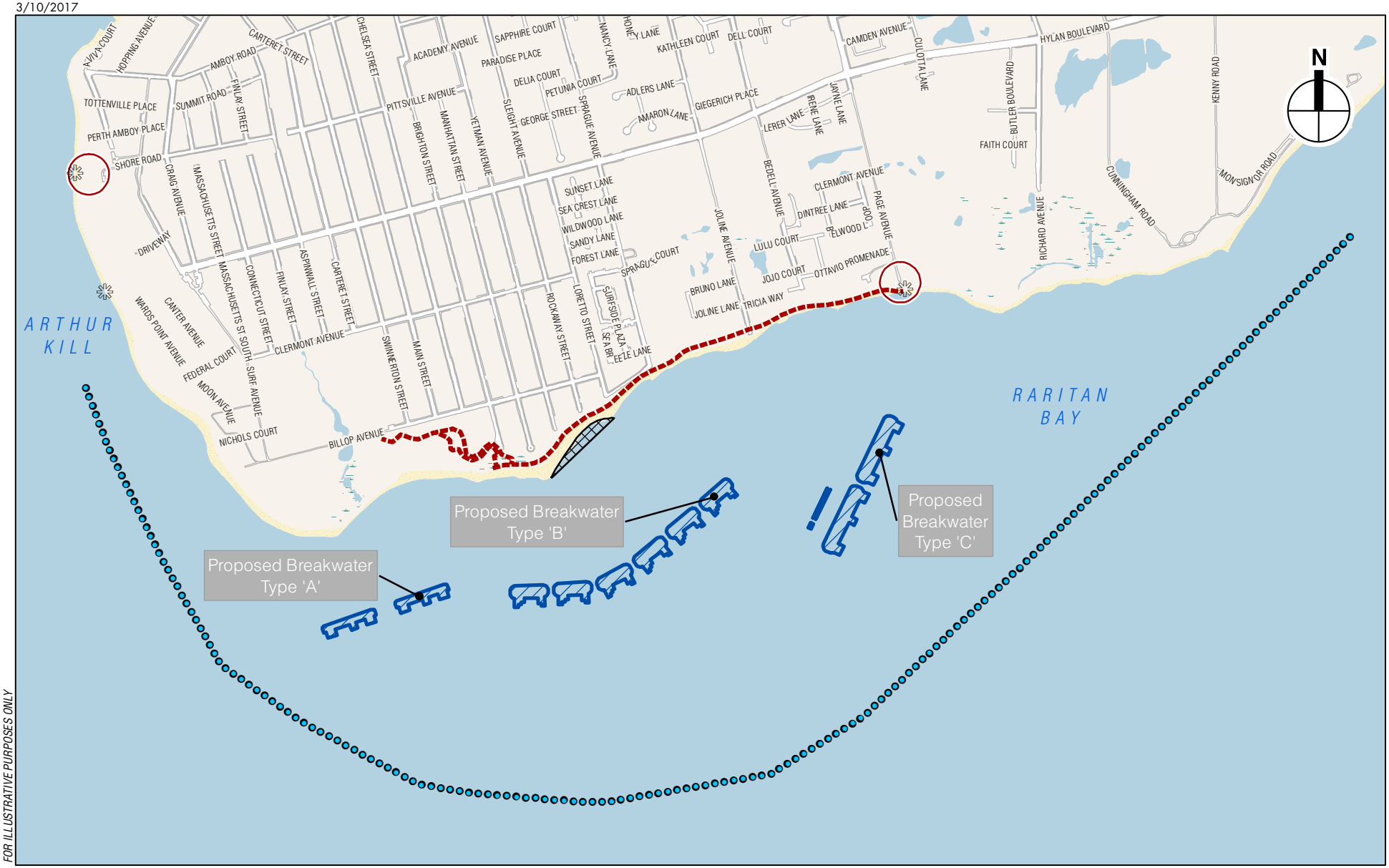

FOR ILLUSTRATIVE PURPOSES ONLY

Proposed Breakwater Features

Proposed Shoreline Restoration Area

Proposed Shoreline Project Elements

Potential Location of Proposed Water Hub (exact location to be determined)

Proposed Floating Dock and Oyster Nursery

Aquatic Resources Study Area (Outer Boundary)

Potential Water Access

Project Location

Coastal and Social Resiliency Initiatives for Tottenville Shoreline

Figure 10-1

required for construction or placement of a structure, or any action or use of land which materially alters the condition of land, including grading, excavating, dumping, mining, dredging, filling or any disturbance of soil. NYSDEC is currently updating CEHA boundaries; however, updated CEHA maps are not yet available. This chapter uses the maps currently available for Staten Island, dated November 10, 1988.

- Flood Hazard Evaluation of State Facilities, Lands and Programs, Article 36, ECL Implementing Regulations 6 NYCRR Part 502, Floodplain Management Criteria for State Projects. Under Article 36 of the ECL and in accordance with 6 NYCRR 502, all state agencies are to ensure that the use of state lands, and the siting, construction, administration and disposition of state-owned and state-financed projects involving any change to improved or unimproved real estate are conducted in ways that would minimize flood hazards and losses. Projects are to consider alternative sites on which the project could be located outside the 100-year floodplain. Projects to be located within the floodplain are to be designed and constructed consistent with the need to minimize flood damage within the 100-year floodplain and include adequate drainage to reduce exposure to flood hazards. All public utilities and facilities associated with the project are to be located and constructed to minimize or eliminate flood damage. No project may be undertaken unless the cumulative effect of the proposed project and existing developments would not cause material flood damage to the existing developments.

10.3 EXISTING CONDITIONS

The Tottenville shoreline is fringed by sand beaches, cobbles, and coarser materials near Mean Low Water (MLW). A man-made temporary dune, comprising sand filled barrier bags topped with sand installed following Superstorm Sandy, provides temporary erosion control measures and coastal flood risk reduction along approximately between Swinnerton Street and Sprague Avenue. Portions of this man-made dune have eroded, exposing the barrier bags. Analysis of historical shoreline change conducted as part of the design of the Breakwaters Project revealed varying shoreline change rates across the project area. The majority of the study area experienced erosion from 1978 to 2012 (pre-Hurricane Sandy) with rates ranging from -.5 feet per year to -3.5 feet per year. The highest erosion rates were experienced in Conference House Park between Finlay Street and Chelsea Street. Other sections of the shoreline experienced deposition of material (i.e., accretion) during that time, with rates ranging from 0 to 2.2 feet per year. This highest accretion rates were experienced in Conference House Park in the most western portion of the study area (**Figure 10-2)**.

In 2012, Superstorm Sandy approached New York City with strong winds that generated powerful waves along the South Shore of Staten Island, and storm surge resulting in significant coastal erosion of the area's protective bluffs. Peak storm tides in Tottenville were measured at approximately 16 feet and many homes in the Tottenville Beach area were damaged due to flooding (PlaNYC 2013). Following Superstorm Sandy, New York City formed the Special Initiative for Rebuilding and Resiliency (SIRR) to analyze the impacts of the storm on the city's buildings, infrastructure, and people, assess climate change risks in the medium term (2020s) and the long term (2050s), and outline strategies for increasing resiliency citywide. One of the studies used to inform these resiliency strategies was NYC Department of City Planning's (NYCDCP's) Urban Waterfront Adaptive Strategies (UWAS) study, which demonstrated that the south shore of Staten Island is particularly vulnerable to erosion during extreme events, as well as on an everyday basis.

In addition to its vulnerability to coastal storm surges and storm waves, the shoreline at Tottenville was identified as an at-risk shoreline vulnerable to sea level rise (SLR) and long-term erosion by New

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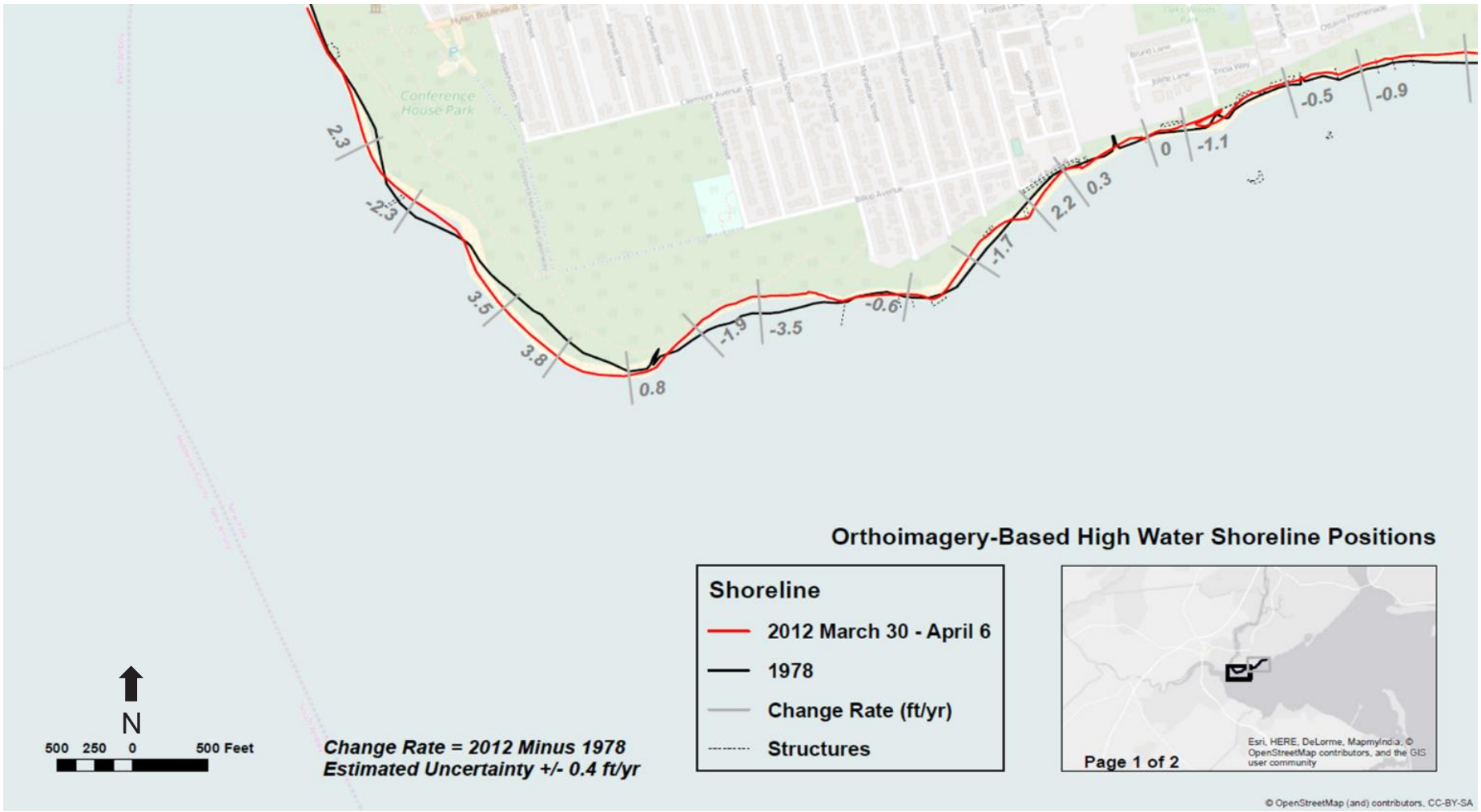

Source: *SCAPE / Landscape Architecture PLLC*

NOTE: Negative rates indicate erosion, positive rates indicate accretion

Shoreline Change 1978-2012

Figure 10-2

York City Economic Development Corporation Study in 2014 (NYCEDC 2014). SLR at the Sandy Hook NOAA tide gage (#8531680) has been observed at a rate of 1.34 feet/100 years between 1932 and 2014.

10.3.1 FLOODPLAINS

FEMA released revised preliminary FIRMs on January 30, 2015 that precede the future publication of new, duly adopted, final FIRMs. The revised preliminary maps represent the Best Available Flood Hazard Data at this time. FEMA, and the Federal Government as a whole, requires communities to use the preliminary maps or the current effective maps, whichever is more restrictive, per the Federal Uniform Flood Risk Reduction Standard for Sandy Rebuilding and the FEMA Best Available Data memo, both from 2013. Based on the revised preliminary FIRMs, the study area is fully within the 100-year floodplain in Zone AE (the area with a 1 percent chance of flooding each year) and Zone VE (an area of high flood risk subject to inundation by the 1% annual-chance flood event with additional hazards due to storm-induced velocity wave action, a 3-foot or higher breaking wave). Zones AE and VE are considered a Special Flood Hazard Area (SFHA). The preliminary FIRM 100-year flood elevations (i.e., Base Flood Elevation [BFE]) in the study area range from +13 to +19 feet North American Vertical Datum of 1988 (NAVD88) and are highest in the VE zone along the shoreline (**Figure 10-3**). Most of the 100-year floodplain within the study area is within the Limit of Moderate Wave Action (LiMWA).[2] While FEMA does not impose floodplain management requirements based on the LiMWA, it is mapped to help communicate the higher risk that exists in that area (FEMA 2013).

Coastal floodplains are influenced by astronomic tide and meteorological forces (e.g., nor'easters and hurricanes) rather than local flooding caused by precipitation (FEMA 2013).

10.3.2 COASTAL EROSION HAZARD AREA (CEHA)

Most of the south shore of Staten Island is within the NPFA of the CEHA (**Figures 10-4a and Figure 10-4b**). NPFAs within coastal areas, such as dunes and beaches, provide buffering and protection against wave energy and mitigate the loss of coastal habitat and property due to erosion. The NPFA along the southern shore of Staten Island encompasses the entire shoreline to north of the Verrazano-Narrows Bridge. Within the study area, the NPFA extends landward to the northern edge of Surf Avenue in the western portion of the study area and north of the sand-vegetation line in the eastern portion of the study area. Much of the historical shoreline erosion has occurred within the CEHA. The western portion of the study area comprising Water Hub Potential Location 2 is outside the CEHA. NYSDEC is updating the CEHA and the boundaries in the study area are subject to change prior to implementation of the Proposed Actions.

[2] The LiMWA is the portion of the 1% annual chance coastal flood hazard area referenced by building codes and standards, where base flood wave heights are between 1.5 and 3 feet, and where wave characteristics are deemed sufficient to damage many National Flood Insurance Program (NFIP)-compliant structures on shallow or solid wall foundations.

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Proposed Breakwater Features

Proposed Shoreline Project Elements

Proposed Shoreline Restoration Area

Potential Location of Proposed Water Hub (exact location to be determined)

Proposed Floating Dock and Oyster Nursey

1% Annual Chance Flood Hazard (100-year floodplain)

0.2% Annual Chance Flood Hazard (500-year floodplain)

Limit of Moderate Wave Action (LiMWA)

Potential Water Access

FOR ILLUSTRATIVE PURPOSES ONLY

0 2,000 FEET

Coastal and Social Resiliency Initiatives for Tottenville Shoreline

FEMA Flood Hazard Preliminary

Figure 10-3

This map was prepared by the New York State Department of Environmental Conservation. It was financed, in part, through a grant from the United States Department of Commerce, National Oceanic and Atmospheric Administration, under the Coastal Zone Management Act of 1972, as amended.

REVISIONS TABLE

Date:	Change:	By:
12/1/91	Lead	L.K.
10/1/92	Extended Surf Ave.	G.F.K.

LEGEND

COASTAL EROSION HAZARD AREA CLASSIFICATIONS

Landward Limit of Natural Protective Feature Area

Landward Limit of Structural Hazard Area

COUNTY LINE

TOWN LINE

CITY OR VILLAGE CORPORATE LIMITS

PARK OR RESERVATION LINE

COPIES OF COASTAL EROSION HAZARD AREA MAPS ARE AVAILABLE FROM
NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
COASTAL EROSION MANAGEMENT PROGRAM
50 WOLF ROAD
ALBANY, N.Y. 12233-0001

SCALE 1:2400 1"=200' (APPROX.)

200 0 200 400 600 800 FEET

50 0 50 100 150 METERS

COASTAL EROSION HAZARD AREA MAP

STATEN ISLAND

RICHMOND COUNTY, NEW YORK

This map prepared pursuant to Environmental Conservation Law, Article 34, and approved by the Commissioner of Environmental Conservation and issued on 11/10/88

Photo No. 17-279-78 SHEET 1 OF 14

Coastal Erosion Hazard Area Map
Figure 10-4a

This map was prepared by the New York State Department of Environmental Conservation. It was financed, in part, through a grant from the United States Department of Commerce, National Oceanic and Atmospheric Administration, under the Coastal Zone Management Act of 1972, as amended.

REVISIONS TABLE

Date:	Change:	By:
12/1/91	Legend	BK

LEGEND

COASTAL EROSION HAZARD AREA CLASSIFICATIONS

Landward Limit of Natural Protective Feature Area

Landward Limit of Structural Hazard Area

COUNTY LINE

TOWN LINE

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PARK OR RESERVATION LINE

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SCALE 1:2400 1"=200' (APPROX.)

200 0 200 400 600 800 FEET

50 0 50 100 150 METERS

COASTAL EROSION HAZARD AREA MAP

STATEN ISLAND

RICHMOND COUNTY, NEW YORK

This map prepared pursuant to Environmental Conservation Law, Article 34, and approved by the Commissioner of Environmental Conservation and issued on 11/10/88

Photo No. 17-277-78 SHEET 2 OF 14

Coastal Erosion Hazard Area Map
Figure 10-4b

10.4 EFFECTS ASSESSMENT

10.4.1 ALTERNATIVE 1—NO ACTION ALTERNATIVE

The No Action alternative assumes that no new structural risk reduction projects would be implemented in the study area, and the current trends with respect to coastal conditions at Tottenville relating to erosion and wave action would continue. Existing strategies to educate New Yorkers and the general public on the risks posed by climate change would continue under the No Action Alternative.

Under the No Action Alternative, the existing man-made dune would remain. These dunes and the Tottenville shoreline would remain vulnerable to intense wave energy and severe coastal flooding, and thus continue to be at risk from storm wave damage and both event-based and long term erosion. Based on historical trends, the Tottenville shoreline is expected to continue to erode in certain locations. Numeric simulation of shoreline changes using a shoreline response numerical modeling system revealed that in the southwestern portions of the site (southwest of Sprague Avenue) both the overall pattern and rates of shoreline erosion and accretion are likely to continue into the future, including erosion rates of 1 to 2 feet per year between Loretto Street and Manhattan Street, and between 2.0 and 3.5 feet per year in Conference House Park between Main Street and Wards Point. Northeast of Sprague Avenue, modeling indicates that the general pattern of erosion and accretion will remain the same as those observed historically, though the simulation shows future rates of change slightly lower than those historically observed. The New York City Panel on Climate Change projects that the sea level in New York City will rise approximately 11 to 31 inches by the middle of the century (Horton et al. 2015), resulting in an increase in the height of the 100-year flood elevation and increasing the risk for flooding within the study area. These erosion rates, combined with projected sea level rise, could eliminate some beach sections and leave others completely inaccessible at high tide, eliminating continuous public access along the shoreline and reducing the protective beach which is the first line of defense against erosion and waves.

10.4.2 ALTERNATIVE 2 (PREFERRED ALTERNATIVE)—THE LAYERED TOTTENVILLE SHORELINE RESILIENCY STRATEGY: LIVING BREAKWATERS AND TOTTENVILLE SHORELINE PROTECTION PROJECT (LAYERED STRATEGY)

As described in Chapter 1, “Purpose and Need and Alternatives,” the Layered Strategy consists of the implementation of two individual projects: the Living Breakwaters Project and the Tottenville Shoreline Protection Project.

The primary component of the Breakwaters Project would be an ecologically enhanced breakwater system that would provide coastal risk reduction by reducing wave energy at the shoreline, and reducing or reversing shoreline erosion. The breakwater system would increase habitat diversity by providing a combination of exposed, intertidal and subtidal reef habitat, including “reef streets” (pockets of habitat complexity within the structure). Another key element of the Breakwaters Project is a proposed community Water Hub that would provide physical space for access to the waterfront, orientation, education, information on shoreline resiliency, gathering space and equipment storage for New York City Department of Parks and Recreation (NYC Parks) maintenance. Two locations are currently proposed for the Water Hub. Potential Location 1 would be located in the vicinity of the southern terminus of Page Avenue where an approximately 5,000 square foot building would be constructed along with

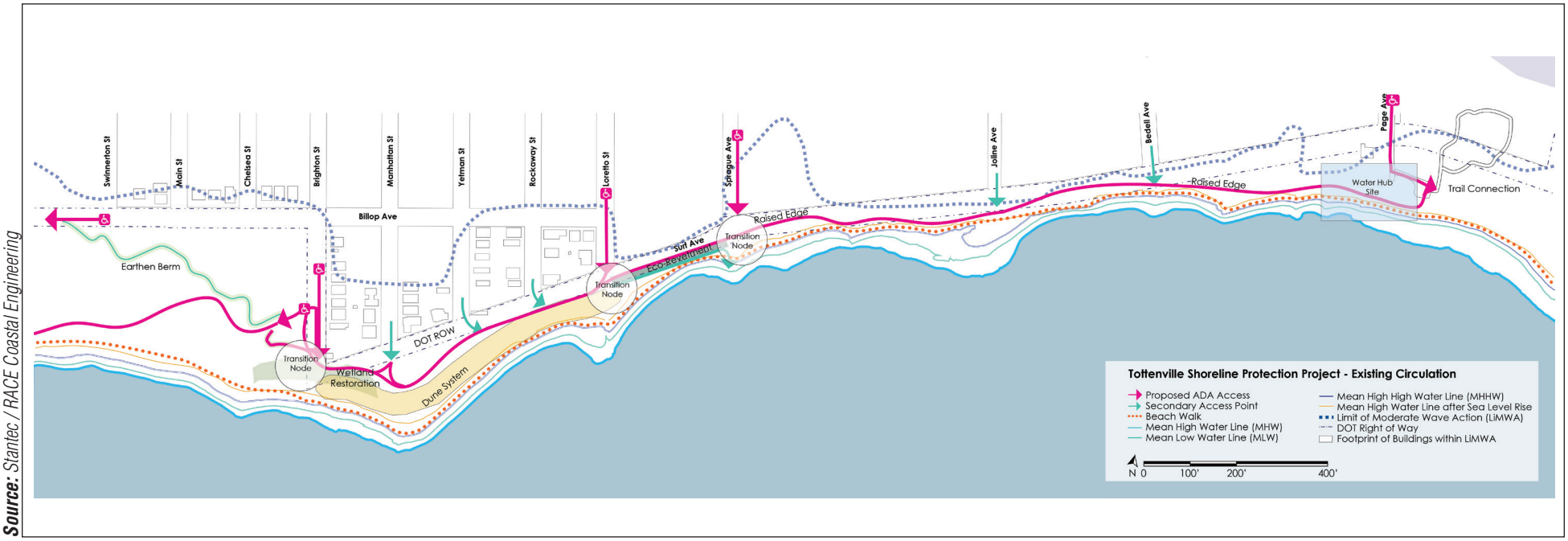
approximately 35,000 square feet of site improvements. Potential Location 2 would be located in the north-western portion of Conference House Park where one of two NYC Parks buildings would be adaptively reused as the Water Hub facility. The Water Hub programming would provide space to engage students in waterfront education, oyster restoration and reef building, and cultivating long-term estuary stewardship. Programming would educate residents about the coastal environment, with its risks and benefits, and build awareness, preparedness and stewardship within the community. Direct water access from shore would be provided on-site as an accessory seasonal boat launch in the vicinity of the Water Hub at Potential Location 1. If sited near either the two existing NYC Parks structures (i.e., Biddle House or the Rutan-Beckett house), water access would be provided with Americans with Disabilities Act (ADA) accessible pathways and ramps from the grounds of the house to the beach area to a seasonally deployed temporary floating boat launch. At the site of the Pavilion, water access would be provided by floating dock that would be access from the Pavilion by a ramp. Lastly, the project would include a one-time addition of new sand for shoreline restoration along approximately 806 feet of shoreline between Manhattan Street and Loretto Street to build up a particularly narrow, eroded section of the beach.

The Shoreline Project would consist of a series of shoreline risk reduction measures, including an earthen berm, a hybrid dune system, an eco-revetment, and raised edge (revetment with trail)along with wetland enhancements, and landscaping with native coastal plant species, from approximately Carteret Street to Page Avenue (**Figure 10-5**). The earthen berm would extend from about Swinnerton Street to Brighton Street. At Brighton Street the system would transition to a hybrid dune system which would extend to Loretto Street. At Loretto Street, the proposed hybrid dune system would transition to an eco-revetment which would parallel along Surf Avenue to Sprague Avenue. At Sprague Avenue, the eco-revetment would transition to the raised edge which would parallel the shoreline until approximately Page Avenue. Americans with Disabilities Act (ADA) accessible pathways, access points and overlooks would be constructed along the shoreline protection system.

FLOODPLAINS

The proposed breakwater system is designed to reduce wave energy and reduce or reverse shoreline erosion in the study area. The Breakwaters Project is intended to provide effective wave attenuation for 100-year storm waves and would reduce 100-year wave heights by at least 50 percent. Breakwater crest design elevations and breakwater locations were selected based on the relative need for storm wave attenuation and erosion risk reduction along the shoreline. Breakwaters with higher crests and shorter gap widths would be sited to protect upland areas containing buildings and infrastructure exposed and vulnerable to wave action during storm events (i.e., priority beach zones). Three types of breakwaters are proposed for Raritan Bay in three groups of breakwater segments: Type A on the west, Type B in the center, and Type C on the east (**Figure 10-1**). Types B and C breakwaters would have a crest elevation of +14 feet NAVD88, designed to protect the most vulnerable portions of the shoreline. This crest elevation would effectively prevent transmission of waves greater than 3 feet in a storm up to the 100-year storm event with 30 inches of SLR. Type A breakwaters, with elevations of +5 feet NAVD88, are proposed where the shoreline is not as vulnerable to storm wave action. These breakwaters would remain above MHW (+2.08 feet NAVD88) under the 30-inch SLR scenario.

Wave attenuation provided by the breakwaters on a day-to-day basis would help to maintain beach conditions by reducing or reversing long-term beach erosion rates, reducing exposure of shoreline structures to wave damage and erosion, and encouraging accretion in priority beach



Source: *Stantec / RACE Coastal Engineering*

Proposed Shoreline Project and CEHA

Coastal and Social Resiliency Initiatives for Tottenville Shoreline

Figure 10-5

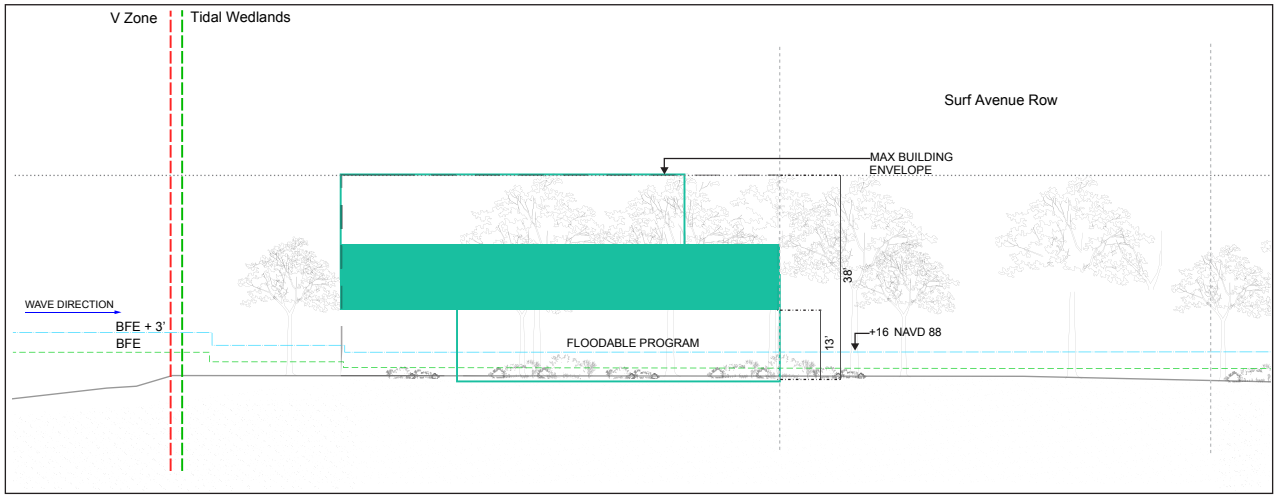
zones and where the beach is currently most narrow. The breakwater system will hold sand in the system through wave energy reduction along the shoreline. Down drift erosion past the project area is not considered to be an issue as the dominant direction of long-shore transport of sediment is from the north-east to the south-west and the breakwater system extends to the most south-western tip of the shoreline, with no exposed shoreline down-drift of the proposed breakwaters. One-time shoreline restoration is proposed for the narrow section of shoreline between Loretto Street and Manhattan Street. The breakwaters will act to hold this sand in place (**Figure 10-1**).

There are currently two proposed locations for the Water Hub facility: Potential Location 1 near Page Avenue with a parking area and a recreational boat launch (**Figure 10-1**), and Potential Location 2 in the northwestern portion of Conference House Park. At Potential Location 1, there are two proposed sites (a Page Avenue East option and a Page Avenue West option, both requiring construction of a new building) for the building footprint. Both sites would be located outside Zone VE at elevations of either +11 feet NAVD88 or +7 feet NAVD88; however, a portion of the proposed parking for the eastern site would fall within Zone VE. The Water Hub building at Potential Location 1 would be elevated 3 feet above the BFE, mitigating the risk of a structure located in the 100-year floodplain and conforming to EO 11988 and EO 13690 and Article 36 of the ECL (**Figures 10-6a and 10-6b)**. At Potential Location 2, one of two NYC Parks structures would be rehabilitated and adaptively reused for Water Hub programming. Located at elevations of approximately +36 and +64 feet NAVD88, both structures are located outside any floodplains. Should the Water Hub be located at Potential Location 2, a small facility (1,600 square feet or less) would be located near the terminus of Page Avenue and would be within the 100-year floodplain. This small facility would provide seating, wayfinding and potential storage for kayaks and beach cleaning equipment and would be connected to the public water supply.

Similar to other portions of New York City, Staten Island is affected by local stormwater flooding (e.g., flooding of inland portions of the city from short-term, high-intensity rain events in areas with poor drainage), fluvial flooding (e.g., streams overflowing their banks), and coastal flooding (e.g., long and short wave surges that affect the shores of the Atlantic Ocean, bays such as Raritan Bay, and tidally influenced creeks and rivers [FEMA 2013]). Within New York City, coastal flooding is the primary cause of flood damage. The floodplain within and adjacent to the study area is affected by coastal flooding and would not be affected by construction or regrading/filling of the floodplain as would occur within a riverine floodplain. Coastal floodplains are influenced by astronomic tide and meteorological forces (e.g., nor'easters and hurricanes) rather than local flooding caused by precipitation (FEMA 2013). Therefore, the occupancy of the floodplain by the Shoreline Project, the Water Hub at Potential Location 1, the proposed seasonal boat launches, or year-round boat dock, and a potential small facility proposed at Location 1 should the Water Hub be located at Potential Location 2 would not affect the flood elevation or increased risks due to flooding adjacent to the study area. In addition, the Shoreline Project would provide on-shore risk reduction measures that would augment the wave attenuation potential provided by the Breakwaters Project. The Shoreline Project has been designed to provide protection for upland areas from wave energy and erosion under storm return periods ranging from 10 to 100 years with SLR, and storm conditions similar to those experienced with Superstorm Sandy.

3.10.17

BUILDING FOOTPRINT
PARKING/OTHER OUTDOOR SURFACE
DPR VEHICLE GARAGE
PEDESTRIAN BEACH ACCESS PATH
BOAT LAUNCH FROM SHORE
ROW SURVEY
CEHA
VE INLAND BOUNDARY
TIDAL WETLANDS INLAND BOUNDARY
A, AE, AO INLAND BOUNDARY

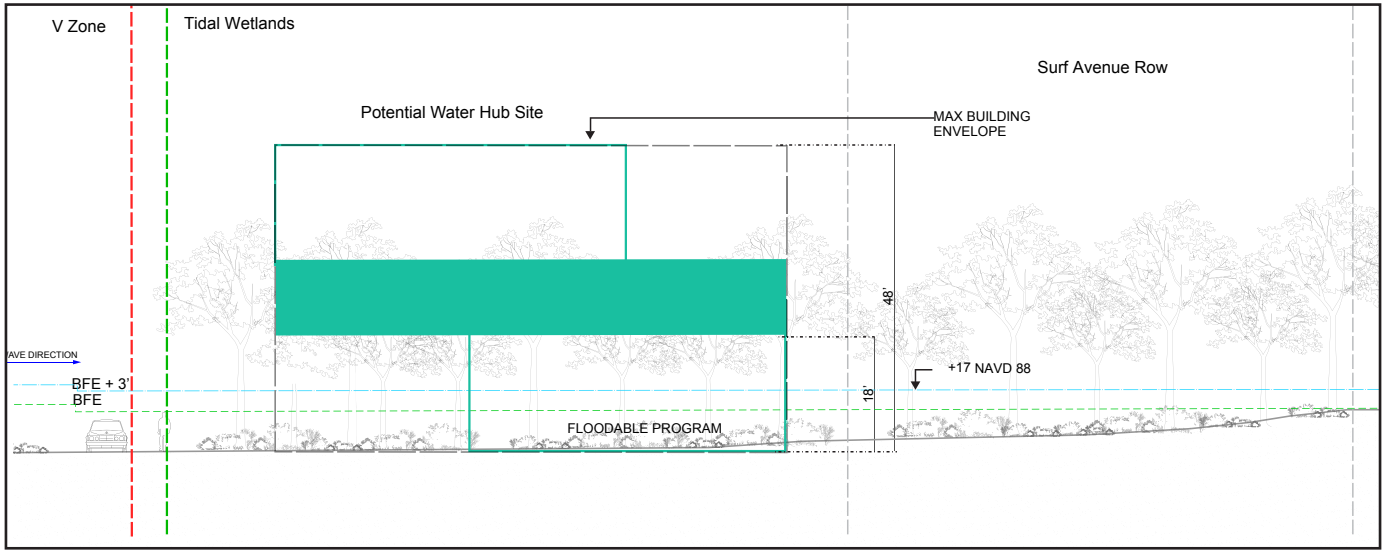


Source: *Stantec / RACE Coastal Engineering*

Proposed Water Hub Location 1—Page West Option

3.10.17

BUILDING FOOTPRINT
PARKING/OTHER OUTDOOR SURFACE
DPR VEHICLE GARAGE
PEDESTRIAN BEACH ACCESS PATH
BOAT LAUNCH FROM SHORE
ROW SURVEY
CEHA
VE INLAND BOUNDARY
TIDAL WETLANDS INLAND BOUNDARY
A, AE, AO INLAND BOUNDARY



Source: *Stantec / RACE Coastal Engineering*

Proposed Water Hub Location 1—Page East Option

Coastal and Social Resiliency Initiatives for Tottenville Shoreline

Figure 10-6b

By its nature, there is no practicable alternative to constructing the Shoreline Project or some components of the Water Hub in the 100-year floodplain. The Shoreline Project elements and the Water Hub are "functionally dependent"[3] on being located in the floodplain and NYSDEC tidal wetland adjacent area. The Water Hub at Potential Location 2 would allow for the Water Hub programming to be located outside of the 100-year floodplain. However, the small storage facility that would be located within Potential Location 1 should the Water Hub be located at Potential Location 2 would be within the 100-year floodplain. This small storage facility would provide water access necessary to achieve the purpose and need of the Proposed Action. The Proposed Actions would be consistent with EO 11988 and EO 13690 by improving the resiliency of Tottenville against the impacts of flooding and risks associated with climate change. Additionally, the Shoreline Project was developed using nature-based approaches that include the earthen berm that would be planted with native coastal species, hybrid dune planted with dune vegetation, and eco-revetment and raised edge which would be landscaped with native coastal plant species. There are no practicable alternative locations for the Shoreline Project outside of the 100-year floodplain given the constraint of residential development landward, and the narrow shoreline as described under "Existing Conditions." The location of the Shoreline Project within of the 100-year floodplain is essential for the efficacy of the Shoreline Project to provide protection against wave energy and erosion.

The Layered Strategy would provide coastal resiliency in vulnerable areas along the Tottenville shoreline. While the Layered Strategy would not prevent flooding from coastal storm events, it would attenuate wave energy and reduce wave heights within the study area, and reduce or delay flooding of inland areas during certain storm events, minimizing risk to shoreline structures within the 100-year floodplain in and adjacent to the study area. While the Layered Strategy may potentially result in a change in the mapped Zone VE and Base Flood Elevations below the LiMWA in the future, subject to necessary review and approvals, this is not a targeted goal of the Proposed Actions.

The Layered Strategy would not have the potential to result in direct or indirect adverse impacts to the floodplain and is appropriate for siting in the 100-year floodplain consistent with 24 CFR § 55.20 regulations of the HUD implementing Executive Order 11988 Floodplain Management concerning financial assistance for activities that are within and or affect a floodplain. As part of the EIS, GOSR will complete the 8-step floodplain management and protection of wetlands decision-making required by 24 CFR § 55.20 for proposed actions located in a 100-year floodplain and/or wetland. On March 24, 2017, in accordance with Step 2 of the decision-making process at 24 CFR § 55.20(b), GOSR published and distributed early notice of a proposed activity in a 100-year floodplain and wetland.

COASTAL EROSION HAZARD AREA

Article 36 of the ECL and regulations at 6 NYCRR 505 prohibits construction within the CEHA without a Coastal Erosion Management Permit. With the exception of the earthen berm, most of the remaining portions of the Shoreline Project fall within the CEHA NPFA (**Figure 10-5**). The two proposed sites for the Water Hub are located outside of the CEHA, although a portion of the proposed parking areas would fall within the CEHA. The remaining in-water components of the Breakwaters Project would be located outside of the CEHA NPFA, but would have a positive

[3] Functionally dependent use, as defined by 24 CFR § 55.2(6), means a land use that must necessarily be conducted in close proximity to water (e.g. a water-front park).

effect on the NPFA by reducing or reversing shoreline erosion. While a Coastal Erosion Management Permit would be required for construction of the Proposed Actions within the CEHA (i.e., the hybrid dune, eco-revetment, raised edge, shoreline restoration, and Water Hub parking), the design for each element is generally in conformance with CEHA regulations. The Layered Strategy would reduce or reverse shoreline erosion and reduce the risk of wave action to the shoreline. The proposed earthen berm and the hybrid dune system are considered natural protective features under 6 NYCRR 505. Treatments such as dunes buffer shorelands from the energy of open water and are of greatest protective value during conditions of storm-induced high water. The eco-revetment and raised edge would provide additional shoreline protection from wave energy, minimize the potential for erosion of the beach at the toe of the structure, and allow for habitat enhancement through landscaping with native coastal plant species. The raised edge would be landward of Mean Higher High Water (MHHW) along its entire length and would be between +8.0 and 11 feet NAVD 88. An area of un-permitted fill material in the vicinity of Tricia Way within the stretch of the raised edge project component is within the CEHA and would be removed and reused in accordance with a Beneficial Use Determination as part of the Layered Strategy.

Shoreline restoration using clean sand suitable for placement within the CEHA is proposed for a narrow, erosion-prone section of the shoreline between Manhattan Street and Loretto Street (**Figure 10-1**). The breakwater system would help hold this sand in place, allowing the shoreline to reach equilibrium with a wider beach, providing greater erosion protection to this vulnerable section of the shoreline.

The Water Hub parking area at Potential Location 1 would be within the CEHA and would require a CEHA variance for permitting. Although the design of the proposed parking area would incorporate measures to mitigate adverse impacts on natural systems, the placement of a permanent structure within the CEHA that is not a regulated activity would necessitate a variance from CEHA regulations. The CEHA boundary does not extend up to the area of the Water Hub Potential Location 2; therefore, this Water Hub option would be fully outside the CEHA and would not require CEHA permitting.

As described above, historic shoreline erosion rates in the study area have been upward of 3.5 feet per year in some locations, justifying the need for shoreline risk reduction measures in the Tottenville area. The Layered Strategy would not adversely affect the CEHA. Instead, it would result in the enhancement of natural protective features within the CEHA NPFA while providing reduced storm surge risk to NPFAs by attenuating wave energy.

10.4.3 ALTERNATIVE 3—BREAKWATERS WITHOUT SHORELINE PROTECTION SYSTEM

This alternative represents conditions with the proposed breakwaters in place (including the proposed on-shore community Water Hub and associated landscape elements), but without the Shoreline Project. The existing man-made dunes would remain in place and would be maintained by NYC Parks.

FLOODPLAINS

Similar to Alternative 2, the Living Breakwaters Project without the Shoreline Project would provide greater coastal resiliency than the No Action Alternative, but it would be less effective at protecting inland areas against wave energy and therefore be less resilient than Alternative 2. The storm wave reduction by the breakwaters would be the same as described in Alternative 2,

however this alternative would not have the added wave reduction benefits provided by the Shoreline Project. Long term shoreline and beach erosion reduction benefits would be the same as in Alternative 2, though benefits to event-based erosion would likely be somewhat reduced due to the removal of the Shoreline Project. Similar to Alternative 2, this Alternative would be consistent with EO 11988 and EO 13690 because the Water Hub facility at Potential Location 1 would be elevated above BFE and there would be no other shoreline structure in the floodplain. Additionally, the Water Hub at Potential Location 2 would be fully outside the 100-year floodplain. This Alternative would result in reduced protection of existing structures within 100-year floodplain.

COASTAL EROSION HAZARD AREA

The only portion of the Breakwaters Project within the CEHA would be the parking lot for the Water Hub and the area of proposed shoreline restoration between Loretto Street and Manhattan Street. A Coastal Erosion Management Permit would only be required for its construction and for the placement of shoreline restoration between Manhattan and Loretto Streets. As was discussed for the Layered Strategy, this alternative would require a CEHA variance for the proposed Water Hub parking area at Potential Location 1. The shoreline within the CEHA would be more resilient than it would under the No Action Alternative, but would remain more vulnerable to erosion than it would under the Layered Strategy Alternative, and would not receive the enhancements of natural protective features within the CEHA NPFA.

10.4.4 ALTERNATIVE 4—SHORELINE PROTECTION SYSTEM WITHOUT BREAKWATERS

This alternative will evaluate conditions with the proposed shoreline protection system in place, but without the proposed breakwaters and Water Hub.

FLOODPLAINS

The Shoreline Project without the Breakwaters Project would provide greater resiliency than the No Action Alternative, but would not provide the reduction in wave energy and height prior to reaching the shoreline that would occur under the Layered Strategy Alternative. While there would be some wave reduction from the various shoreline project elements during storm events, this Alternative would be less effective at protecting the Tottenville shoreline and would not achieve the same level of resiliency as the Layered Strategy. This Alternative would be consistent with EO 11988 and EO 13690 by improving the resiliency of communities against the impacts of flooding and risks associated with climate change; however the proposed earthen berm, hybrid dune system, eco-revetment, and raised edge with revetment would be vulnerable to existing wave energy without the proposed breakwater system.

COASTAL EROSION HAZARD AREA

A Coastal Erosion Management Permit would be required for the Proposed Actions that comprise the Shoreline Project. This Alternative would enhance shoreline protective features of the NPFA, providing greater resiliency than the No Action Alternative, but would not reduce long-term shoreline erosion rates, except that the inclusion of armored features such as the rock-core of the hybrid dune, the eco-revetment and the raised edge would create an inland limit to erosion. Without the Breakwaters Project, the Shoreline Project would be susceptible to erosion.

This Alternative would not include shoreline restoration between Loretto Street and Manhattan Street, and that portion of the beach would remain narrow and particularly vulnerable to erosion.

10.5 MINIMIZATION AND MITIGATION OF IMPACTS

The Proposed Actions would not adversely affect the 100-year floodplain or the CEHA; therefore, no additional mitigation is needed for the Proposed Actions. The Proposed Actions would provide resiliency along the Tottenville shoreline by attenuating wave energy and height, minimizing erosion of the shoreline, and enhancing native coastal plant communities. The design of the Water Hub elevation and selection of Water Hub sites considered the CEHA mapping and requirements for construction within the 100-year floodplain to withstand potential storm activity, wave action, and storm surge, as well as future climate change conditions. The two proposed building footprints for the Water Hub at Potential Location 1 (one east of Page Avenue and one west of Page Avenue) and the Water Hub at Potential Location 2 were chosen for further analysis specifically because they would be located outside of the CEHA, DEC tidal wetlands boundary, and FEMA Zone VE (**Figures 10-6a and 10-6b)**.

10.6 LITERATURE CITED

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